Vehicle Dump and Community Landfill, Iqaluit, Nunavut
Ecological and Human Health Detailed Quantitative Risk Assessment (DQRA)

DRAFT REPORT

Prepared for:

Public Works and Government Services Canada
800 Burrard Street
Vancouver, BC
V6Z 2V8

On behalf of Transport Canada

Prepared by:

Franz Environmental Inc.
329 Churchill Ave. North., Suite 200
Ottawa, ON
K1Z 5B8

1584-0901
March 31, 2010

Susan Winch, Ph.D.
Ivy YuXia Liu, M.Sc.

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Executive Summary

Franz Environmental Inc. (FRANZ) was retained by Public Works and Government Services Canada (PWGSC) on behalf of Transport Canada to complete an Ecological and Human Health Detailed Quantitative Risk Assessment (DQRA) for the Vehicle Dump and Community Landfill, Iqaluit, Nunavut.

This project was completed in accordance with the Proposal for Environmental Consulting Services at the Iqaluit Metal/Vehicle Dump, Nunavut, submitted to PWGSC on October 30, 2009.

The project was undertaken to ensure the protection of both human and ecological receptors. The objectives of the ecological and human health DQRA were:

- To identify contaminants of concern in media at the site;
- To identify if an unacceptable risk is present to any human or ecological receptor.

The risk assessment was undertaken based on present site conditions, and incorporated site-specific details obtained through the document review, interviews and field investigation results.

The Iqaluit Vehicle Dump and Community Landfill are situated approximately 1.7 km southwest of the city of Iqaluit, Nunavut. Universal Transverse Mercator (UTM) co-ordinates taken from the center of the site are E521904.94, N7067812.69. Only the top section of the site is accessible by road. The site is located adjacent to Sylvia Grinnell Territorial Park.

The total area of the Landfill and Vehicle dump occupies an area of approximately 7.25 ha (72,500 m^2), which includes the up-gradient debris area. The area has been used as a military and municipal landfill since the late 1950's to early 1960's.

The United States Air Force (USAF) used this site from between 1955 to 1963 as a metal dump for vehicles, truck bodies, barrels and scrap metal. The majority of materials were deposited in 1963 when the US Military left Frobisher Bay. Shops, buildings, and other materials were simply bulldozed over the cliff. The cliff is a bedrock outcrop rising approximately 50 m above the tidal area where the Sylvia Grinnell River meets Frobisher Bay. The area to the north side of the slope was used by the USAF and the community of Iqaluit as a landfill site for household garbage until sometime in the 1970's.

The study area was found to contain known and discrete PHC, PCB, metals, and pesticide soil, sediment, and surface water impacts associated with the historical waste disposal activities. Elevated metals (particularly cadmium, copper, lead, and zinc) are widespread; however, spatial

distribution appears to be concentrated mostly at the toe of the main landfill and the central portion of the vehicle dump. Volatile Organic Compounds (specifically PCE and TCE) were detected in sediments and surface waters at a discrete area.

Waste disposal practices have attributed to a slow release of inorganic metals and organic contaminants (e.g PCBs, Pesticides, PHCs) into the environment. Leaching of metals and other organics from the waste debris represents a measureable loading risk to the aquatic environment on site and possibly other surface water bodies (Sylvia Grinnell River).

The risk assessment was undertaken based on present site conditions, and incorporated site-specific details obtained during the Phase III ESA investigation.

The target HQ of 0.5 was not exceeded for any of the PHC fractions (F1, F2, F3 or F4) in either the adult or the toddler receptor.

The target HQ of 0.2 was exceeded in the toddler and the adult for the following: cadmium, lead, and PCBs.

The Health Canada recommended target ILCR ($1.0x\ 10^{-5}$) was exceeded in the adult receptor for benz[a]anthracene and vinyl chloride.

The risks posed by cadmium, lead, benz[a]anthracene and PCBs result primarily from consumption of fish (see model printouts, Appendix B). Concentrations of contaminants in fish, however, are modeled values rather than measured concentrations, therefore the estimate of risk to humans from fish consumption may be overly conservative.

Any decisions to be made on the basis of potential levels of risk to humans resulting from waterborne contaminants should be considered with caution, unless fish tissue concentrations can be obtained. Further, contaminants detected in surface water but not in sediment may not originate from the site, as the Sylvia Grinnell River is fast-flowing and would transport substances from other locations. Long-range transport of PCBs and pesticides to northern climates from southern regions is also possible. Since no background data is available against which to compare surface water concentrations of these contaminants, it is not clear whether or not they originate from the site.

The results of the quantitative ecological risk assessment indicated that **aluminum and F3 PHCs** are present in **soil** at concentrations that may present an unacceptable level of risk to terrestrial plants and soil invertebrates. **Barium, iron, lead and total PCBs** were were present in **brackish sediments** at concentrations that could represent an unacceptable level of risk to

benthic invertebrates and/or aquatic vegetation. **Brackish surface water** contained concentrations of **copper, magnesium, sodium, PCBs, DDT (and its metabolites), and endrin**. Potentially unacceptable risk levels for aquatic biota were also calculated for **aluminum, iron and the F2 fraction of PHCs** due to their respective concentrations in fresh surface water. However, since the majority of surface water on the site is brackish due to periodic inundation of the river floodplain, it is unlikely that contaminants in fresh surface water would result in deleterious effects on aquatic biota at the population level. Freshwater sediments were not evaluated; it was assumed that aquatic receptors would primarily inhabit the areas of brackish water on the site, as smaller freshwater ponds are relatively inaccessible.

Potentially unacceptable risk levels to mammals were also estimated for the following substances due to their concentrations in site soil:

- Aluminum (deer mouse, meadow vole, snowshoe hare, short-tailed shrew)
- PHC F3 and F4 (deer mouse, short-tailed shrew).

Barium concentrations in brackish sediment represented a potentially unacceptable risk to muskrat and mink. An unacceptably high hazard quotient was also calculated for exposure of mink to PCBs, but this HQ was primarily driven by the water-fish-mink pathway, which was based on a highly conservative estimate of the concentration of PCBs in brackish surface water.

Risk quotients could not be calculated for the following contaminants, as no suitable TRV benchmark values were available for these parameters for comparison:

Chemical	Receptor Type	Medium
Aluminum	Invertebrate	Soil
Barium	Invertebrate	Soil
Bromoform		Soil
Iron	Plant	Soil
Iron	Invertebrate	Soil
Iron	Bird	
Iron	Mammal	
Magnesium	Bird	
Magnesium	Mammal	
Manganese	NA	Surface Water (Brackish)
Sodium	Bird	
Sodium	Mammal	
Strontium	NA	Sediment (Brackish)
Vanadium		Surface Water (Brackish)
Vanadium	NA	Sediment (Brackish)
1,1,1,2-tetrachloroethane	Mammal	
1,1,1,2-tetrachloroethane	NA	Soil
Toxaphene	NA	Surface Water (Brackish)
Toxaphene	NA	Surface Water (Fresh)

The unquantified risks of these substances to receptors are considered to be a source of uncertainty in the risk assessment.

Site-specific target levels were developed for site soil and brackish sediments, as shown below.

Site-Specific Target Levels of Threshold Contaminants in Soil

Chemical (Threshold)	Concentration in soil used in RA (mg/kg)	Highest HQ	Receptor	Target HQ	Risk-based maximum allowable value	Maximum concentration in soil	Guidelines (mg/kg dry wt.)				Lowest detection limit	Site-specific target level
							Ecological		Human health			
Aluminum	4.68E+03	9.35E+01	Plant	1	5.00E+01	5.10E+03	NV		NV		5.00E+01	**5.00E+01**
Cadmium	2.78E+00	1.62E+00	Toddler	0.2	3.43E-01	2.24E+01	n/a		1.40E+01	1	1.00E-01	**1.40E+01**
Lead	9.16E+01	2.11E+00	Toddler	0.2	8.68E+00	2.56E+02	n/a		1.40E+02	1	1.00E+00	**1.40E+02**
F3	4.68E+03	1.55E+01	ST_Shrew	1	3.02E+02	4.44E+04	3.00E+02	1	n/a		1.00E+01	**3.02E+02**
F4	4.68E+03	2.10E+01	ST_Shrew	1	2.22E+02	6.96E+03	2.80E+03	1	n/a		1.00E+01	**2.80E+03**
PCBs	1.71E+01	9.72E+01	Adult	0.2	3.52E-02	1.71E+01	n/a		1.30E+00	1	1.00E-02	**1.30E+00**

1 - Canadian Council of Ministers of the Environment (CCME). 2007. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.

Site-Specific Target Levels of Non-Threshold Contaminants in Soil

Chemical (Non-threshold)	Concentration in soil used in RA (mg/kg)	Highest ILCR	Receptor	Target ILCR	Risk-based maximum allowable value	Maximum concentration in soil	Guidelines (mg/kg dry wt.)				Lowest detection limit	Site-specific target level
							Ecological		Human health			
Benz[a]anthracene	1.14E+00	1.31E-04	Adult	1.00E-05	8.70E-02	1.14E+00	n/a		3.30E-01	1	1.00E-02	**3.30E-01**
Vinyl chloride	1.00E-01	1.16E-04	Adult	1.00E-05	8.62E-03	1.00E-01	n/a		3.00E-03	2	2.00E-03	**8.62E-03**

1 - Canadian Council of Ministers of the Environment (CCME). 2007. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.
2 - Ministry of the Environment (MOE). 2004. Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act. Queen's Printer for Ontario, March 2004. Table 1.

Site-Specific Target Levels of Contaminants in Brackish Sediment

Chemical	Concentration in sediment used in RA (mg/kg)	Highest HQ	Receptor	Target HQ	Risk-based maximum allowable value	Maximum concentration in sediment	Guidelines (mg/kg dry wt.)				Lowest detection limit	Site-specific target level
							Ecological		Human health			
Ba	2.02E+01	1.91E+02	Muscrat	1	1.06E-01	2.59E+01	NV		n/a		5.00E-01	**5.00E-01**
Fe	2.98E+04	1.49E+00	NA	1	2.00E+04	4.60E+04	NV		n/a		5.00E+01	**2.00E+04**
Pb	2.58E+01	1.23E+00	NA	1	2.10E+01	6.30E+01	3.02E-11	1	n/a		1.00E+00	**2.10E+01**
PCBs	9.00E-02	3.96E+00	NA	1	2.27E-02	9.00E-02	2.15E-02	1	n/a		3.00E-02	**2.15E-02**

1 - CCME (2002). Canadian Sediment Quality Guidelines for Protection of Aquatic Life, Update 2002, Table 2. Interim marine sediment quality guidelines (ISQGs).

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GLOSSARY OF TERMS

Aerial photography: Photographs taken from an aircraft either obliquely or vertically.
Aggregate: Sand, gravel, or crushed rock.
Algae: Photosynthetic organisms which live and reproduce entirely immersed in water. They range in size from simple, single-celled organisms to large kelps several metres long.
Alkalinity: The aggregate measure of the concentration of hydroxyl, carbonate and bicarbonate ions, and dissolved CO_2. Therefore, it is a general indicator of the acid-buffering capacity of the water body.
Ambient: The natural surrounding (background) conditions in a given area.
Assessment endpoint: A quantitative or quantifiable expression of the environmental value considered to be at risk in a risk assessment.
Bedrock: The solid rock that underlies gravel, soil or other surficial material.
Benthic: Refers to the bottom of a lake or river and/or the organisms that inhabit it.
Benign: Not dangerous to human health or the environment.
Benthos: The whole assemblage of plants or animals living on the lake or river bottom; distinguished from *plankton*.
Bioaccumulation: The net accumulation of a chemical by an organism as a result of uptake from all routes of exposure.
Bioavailability: Degree of ability to be absorbed and ready to interact in organism metabolism.
Biological diversity (biodiversity): The variety of different species, the genetic variability of each species, and the variety of different ecosystems that they form.
Biomagnification: The tendency of some chemicals to accumulate to higher concentrations at higher levels in the food web through dietary accumulation.
Biota: The animal and plant life of a region.
Boreal Forest: The predominantly coniferous forest of northern Canada.
Borehole: Hole made with drilling equipment typically to obtain samples.
Buffering capacity: The degree that a given volume of water or soil is able to neutralize acids.
Carbonate: Any mineral containing carbonate (CO_3^{2-}) ions.
Carcinogen: An agent that has the potential to cause cancer.
Carnivore: An animal that eats the flesh of other animals.
Clay: Soil particles that are smaller than silt (less than 0.002 mm in diameter).
Conductivity: A measurement of the electrical conductivity of a water body or sample in order to determine the amount of dissolved material present.
Conservative: As used in the term conservative estimates, this is considered a pessimistic or an overestimate of the level, effect or hazard, as the case may be.
Contaminant migration: The movement of contaminants from one location to another.
Contamination: Elements both radioactive and non-radioactive that are present at levels above those normally found (i.e. above background).

Decontamination: The process of removing contaminants from equipment, personnel, buildings or water.

Delineate: To determine the outer limits and size of something (i.e., an ore body).

Detection limit: The limit of measurement of a given parameter, below which variations in concentration are indistinguishable from one another.

Discharge: The volume of water passing a given point per unit time, usually expressed as m^3/s.

Dose: A general term used to describe the amount of radiation or chemical absorbed by a person or in some cases a particular organ. The term dose can be used to describe two concepts. The first concept is a physical quantity; for radiation, it is the amount of energy absorbed per unit mass of tissue (see absorbed dose) and for chemicals, it is the concentration in tissue.

Drainage basin: The area of land and water bodies therein, draining to a given point, usually a lake or river.

Ecological Risk Assessment: The application of a formal framework, analytical process, or model to estimate the effects of human actions(s) on a natural resource and to interpret the significance of those effects in light of the uncertainties identified in each component of the assessment process. Such analysis includes initial hazard identification, exposure and dose response assessments, and risk characterization.

Ecosystem: Any natural system in which there is interdependence upon and interaction between living organisms and their physical environment. This interdependence is characterized by the transfer of energy between the organisms themselves and their physical environment in a complex series of cycles.

Element: A substance that is comprised of one and only one distinct kind of atom.

Environment: The sum of all external conditions, influences and forces affecting the development and life of organisms.

Environmental baseline: The data collection characterizing the “natural” environment in its pre-development or pre-impact state. This data is used as a base for determining potential and actual impacts in the defined impact area.

Environmental Assessment: An environmental analysis to determine whether a site/facility would significantly affect the environment and thus require a more detailed environmental impact statement.

Environmental Impact: A change in environmental conditions resulting from an action or development, which may be negative, positive, or neutral.

Erosion: The wearing down (weathering) and removal of soil, rock fragments and bedrock through the action of rivers, glaciers, sea and wind.

Evapotranspiration: The total return of water from the land to the atmosphere, including the process of evaporation from the soil surface and transpiration from plants.

Exposure: The amount of radiation or pollutant present in a given environment that represents a potential health threat to living organisms.

Exposure Assessment: Identifying the pathways by which toxicants may reach individuals, estimating how much of a chemical an individual is likely to be exposed to, and estimating the number likely to be exposed.

Exposure Concentration: The concentration of a chemical or other pollutant representing a health threat in a given environment.

Exposure Pathway: The path from sources of pollutants via, soil, water, or food to man and other species or settings.

Geochemistry: Refers to the chemical analysis of surface and subsurface water, rock alluvium, soil and plants.

Grading: The process of making a surface level or evenly sloped.

Groundwater: Water beneath the earth's surface, accumulating as a result of infiltration and seepage, and serving as a source of springs and wells.

Habitat: The natural home of a plant or animal.

Hazard: Potential for radiation, a chemical or other pollutant to cause human illness or injury. Hazard identification of a given substance is an informed judgment based on verifiable toxicity data from animal models or human studies.

Hazard Assessment: Evaluating the effects of a contaminant or determining a margin of safety for an organism by comparing the concentration that causes toxic effects with an estimate of exposure to the organism.

Heavy metals: Any metal with a high atomic weight (usually greater than 100). They are poisonous and tend to persist in living tissue once ingested, e.g. mercury, lead, cadmium and chromium.

Human Health Risk Assessment: The process of quantifying risks and determining the acceptability of those risks to humans.

Hydrogeology: The study of subsurface waters and related geologic aspects of surface water.

Hydrology: The study of the characteristics, occurrence, movement and utilization of water on or below the earth's surface and within its atmosphere.

Impervious liner: A layer of clay or manmade material such as High-Density Polyethylene (HDPE), used to seal the bottom of containment structures in order to prevent percolation and migration of potential contaminants.

Incremental: Small increase.

Leachate: The water that percolates through a porous medium such as soil and transports any salts or other dissolvable materials, which may be found in the soil.

Leaching: Washing out of soluble substances by water passing down through rock or soil. In a milling sense, indicates the dissolving of ore minerals from the ground ore.

Limnological: Referring to the scientific study of lakes and their physical, chemical and biological components.

Loadings: Total mass of contaminants to a water body or to the land surface over a specified time.

Macrophytes: Rooted aquatic vascular plants.

Maintenance Activities: activities undertaken to ensure that conditions remain in the desired state

Mean: The average value of the data.

Measurement endpoint: A quantitative summary of the results of a toxicity test, a biological monitoring study, or other activity intended to reveal the effects of a substance.

Mineral: A naturally occurring inorganic, crystalline solid that has a definite chemical composition and characteristic physical properties.

Mitigation: An action or design intended to reduce the severity or extent of an environmental impact.

Modeling: Using mathematical principles, information is arranged in a computer program to model conditions in the environment and to predict the outcome of certain operations.

Monitoring: Sampling, measurement, and/or inspection.

Overburden: Unconsolidated soil and rock material overlying bedrock.

Oxidation: The process of combining with oxygen, especially at the atomic level.

Particulate: Consisting of particles.

Pathway: The physical course a chemical or pollutant takes from its source to the exposed organism.

Pathways analysis: A method of estimating the transfer of contaminants (e.g. metals released in water) and subsequently accumulating up the food chain to fish, vegetation, mammals and humans and the resulting radiological dose to humans.

PCBs: A group of manufactured chemicals including 209 different, but closely related, compounds made up of carbon, hydrogen, and chlorine. If released to the environment, they persist for long periods of time and can biomagnify in the food web. They are an organic toxicant suspected of causing cancer, endocrine disruption, and other adverse impacts on organisms.

Permeability: Describes the ability of subsurface features to transport water.

pH: A number expressing the degree of alkalinity or acidity of a substance according to the hydrogen ion concentration. A substance is said to be “neutral” if its pH is 7, acidic if less than 7 and alkaline if greater than 7.

Phytoplankton: Any microscopic or near microscopic, free-floating autotrophic aquatic plant.

Population: A group within a single species, the individuals of which can and do freely interbreed.

Porosity: The relative volume of open spaces within a rock or soil. (Usually expressed as a percentage of the total volume of the material occupied by the open spaces, or interstices.)

Porewater: Water contaminated and trapped within void spaces in soils or rocks.

Precipitation: The deposition of atmospheric moisture as rain, sleet, snow, hail, frost or dew.

Radiation: The emission and propagation of energy through space or matter in the form of electromagnetic waves (e.g. gamma rays) or fast-moving particles such as alpha and beta particles.

Radioactive: The condition of a material exhibiting the spontaneous decay of an unstable atomic nucleus into a stable or unstable nucleus (e.g. uranium-238 decays into thorium-234 (unstable) and polonium-210 decays into lead-208 (stable)).

Radionuclide: An element or isotope which is radioactive as a result of the instability of the nucleus of its atom (e.g. radium or uranium).

Receptor: A human or ecological entity exposed to a contaminant released to the environment.

Reclamation: Restoration of a site to a beneficial use, which may be for purposes other than the original use.

Remediation: The improvement of a contaminated site to prevent, minimize or mitigate damage to human health or the environment. Remediation involves the development and application of a planned approach that removes, destroys, contains or otherwise reduces the availability of contaminants to receptors of concern.

Remediation Issue: Issues of concern for a specific aspect of the site.

Risk: A measure of the probability that damage to life, health, property, and/or the environment will occur as a result of a given hazard.

Risk Assessment: Qualitative and quantitative evaluation of the risk posed to human health and/or the environment by the actual or potential presence and/or use of specific pollutants.

Risk Characterization: The last phase of the risk assessment process that estimates the potential for adverse health or ecological effects to occur from exposure to a stressor and evaluates the uncertainty involved.

Run-off: The part of rainfall that is not absorbed directly by the soil but is drained off in rills or streams.

Screening: A preliminary stage of the assessment process for quick evaluation of relatively simple and routine activities or for determining the level of effort required for evaluating more complex projects.

Sediment: Loose, solid particles resulting from the breakdown of rocks, chemical precipitation or from organisms.

Slumping: Sagging or physical subsidence of materials.

Topographic map: A map showing elevations by means of contour lines (i.e. lines joining points of equal elevation).

Total dissolved solids (TDS): The sum of all the concentrations of dissolved ions in a solution usually expressed as mg/L.

Total suspended solids (TSS): The total amount of suspended solid material in a sample, usually expressed as mg/L.

Uncertainty: A quantitative expression of error.

Uptake: The process/act by which a contaminant (e.g. a heavy metal) enters a biological organism (e.g. inhalation, ingestion).

Watershed: A drainage area or basin into which all surface water from a particular area collects and is transported.

Zooplankton: Any microscopic or nearly microscopic animals that move passively in aquatic ecosystems.

UNITS AND ABBREVIATIONS

g	gram
m	metre
m^2	square metre
m^3	cubic metres
m^3/y	cubic metres per year
μg/g	microgram per gram
μg/L	microgram per litre

CHEMICAL SYMBOLS

Aluminum	Al
Ammonia	NH_3
Arsenic	As
Barium	Ba
Beryllium	Be
Cadmium	Cd
Calcium	Ca
Chloride	Cl
Chromium	Cr
Cobalt	Co
Copper	Cu
Iron	Fe
Lead	Pb
Lithium	Li
Magnesium	Mg
Manganese	Mn
Molybdenum	Mo
Nickel	Ni
Phosphorous	P
Potassium	K
Selenium	Se
Silver	Ag
Sodium	Na
Strontium	Sr
Sulphate	SO_4
Uranium	U
Vanadium	V
Zinc	Zn

LIST OF ABBREVIATIONS AND ACRONYMS

AI	Adequate Intake
ATP	Adenosine Triphosphate
ATSDR	Agency for Toxic Substance and Disease Registry
BCF	Bioconcentration Factors
BSAF	Biota-Soil and Sediment Accumulation Factors
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CALA	Canadian Association for Laboratory Accreditation Inc.
CCME	Canadian Council of Ministers of the Environment
COEC	Contaminant of Environmental Concern
COPC	Contaminant of Potential Concern
COPEC	Contaminant of Potential Environmental Concern
CSQG	Canadian Soil Quality Guidelines
CWS	Canada Wide Standards (CWS) for Petroleum Hydrocarbons (PHC)
DDT	Dichlorodiphenyltrichloroethane
DNA	Deoxyribonucleic acid
DQRA	Detailed Quantitative Risk Assessment
DRE	Destruction and Removal Efficiency
DRI	Dietary Reference Intake
ECSM	Ecological Conceptual Site Model
EEAEL	Estimated Exposure Adverse Effect Levels
EPS	Ecological Preliminary Standards
EQG	Environmental Quality Guideline
EqP	Equilibrium Partitioning
ERA	Ecological Risk Assessment
ERE	Ecological Risk Evaluation
ESA	Environmental Site Assessment
FCM	Food Chain Multipliers
FCSAP	Federal Contaminated Site Action Plan
FWAL	Protection of Freshwater and Aquatic Life
GAC	Granular Activated Carbon
HazMat	Hazardous Materials
HC	Health Canada
HHRA	Human Health Risk Assessment
HQ	Hazard Quotient
HTTD	High Temperature Thermal Desorption
ILCR	Incremental Lifetime Cancer Risks
ISQG	Interim Sediment Quality Guidelines
LNAPL	Light Non-Aqueous Petroleum Liquid

LOAEL	Lowest Observable Adverse Effect Level
LOEL	Lowest Observable Effects Level
LTTD	Low Temperature Thermal Desorption
MNA	Monitored Natural Attenuation
MOE	Ministry of the Environment
NCSCS	National Classification System for Contaminated Sites
NOAEL	No-Observeable Adverse Effect Levels
NRC	National Research Council
ORNL	Oak Ridge National Laboratory (US)
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PCOC	Potential Contaminants of Concern
PFAS	Perfluoroakylated Substances
PFC	Perfluorinated alkyl Compounds
PFOS	Perfluorooctane Sulfonate
PHC	Petroleum Hydrocarbons
PSQG	Provincial Sediment Quality Guidelines
PWGSC	Public Works and Government Services Canada
PWQO	Provincial Water Quality Objectives
QA/QC	Quality Assurance / Quality Control
RDA	Recommended Dietary Allowance
RPD	Relative Percent Difference
RfD	Reference Dose
RMC	Royal Military College
RNA	Ribonucleic acid
RQ	Risk Quotient
S/S	Solification/Stabilization
SARA	Species at Risk Act
SSI	Site Specific Investigation
SSRA	Site Specific Risk Assessment
SSTL	Site Specific Target Levels
SVE	Soil Vapour Extraction
TC	Transport Canada
TDI	Tolerable Daily Intake
TOC	Total Organic Carbons
TPH	Total Petroleum Hydrocarbons
TRV	Toxicity Reference Values
UCLM	95% Upper Confidence Limit of the Mean
ULN	“Upper Limit of Normal” Contaminate Guidelines

USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
VEC	Valued Ecosystem Components
VOC	Volatile Organic Compounds
ZVI	Zero Valent Iron

1.0 INTRODUCTION

Franz Environmental Inc. (FRANZ) was retained by Public Works and Government Services Canada (PWGSC) on behalf of Transport Canada to complete an Ecological and Human Health Detailed Quantitative Risk Assessment (DQRA) for the Vehicle Dump and Community Landfill, Iqaluit, Nunavut.

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1.1 Objectives

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1.2 Scope of Work

The risk assessment was undertaken based on present site conditions, and incorporated site-specific details obtained through the document review, interviews and field investigation results.

1.3 Background Information

The Iqaluit Vehicle Dump and Community Landfill is situated approximately 1.7 km southwest of the city of Iqaluit, Nunavut. Universal Transverse Mercator (UTM) co-ordinates taken from the center of the site are E521904.94, N7067812.69. Only the top section of the site is accessible by road. The site is located adjacent to Sylvia Grinnell Territorial Park.

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The United States Air Force (USAF) used this site from between 1955 to 1963 as a metal dump for vehicles, truck bodies, barrels and scrap metal. The majority of materials were deposited in 1963 when the US military left Frobisher Bay. Shops, buildings, and other materials were simply bulldozed over the cliff. The cliff is a bedrock outcrop rising approximately 50 m above the tidal area where the Sylvia Grinnell River meets Frobisher Bay. The area to the north side of the slope was used by the USAF and the community of Iqaluit as a landfill site for household garbage until sometime in the 1970's.

The study area was found to contain known and discrete PHC, PCB, metals, and pesticide soil, sediment, and surface water impacts associated with the historical waste disposal activities. Elevated metals (particularly cadmium, copper, lead, and zinc) are widespread; however, spatial distribution appears to be concentrated mostly at the toe of the main landfill and the central portion of the vehicle dump. Volatile organic compounds (VOCs, specifically PCE and TCE) were detected in sediments and surface waters in one discrete area.

Waste disposal practices have resulted in a slow release of inorganic metals and organic contaminants (e.g. PCBs, pesticides, PHCs) into the environment. Leaching of metals and other organics from the waste debris represents a measureable loading risk to the aquatic environment on site and possibly other surface water bodies, particularly the Sylvia Grinnell River.

2.0 IDENTIFICATION OF CONTAMINANTS OF POTENTIAL CONCERN

2.1 Chemical Screening – COPCs in Soil

2.1.1 Inorganics

Measured concentrations of inorganic elements in site soil were evaluated against average background concentrations, and CCME Soil Quality Guidelines for coarse-grained soils for ecological and human health. Where no values were available, measured concentrations were compared to generic CCME soil quality guidelines for coarse-grained parkland soil. Results indicated that the following inorganic elements were present in site soils in excess of human health guidelines (or parkland guidelines, as appropriate), and were carried forward to the qualitative assessment for human health: **cadmium, lead, and zinc.**

The following inorganic elements were present in site soils in excess of CCME ecological guidelines (or parkland guidelines, as appropriate), and were carried forward to the qualitative assessment for ecological risk: **cadmium, copper, selenium and zinc.**

There were no generic criteria available against which to evaluate **aluminum, calcium, iron, magnesium, manganese, phosphorus, potassium, sodium, strontium or tin** in the chemical screening, therefore they were evaluated qualitatively with respect to both human health and ecological risk.

Results of the chemical screening of inorganic elements in soil are shown in Table 2.1, below.

Table 2.1 Results of the chemical screening of inorganic elements in soil (µg/g)

Contaminant	CCME Soil PL [1]	Ecological	CCME Human Health [1]	Average Background	RDL	No. of Samples	No. Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in qualitative ERA?	Retained in Human Health quantitative?
Aluminum	-				50	14	13	2600	4392	5100	(Y)	(Y)
Antimony	20			<10	0.2	38	27	0.2	6.6	10	N	N
Arsenic	12[a]	17	12	<5.0	1	38	21	1	4	5.3	N	N
Barium	500	500	500	23.5	0.5	38	38	17	45	425	N	N
Beryllium	4[a]			<0.50	0.2	38	10	0.2	0.4	1.02	N	N
Cadmium	10	10	14	<0.50	0.1	38	16	0.1	1.0	22.4	**Y**	**Y**
Calcium	-				50	14	14	1900	2692	7700	(Y)	(Y)
Chromium	64	64	220	10.2	1	38	38	6.4	18.7	25.5	N	N
Chromium (VI)	0.4	64	220		0.2	14	1	0.2	0.2	0.4	N	N
Cobalt	50[a]			3.2	0.1	38	38	2.1	3.6	5.9	N	N
Copper	63	63	1100	5.2	0.5	38	38	3.9	16.8	103	**Y**	N
Iron	-				50	14	14	9900	21531	29000	(Y)	(Y)
Lead	140	300	140	<30	1	38	26	2	42	256	N	**Y**
Magnesium	-				50	14	14	1800	2462	3100	(Y)	(Y)
Manganese	-				1	14	14	45	119	250	(Y)	(Y)
Mercury	6.6	12	6.6	<0.0050	0.05	38	19	0.005	0.0	0.285	N	N
Molybdenum	10[a]			<4.0	0.5	38	21	0.5	3.1	5.6	N	N
Nickel	50	50	50	5.6	0.5	38	34	4.5	6.1	8.8	N	N
Phosphorus	-				50	14	14	570	705	850	(Y)	(Y)
Potassium	-			6.605	200	30	30	5.03	337	960	(Y)	(Y)
Selenium	1	1	80	<0.6	0.5	38	6	0.5	0.9	2	**Y**	N
Silver	20[a]			<2.1	0.2	38	9	0.2	1.4	2	N	N
Sodium	-				100	14	12	100	135	280	(Y)	(Y)
Strontium	-				1	14	14	4	7	14	(Y)	(Y)
Thallium	1	1.4	1	<1.0	0.05	38	12	0.05	0.7	1	N	N
Tin (Sn)				<5.0	5	24	11	5	5.5	9.8	(Y)	(Y)
Vanadium	130	130	130	39.6	5	38	38	13.9	41.7	68	N	N
Zinc	200	200	200	28.35	5	38	38	22	63	488	**Y**	**Y**

1= CCME (2007), Canadian Soil Quality Guidelines, Update 7.0, Table 1. Canadian Soil Quality Guidelines, Parkland Use, coarse-grained soils.

RDL = Reportable Detection Limit

(Y)= Inorganics that there were no generic criteria available to evaluate in the chemical screening, and they were subsequently carried forward to the qualitative assessment for either ecological and human health risk.

Y= Inorganics that exceeded human health guidelines (or parkland guidelines, as appropriate), or CCME ecological guidelines, and they were subsequently carried forward to the qualitative assessment for either ecological or human health risk.

2.1.2 Polyaromatic Hydrocarbons (PAHs)

Concentrations of polyaromatic hydrocarbons (PAHs) in soil were compared against CCME coarse soil quality guidelines for ecological and human health. Where these were unavailable, CCME parkland values for coarse soil were used, and in the absence of parkland values, the Ontario Ministry of Environment Standards for all other types of property uses were used (Table 1. Full depth background site condition standards).

Only benzo(g,h,i)perylene did not comply with soil quality guidelines for ecological receptors. All other PAHs were screened out of the risk assessment at this stage.

With respect to human receptors, the following PAHs were non-compliant with applicable guidelines, and were therefore carried forward in the risk assessment: **acenaphthene, benzo(a)anthracene, benzo(b+j)fluoranthene, benzo(k)fluoranthene and dibenz(a,h)anthracene**.

Results of the chemical screening of PAHs in soil are shown in Table 2.2 below.

Table 2.2 Results of the chemical screening of PAHs in soil (µg/g)

Contaminant	CCME Soil PL [1]	CCME Ecological [1]	CCME Human health [1]	MOE [2]	RDL	No. of Samples	No. of Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Human Health Qualitative?
Acenaphthene	-	21.5	-	0.07	0.01	12	0	0.01	0.035	0.1	**Y**
Acenaphthylene	-	320	-	0.08	0.005	12	0	0.005	0.035	0.05	N
Anthracene	-	2.5	-	0.16	0.005	12	1	0.005	0.039	0.1	N
Benzo(a)anthracene	1	6.2	0.33	0.74	0.01	12	2	0.01	0.144	1.14	**Y**
Benzo(a)pyrene	0.7	20	5.3	0.49	0.005	12	2	0.005	0.142	1.31	N
Benzo(b+j)fluoranthene	1	6.2	0.16	0.47	0.05	7	2	0.05	0.309	1.78	**Y**
Benzo(g,h,i)perylene	-	-	6.8	0.68	0.02	12	2	0.02	0.109	0.728	N
Benzo(k)fluoranthene	1	6.2	0.34	0.48	0.01	12	1	0.01	0.092	0.662	**Y**
Chrysene	-	6.2	2.1	0.69	0.01	12	2	0.01	0.126	1.04	N
Dibenz(a,h)anthracene	1	-	0.23	0.16	0.02	12	1	0.02	0.068	0.235	**Y**
Fluoranthene	-	50	-	1.1	0.005	12	3	0.005	0.128	1.07	N
Fluorene	-	15.4	-	0.12	0.005	12	0	0.005	0.035	0.05	N
Indeno(1,2,3-cd)pyrene	1	-	2.7	0.38	0.02	12	1	0.02	0.124	0.881	N
2-Methylnaphthalene	-	-	-	0.29	0.005	12	0	0.005	0.035	0.05	N
Naphthalene	0.6	8.8	-	0.09	0.005	12	0	0.005	0.035	0.05	N
Phenanthrene	5	43.0	-	0.69	0.005	12	3	0.005	0.052	0.171	N
Pyrene	10	7.7	-	1.0	0.005	12	3	0.005	0.123	1.04	N

All units in ug/g, unless otherwise noted.

1= Canadian Council of Ministers of the Environment (CCME). 2007. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.

2= Ministry of the Environment (MOE). Table 1: Full depth background site condition standards2004. Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act. Queen's Printer for Ontario, March 2004.

\- Guideline values are unavailable

RDL = Reportable Detection Limit

2.1.3 BTEX Compounds and Petroleum Hydrocarbons (PHCs)

Soil concentrations of BTEX compounds were evaluated against CCME soil quality guidelines for ecological and human health; concentrations of PHC fractions F1 to F4 were compared to CCME Canada-Wide Standards (CWS) for Petroleum Hydrocarbons in Soil (coarse-grained, parkland soil).

Benzene, and PHC fractions F1, F2 and F3 were carried forward in the **human health** risk assessment, and **PHC fractions F2, F3 and F4** were carried forward in the **ecological** risk assessment.

Results of the chemical screening of BTEX compounds and PHCs are shown in Table 2.3 below.

Table 2.3 Results of the chemical screening of BTEX compounds and PHCs (µg/g) in soil

Contaminant	CCME Soil PL[1]	CCME cological[1]	CCME Human Health[1]	Lowest RDL	No. of Samples	No. Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?	Retained in Human Health Qualitative?
Benzene	0.03	31	0.03	0.002	32	0	0.002	0.023	0.04	N	**Y**
Ethylbenzene	0.082	55	0.082	0.002	32	0	0.002	0.032	0.05	N	N
Toluene	0.37	75	0.37	0.002	32	0	0.002	0.032	0.05	N	N
m+p-Xylene	-			0.002	32	0	0.002	0.032	0.05	N	
o-Xylene	-			0.002	32	0	0.002	0.032	0.05	N	
Xylenes (total)	11	95	11	0.002	32	0	0.002	0.063	0.1	N	N
F1 (C6-C10)	-			10	32	1	10	15	180	N	
F1 (C6-C10) minus BTEX	-	210	30	10	32	1	10	15	180	N	**Y**
F2 (C10-C16)	-	150	150	10	32	5	10	70	1100	**Y**	**Y**
F3 (C16-C34)	-	300	2500	10	32	10	10	1511	44400	**Y**	**Y**
F4 (C34-C50)	-	2800	10000*	10	32	10	10	288	6960	**Y**	N

All units in ug/g, unless otherwise noted.

1= Canadian Council of Ministers of the Environment (CCME). 2007. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.

*= A management limit has been developed that may be used in place of the ecological criteria below 3 meters depth, this limit was used as human health risk criteria in this situation.

RDL = Reportable Detection Limit

2.1.4 Volatile Organic Compounds (VOCs)

VOC concentrations in site soil were compared to CCME soil quality guidelines for coarse-grained parkland soils. With the exception of trichloroethene, no distinction is made between values protective of ecological receptors and human receptors. Where no CCME values were available, the Ontario Ministry of Environment Standards for all other types of property uses (Table 1. Full depth background site condition standards). were applied in the chemical screening. Substances with no guidelines or standards were eliminated from the risk assessment if all values were below detection limits, otherwise they were carried forward in both the human health and ecological risk assessments.

On the basis of the chemical screening, **bromoform, 1,1,1,2-tetrachloroethane and vinyl chloride** were retained in the risk assessment.

Table 2.4 below presents the results of the chemical screening of VOCs in site soil.

Table 2.4 Results of the chemical screening of VOCs (µg/g) in soil

Contaminant	CCME Soil PL [1]	CCME Human Health [1]	MOE [2] guideline Table1.	RDL	No. of Samples	No. of Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Human Health Qualitative?	Retained in Ecological Qualitative?
Acetone	-			0.1	7	1	0.1	0.100	0.1	N	N
Bromodichloromethane	-			0.002	13	0	0.002	0.024	0.05	N	N
Bromoform	-		0.002	0.002	13	0	0.002	0.024	0.05	**Y**	**Y**
Bromomethane	-		0.003	0.003	7	0	0.003	0.003	0.003	N	N
Carbon tetrachloride	5		0.002	0.002	13	0	0.002	0.024	0.05	N	N
Chlorobenzene	1		0.002	0.002	13	0	0.002	0.024	0.05	N	N
Chlorodibromomethane	-		0.003	0.002	13	0	0.002	0.002	0.002	N	N
Chloroform	5		0.006	0.002	13	0	0.002	0.047	0.1	N	N
Chloroethane	1			0.1	6	0	0.1	0.100	0.1	N	N
Chloromethane				0.1	6	0	0.1	0.100	0.1	N	N
1,2-Dichlorobenzene	1		0.002	0.002	13	0	0.002	0.024	0.05	N	N
1,3-Dichlorobenzene	1		0.002	0.002	13	0	0.002	0.024	0.05	N	N
1,4-Dichlorobenzene	1		0.002	0.002	13	0	0.002	0.024	0.05	N	N
1,1-Dichloroethane	5		0.002	0.002	13	0	0.002	0.024	0.05	N	N
1,2-Dichloroethane	5		0.002	0.002	13	0	0.002	0.024	0.05	N	N
1,1-Dichloroethene	5		0.002	0.002	13	0	0.002	0.002	0.002	N	N
cis-1,2-Dichloroethene	5			0.002	13	0	0.002	0.002	0.002	N	N
trans-1,2-Dichloroethene	5		0.003	0.002	13	0	0.002	0.002	0.002	N	N
Dichloromethane	5			0.003	13	0	0.003	0.225	0.8	N	N
1,2-Dichloropropane	5		0.002	0.002	13	0	0.002	0.024	0.05	N	N
cis-1,3-Dichloropropene	-			0.002	13	0	0.002	0.002	0.002	N	N
trans-1,3-Dichloropropene	5		0.003	0.002	13	0	0.002	0.002	0.002	N	N
Ethylene dibromide	-		0.004	0.002	7	0	0.002	0.002	0.002	N	N
Hexachlorobenzene	2		0.46	0.002	3	0	0.002	0.003	0.003	N	N
Hexachlorobutadiene	-		0.38	0.01	3	0	0.01	0.010	0.01	N	N
Methyl ethyl ketone	-		0.27	0.03	7	0	0.03	0.030	0.03	N	N
Methyl isobutyl ketone	-		0.48	0.03	7	0	0.03	0.030	0.03	N	N
Methyl-tert-butylether	-		5.7	0.002	13	3	0.002	0.002	0.002	N	N
Styrene	5		0.002	0.002	13	0	0.002	0.024	0.05	N	N
1,1,1,2-Tetrachloroethane	-		0.019	0.002	13	0	0.002	0.024	0.05	**Y**	**Y**
1,1,2,2-Tetrachloroethane	5		0.004	0.002	13	0	0.002	0.024	0.05	N	N
Tetrachloroethene	0.2		0.002	0.002	13	2	0.002	0.014	0.057	N	N
1,1,1-Trichloroethane	5		0.009	0.002	13	0	0.002	0.024	0.05	N	N
1,1,2-Trichloroethane	5		0.002	0.002	13	1	0.002	0.024	0.05	N	N
Trichloroethene	0.01	0.01	0.004	0.002	13	1	0.002	0.002	0.005	N	N
Trichlorofluoromethane				0.1	6	0	0.1	0.100	0.1	N	N
Vinyl chloride	-		0.003	0.002	13	0	0.002	0.047	0.1	**Y**	**Y**

All units in ug/g, unless otherwise noted.

1= Canadian Council of Ministers of the Environment (CCME). 2007. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.

2= Ministry of the Environment (MOE). 2004. Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act. Queen's Printer for Ontario, Marc

RDL = Reportable Detection Limit

2.1.5 PCBs and Pesticides/Herbicides

Total PCB concentrations in site soil were compared with the CCME soil quality guideline for coarse-grained, parkland soil. The maximum measured concentration exceeded the guideline, and **total PCBs** were therefore retained in the risk assessment with respect to both human and ecological receptors.

Table 2.5, below, shows the results of chemical screening for PCBs in soil.

Table 2.5 Results of the chemical screening of PCBs (µg/g) in soil

Chemicals	CCME Soil PL [1]	Ecological	Human Health	CCME Soil CL [2]	MOE	RDL	No. of samples	No. Detected	No. of Non-detected	Minimum concentration	Average Concentration	Maximum Concentration	Retained in ECO qualitative	Retained in HH qualitative
Aroclor 1016	-			-		0.01	21	0	21	0.01	0.2243	1.5		
Aroclor 1221	-			-		0.01	21	0	21	0.01	0.2248	1.5		
Aroclor 1232	-			-		0.01	21	0	21	0.01	0.2243	1.5		
Aroclor 1242	-			-		0.01	21	0	21	0.01	0.2243	1.5		
Aroclor 1248	-			-		0.01	21	1	20	0.01	0.2319	1.5		
Aroclor 1254	-			-		0.01	21	1	20	0.01	0.2269	1.5		
Aroclor 1260	-			-		0.01	21	5	16	0.01	2.0801	17.1		
Aroclor 1262	-			-		0.01	21	0	21	0.01	0.2243	1.5		
Aroclor 1268	-			-		0.01	21	0	21	0.01	0.2243	1.5		
Polychlorinated biphenyls	1.3	1.3		33	0.3	0.01	21	5	16	0.01	2.0943	17.1	**Y**	**Y**

All units in ug/g, unless otherwise noted.

Notes:

1 = CCME (2007), Canadian Soil Quality Guidelines, Update 7.0, Table 1. Canadian Soil Quality Guidelines, Residential / Parkland Use, coarse-grained soils.
2 = CCME (2007), Canadian Soil Quality Guidelines, Update 7.0, Table 1. Canadian Soil Quality Guidelines, Commercial Use, coarse-grained soils.
RDL = Reportable Detection Limit
-' = No Guideline

DDT (and its metabolites) and hexachlorobenzene concentrations in site soils were evaluated against CCME soil quality guidelines. All other organochlorine pesticides were evaluated against the Ontario Ministry of Environment Standards for all other types of property uses (Table 1. Full depth background site condition standards). Substances with no standards or guidelines were eliminated from the risk assessment if all values were below the detection limit. Since standards and guidelines for pesticides are not specific to ecological or human health, the available guidelines were considered applicable for both types of receptors.

Results of the chemical screening of pesticides are presented in Table 2.6 below. **All pesticides were eliminated** from the risk assessment on the basis of the chemical screening.

Table 2.6 Results of the chemical screening of pesticides (µg/g) in soil

Contaminant	CCME Soil PL [1]	CCME Human Health [1]	MOE [2] guideline Table1.	RDL	No. of Samples	No. of Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Human Health Qualitative?	Retained in Ecological Qualitative?
Aldrin	-		0.05	0.001	6	0	0.001	0.0055	0.03	N	N
Chlordane	-		0.05	0.003	1	0	0.002	0.0025	0.003	N	N
alpha-BHC				0.001	5	0	0.001	0.0013	0.002	N	N
alpha-Chlordane	-			0.002	1	0	0.002	0.002	0.002	N	N
beta-BHC				0.002	5	0	0.002	0.002	0.002	N	N
trans-Chlordane	-			0.001	6	0	0.001	0.00164	0.003	N	N
2,4'-DDD	-			0.001	6	0	0.001	0.0015	0.002	N	N
Lindane (gamma - BHC)			0.41	0.001	6	0	0.001	0.0013	0.002	N	N
4,4'-DDD	-			0.001	6	4	0.0015	0.00864	0.044	N	N
DDD (total)	-		2.2	0.002	1	0	0.002	0.002	0.002	N	N
delta-BHC				0.001	5	0	0.001	0.0013	0.002	N	N
2,4'-DDE	-			0.001	6	0	0.001	0.00164	0.003	N	N
4,4'-DDE	-			0.001	6	2	0.001	0.00211	0.0049	N	N
DDE (total)	-		1.6	0.002	1	0	0.002	0.0025	0.003	N	N
cis-Chlordane (alpha)				0.001	5	0	0.001	0.0013	0.002	N	N
2,4'-DDT	0.7			0.002	6	3	0.002	0.01116	0.0586	N	N
4,4'-DDT	0.7			0.002	6	5	0.002	0.0456	0.247	N	N
DDT plus metabolites	-			0.002	1	1	0.002	0.0025	0.003	N	N
DDT (total)	0.7		1.4	0.002	1	1	0.002	0.0025	0.003	N	N
Dieldrin	-		0.05	0.001	6	0	0.001	0.00179	0.004	N	N
Endosulfan	-		0.18	0.002	1	0	0.002	0.004	0.006	N	N
alpha-Endosulfan (I)	-			0.001	6	0	0.001	0.0015	0.002	N	N
beta-Endosulfan(II)	-			0.001	6	0	0.001	0.00207	0.006	N	N
Endosulfan Sulfate				0.001	5	0	0.001	0.0013	0.002	N	N
Endrin	-		0.05	0.002	6	0	0.002	0.00414	0.005	N	N
Heptachlor	-		0.05	0.002	6	0	0.002	0.006	0.03	N	N
Heptachlor epoxide	-		0.05	0.001	6	0	0.001	0.00264	0.01	N	N
Hexachlorobenzene	2			0.002	1	0	0.002	0.0025	0.003	N	N
Methoxychlor	-		0.05	0.005	6	0	0.005	0.00586	0.008	N	N
Mirex				0.001	5	0	0.001	0.0013	0.002	N	N
cis-Nonachlor				0.001	5	0	0.001	0.0051	0.02	N	N
trans-Nonachlor				0.001	5	0	0.001	0.0013	0.002	N	N
Oxychlordane				0.001	5	0	0.001	0.0013	0.002	N	N

All units in ug/g, unless otherwise noted.

1= Canadian Council of Ministers of the Environment (CCME). 2007. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.

2= Ministry of the Environment (MOE). 2004. Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act. Queen's Printer for Ontario, March 2004.

RDL = Reportable Detection Limit

2.2 Chemical Screening – COPCs in Surface Water

Since the pathway analysis determined that there were no pathways linking surface water (freshwater or brackish) on the site to human receptors (see Section 3.2.4), concentrations of inorganic elements in site surface water were not evaluated against CCME Canadian Drinking Water Guidelines.

2.2.1 Fresh water

2.2.1.1 Inorganics

Measured concentrations of inorganic elements in fresh water collected from the site were compared against background concentrations and the CCME guidelines for freshwater aquatic life (FWAL). Substances with no CCME FWAL guidelines were retained in the qualitative ecological risk assessment, except where all concentrations were below detection limits and/or background values.

Results of the evaluation of surface water concentrations against CCME FWAL guidelines are presented in Table 2.7 below.

Inorganic contaminants with measured values above CCME FWAL guidelines included **aluminum, antimony, boron, cadmium, hexavalent chromium, copper, iron, , and zinc**. Since the detection limits for **lead, mercury and selenium** were above CCME FWAL and/or average background values, these elements were also retained in the qualitative assessment. As well, **calcium, colbalt, magnesium, manganese, potassium sodium and tin** were retained in the qualitative assessment, as there are no CCME FWAL guidelines for these elements, and their concentrations in water collected from the exposure zone exceeded background concentrations.

Table 2.7 Results of chemical screening of inorganic elements (µg/L) in fresh surface water

Contaminant	CCME Freshwater [1]	CCME AW Marine [2]	Lowest RDL	No. of samples	No. of detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Aluminum (Al)									
pH<6.5	5	-	5	21	12	5	17	119	**Y**
pH>6.5	100	-	250	4	3	11.9	82.75	250	N
Antimony (Sb)	-	-	0.5	25	1	0.5	1.7	25	**Y**
Arsenic (As)	5	12.5	0.5	25	0	0.5	2.3	25	N
Barium (Ba)	-	-	20	10	0	20	28	100	N
Beryllium (Be)	-	-	1	25	0	0.5	3	50	N
Boron (B)	-	-	100	25	10	10	130	920	**Y**
Cadmium (Cd)	0.017	0.12	0.017	25	7	0.017	0.12	0.129	**Y**
Calcium (Ca)	-	-	-	10	10	11200	24960	91500	(Y)
Chromium (Cr)	8.9	56	1	25	0	1	6	50	N
Chromium (Cr)VI	1	1.5	0.5	15	3	0.5	1.0	3.7	**Y**
Cobalt (Co)	-	-	0.3	25	7	0.3	1.3	2.86	(Y)
Copper (Cu)									
H:0 - 120,000ug/L	2	-	1	23	11	1	2	7.1	**Y**
H: >180,000 ug/L	4	-	10	2	0	10	30	50	N
Iron (Fe)	300	-	100	25	25	86	1911	10000	**Y**
Lead (Pb)									
H:0 - 60,000ug/L	1	-	0.5	21	3	0.5	0.6	2	**Y**
H:60 - 120,000ug/L	2	-	0.5	2	1	0.5	1.6	2.77	**Y**
H: >180,000ug/L	0.007	-	5	2	0	5	15	25	**Y**
Lithium (Li)	-	-	5	10	0	5	34	250	N
Magnesium (Mg)	-	-	-	10	10	2800	36474	242000	(Y)
Manganese (Mn)	-	-	-	10	10	15.7	69.3	151	(Y)
Mercury (Hg)	0.026	0.016	0.02	25	0	0.02	0.06	0.1	**Y**
Molybdenum (Mo)	73	-	1	25	2	1	3	1	N
Nickel (Ni)									
H: 0 - 60,000ug/L	25	-	1	21	2	1	1	2	N
H:60 - 120,000ug/L	65	-	1	2	1	1	2	3.7	N
H: >180,000ug/L	0.15	-	10	2	0	10	30	50	N
Phosphorus	-	-	2	15	15	6	36	220	N
Potassium (K)	-	-	2000	10	4	2000	12300	78000	(Y)
Selenium (Se)	1	-	1	25	0	1	4	50	**Y**
Silver (Ag)	0.1	-	0.02	25	1	0.02	0.11	0.1	N
Sodium (Na)	-	-	-	10	10	5200	296100	2040000	(Y)
Thallium (Tl)	0.8	-	0.2	25	2	0.05	0.58	0.08	N
Tungsten	-	-	-	15	0	1	1	1	N
Tin (Sn)	-	-	0.5	10	1	0.5	3.4	0.57	(Y)
Titanium (Ti)	-	-	10	10	0	10	14	50	N
Uranium (U)	-	-	0.2	25	2	0.1	0.6	0.2	N
Vanadium (V)	-	-	1	25	2	1	4	5	N
Zinc (Zn)	30	-	5	25	12	5	14	163	**Y**
Zirconium	-	-	-	15	0	1	1	1	N

All units in ug/L, unless otherwise noted.

1 = CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Candaian water quality guidelines for the protection of aquatic life. Freshwater.

2 = CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Candaian water quality guidelines for the protection of aquatic life. Marine.

RDL = Reportable Detection Limit

2.2.1.2 BTEX Compounds and PHCs

Site-specific concentrations of benzene, ethylbenzene and toluene were below detection limits, and compliant with CCME FWAL guidelines. No such guideline exists for xylenes, therefore the Ontario MOE standard for mixed xylenes in potable groundwater was applied. Xylene concentrations were below the detection limit and the MOE standard.

There are no CCME guidelines for PHCs in surface water, therefore **PHC fractions F3 and F4** were carried forward to the qualitative assessment, as detectable concentrations of these substances were found in one sample.

Results of the chemical screening of BTEX compounds and PHCs are presented in Table 2.8 below.

Table 2.8 Results of chemical screening of BTEX and PHCs (µg/L) in fresh surface water

Parameters	CCME Freshwater [1]	Lowest RDL	No. of Samples	No. Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Volatiles								
Benzene	370	0.5	11	0	0.1	0.4	1	N
Ethylbenzene	90	0.5	11	0	0.1	0.4	1	N
Toluene	2	1	11	0	0.2	0.8	2	N
o-Xylene	---	0.5	11	0	0.1	0.4	1	N
m & p-Xylene	---	0.5	11	0	0.1	0.4	1	N
Xylenes (Total)	---	1	11	0	0.1	0.7	1	N
Extractable Petroleum Hydrocrabons								
F1-BTEX	---	100	11	0	100	100	100	N
CWS F1 (C06-C10)	---	100	11	0	100	100	100	N
CWS F2 (C10-C16)	---	100	11	0	100	220	300	N
CWS F3 (C16-C34)	---	100	11	1	100	265	550	**Y**
CWS F4 (>C34)			5	1	100	133	230	**Y**

All units in ug/L, unless otherwise noted.

1 = CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Candaian water quality guidelines for the protection of aquatic life. Freshwater.

RDL = Reportable Detection Limit

2.2.1.3 PAHs

Concentrations of PAHs in fresh water collected from the site were screened against CCME FWAL values. All values were below detection limits, but since the detection limits for **anthracene, benz(a)anthracene, fluoranthene and pyrene** were above CCME FWAL values in all samples, these substances were retained in the qualitative assessment for ecological receptors, as a conservative measure.

The results of chemical screening of PAH concentrations in fresh water are presented in Table 2.9 below.

Table 2.9 Results of chemical screening of PAHs (µg/L) in fresh surface water

Contaminant	CCME Freshwater [1]	Lowest RDL	No. of Samples	No. of Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	5.8	0.05	4	0	0.05	0.05	0.05	N
Acridine	4.4	0.1	4	0	0.1	0.1	0.1	N
Anthracene	0.012	0.05	4	0	0.05	0.05	0.05	**Y**
Benz(a)anthracene	0.018	0.05	4	0	0.05	0.05	0.05	**Y**
Benzo(a)pyrene	0.015	0.005	4	0	0.005	0.005	0.005	N
Fluoranthene	0.04	0.05	4	0	0.05	0.05	0.05	**Y**
Fluorene	3	0.05	4	0	0.05	0.05	0.05	N
Naphthalene	1.1	0.05	4	0	0.05	0.05	0.05	N
Phenanthrene	0.4	0.05	4	0	0.05	0.05	0.05	N
Pyrene	0.025	0.05	4	0	0.05	0.05	0.05	**Y**

All units in ug/L, unless otherwise noted.

1 = CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Candaian water quality guidelines for the protection of aquatic life. Freshwater.

RDL = Reportable Detection Limit

2.2.1.4 PCBs

Concentrations of total PCBs in fresh water collected from the site were screened against the CCME FWAL guideline value. All values were below detection limits, but since the detection limits were higher than the CCME FWAL guideline value, **total PCBs** were carried forward to the qualitative risk assessment for ecological receptors, as a conservative measure.

The results of chemical screening of PCBs in fresh water are presented in Table 2.10 below.

Table 2.10 Results of chemical screening of PCBs (µg/L) in fresh surface water

Contaminant	CCME AW Freshwater[1]	Lowest RDL	No. of Samples	No. Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Polychlorinated Biphenyls								
PCB-1016	-	0.05	16	0	0.05	0.51	1	N
PCB-1221	-	0.1	16	0	0.1	0.547	1	N
PCB-1232	-	0.05	16	0	0.05	0.51	1	N
PCB-1242	-	0.05	16	0	0.05	0.51	1	N
PCB-1248	-	0.05	16	0	0.05	0.51	1	N
PCB-1254	-	0.05	16	0	0.05	0.51	1	N
PCB-1260	-	0.05	16	0	0.05	0.51	1	N
PCB-1262	-	0.05	9	0	0.05	0.817	1	N
PCB-1268	-	0.05	9	0	0.05	0.817	1	N
Total Polychlorinated Biphenyls	0.001	0.1	15	0	0.1	0.547	1	**Y**

All units in ug/L, unless otherwise noted.

1 = CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Candaian water quality guidelines for the protection of aquatic life. Freshwater.

RDL = Reportable Detection Limit

2.2.1.5 Pesticides

All concentrations of organochlorine pesticides in fresh water collected from the site were below detection limits. As a conservative measure, however, **DDT (plus metabolites), lindance, endrin, and toxaphene** were carried forward to the qualitative ecological risk assessment, as all detection limits were above the corresponding CCME FWAL guidelines for these substances.

Results of the chemical screening of pesticides in surface freshwater are shown in Table 2.11 below.

Table 2.11 Results of chemical screening of pesticides (µg/L) in fresh surface water

Contaminant	CCME Freshwater [1]	Lowest RDL	No. of Samples	No. Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Organochlorine Pesticides								
Aldrin	-	0.05	8	0	0.005	0.01375	0.05	N
alpha-BHC		0.05	1	0	0.05	0.05	0.05	N
beta-BHC		0.1	1	0	0.1	0.1	0.1	N
Lindane (gamma - BHC)	0.01	0.05	1	0	0.05	0.05	0.05	**Y**
Chlordane	0.006	0.005	7	0	0.005	0.0086	0.03	N
delta-BHC		0.05	1	0	0.05	0.05	0.05	N
cis-Chlordane (alpha)	-	0.005	8	0	0.005	0.01375	0.05	N
trans-Chlordane (gamma)	-	0.005	8	0	0.005	0.01375	0.05	N
2,4'-DDD	-	0.005	8	0	0.005	0.02	0.1	N
4,4'-DDD	-	0.005	8	0	0.005	0.01375	0.05	N
DDD (total)	-	0.005	7	0	0.005	0.0086	0.03	N
2,4'-DDE	-	0.005	8	0	0.005	0.02	0.1	N
4,4'-DDE	-	0.005	8	0	0.005	0.01375	0.05	N
DDE (total)	-	0.005	7	0	0.005	0.0086	0.03	N
2,4'-DDT	-	0.005	8	0	0.005	0.02	0.1	N
4,4'-DDT		0.005	8	0	0.005	0.02	0.1	N
DDT plus metabolites	0.001	0.005	7	0	0.005	0.0086	0.03	**Y**
DDT (total)	-	0.005	7	0	0.005	0.0086	0.03	N
Dieldrin	-	0.005	8	0	0.005	0.01375	0.05	N
Endosulfan	0.02	0.005	7	0	0.005	0.0086	0.03	N
Endosulfan I	0.02	0.005	8	0	0.005	0.01375	0.03	N
Endosulfan II	0.02	0.005	8	0	0.005	0.01375	0.03	N
Endosulfan Sulfate	0.02	0.005	8	0	0.005	0.01375	0.03	N
Endrin	0.0023	0.005	8	0	0.005	0.0325	0.03	**Y**
Endrin aldehyde	-	0.005	7	0	0.005	0.0086	0.03	N
Endrin ketone	-	0.005	7	0	0.005	0.0086	0.03	N
alpha-HCH	-	0.005	7	0	0.005	0.0086	0.03	N
beta-HCH	-	0.005	7	0	0.005	0.0086	0.03	N
delta-HCH	-	0.005	7	0	0.005	0.0086	0.03	N
gamma-HCH	0.01	0.005	7	0	0.005	0.0086	0.03	N
Heptachlor	-	0.005	8	0	0.005	0.02	0.1	N
Heptachlor Epoxide	0.01	0.005	8	0	0.005	0.01375	0.03	N
Hexachlorobenzene	-	0.005	7	0	0.005	0.0086	0.03	N
Methoxychlor	-	0.01	8	0	0.01	0.04125	0.2	N
Mirex	-	0.005	8	0	0.005	0.01375	0.05	N
cis-Nonachlor		0.05	1	0	0.05	0.05	0.05	N
trans-Nonachlor		0.05	1	0	0.05	0.05	0.05	N
Oxychlordane		0.05	1	0	0.05	0.05	0.05	N
Octachlorostyrene	-	0.005	7	0	0.005	0.0086	0.03	N
Toxaphene	0.008	0.2	7	0	0.2	0.3143	1	**Y**

All units in ug/L, unless otherwise noted.

1 = CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Candaian water quality guidelines for the protection of aquatic life. Freshwater.

RDL = Reportable Detection Limit

2.2.1.6 VOCs

Measured concentrations of VOCs in fresh water collected from the site were compared against CCME guidelines for freshwater aquatic life (FWAL). Substances with no CCME FWAL guidelines were retained in the qualitative ecological risk assessment, except where all concentrations were below detection limits.

Cis-1,2-dichloroethylene, tetrachloroethylene, 1,1,2-trichloroethane and trichloroethylene were retained in the qualitative assessment. All other VOCs were eliminated in the chemical screening.

Results of the chemical screening of VOCs in fresh surface water are presented in Table 2.12 below.

Table 2.12 Results of chemical screening of VOCs (µg/L) in fresh surface water

Contaminant	CCME AW Freshwater[1]	Lowest RDL	No. of Samples	No. Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Volatile Organic Compounds								
Acetone	-	10	5	0	10	28	100	N
Benzene	370	0.1	5	0	0.1	0.28	1	N
Bromodichloromethane	-	0.1	5	0	0.1	0.28	1	N
Bromoform	-	0.2	5	0	0.2	0.56	2	N
Bromomethane	-	0.5	5	0	0.5	1.4	5	N
Carbon Tetrachloride	13.3	0.1	5	0	0.1	0.28	1	N
Chlorobenzene	1.3	0.1	5	0	0.1	0.28	1	N
Dibromochloromethane	-	0.2	5	0	0.2	0.56	2	N
Chloroform	1.8	0.1	5	0	0.1	0.28	1	N
1,2-Dichlorobenzene	0.7	0.2	5	0	0.2	0.56	2	N
1,3-Dichlorobenzene	150	0.2	5	0	0.2	0.56	2	N
1,4-Dichlorobenzene	26	0.2	5	0	0.2	0.56	2	N
1,1-Dichloroethane	-	0.1	5	0	0.1	0.28	1	N
1,2-Dichloroethane	100	0.2	5	0	0.2	0.56	2	N
1,1-Dichloroethylene	-	0.1	5	0	0.1	0.28	1	N
cis-1,2-Dichloroethylene	-	0.1	5	1	0.1	0.48	2	**Y**
trans-1,2-Dichloroethylene	-	0.1	5	0	0.1	0.28	1	N
Dichloromethane	98.1	0.5	5	0	0.5	1.4	5	N
1,2-Dichloropropane	-	0.1	5	0	0.1	0.28	1	N
cis-1,3-Dichloropropylene	-	0.2	5	0	0.2	0.56	2	N
trans-1,3-Dichloropropylene	-	0.2	5	0	0.2	0.56	2	N
Ethylbenzene	90	0.1	5	0	0.1	0.28	1	N
Ethylene dibromide	-	0.2	5	0	0.2	0.56	2	N
Hexachlorobenzene	-	0.005	7	0	0.005	0.00857	0.03	N
Methyl ethyl ketone	-	5	5	0	5	14	50	N
Methyl isobutyl ketone	-	5	5	0	5	14	50	N
Methyl t-butyl ether (MTBE)	10000	0.2	5	0	0.2	0.56	2	N
Styrene	72	0.2	5	0	0.2	0.56	2	N
1,1,1,2-Tetrachloroethane	-	0.1	5	0	0.1	0.28	1	N
1,1,2,2-Tetrachloroethane	-	0.2	5	0	0.2	0.56	2	N
Tetrachloroethylene	111	0.1	5	1	0.1	42.08	210	**Y**
Toluene	2	0.2	5	0	0.2	0.56	2	N
1,1,1-Trichloroethane	-	0.1	5	0	0.1	0.28	1	N
1,1,2-Trichloroethane	-	0.2	5	1	0.2	0.76	3	**Y**
Trichloroethylene	21	0.1	5	1	0.1	12.5	62	**Y**
Vinyl Chloride	-	0.2	5	0	0.2	0.56	2	N
ortho-Xylene	-	0.1	5	0	0.1	0.28	1	N
meta- & para-Xylene	-	0.1	5	0	0.1	0.28	1	N
Xylenes	-	0.1	5	0	0.1	0.28	1	N

All units in ug/L, unless otherwise noted.

1 = CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Candaian water quality guidelines for the protection of aquatic life. Freshwater.

RDL = Reportable Detection Limit

2.2.2 Brackish water

2.2.2.1 Inorganics

Measured concentrations of inorganic elements in brackish water collected from the site were preferentially evaluated against CCME Water Quality Guidelines for the Protection of Aquatic Life in marine water. For elements with no marine guidelines, the FWAL guidelines were used.

Results of the chemical screening are presented in Table 2.13 below.

Aluminum, boron, cadmium, copper, iron and mercury exceeded CCME FWAL and/or marine water quality guidelines, therefore these elements were retained in the qualitative ecological assessment. **Calcium, magnesium, manganese, sodium and vanadium** lacked CCME guideline values and measured concentrations in brackish surface waters exceeded background values; these substances were also carried forward to the qualitative evaluation for surface water.

Table 2.13 Results of chemical screening of Inorganic elements (µg/L) in brackish surface water

Contaminant	CCME Freshwater [1]	CCME AW Marine [2]	No. of samples	No. of detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Total Metals								
Aluminum (Al)		-						
pH<6.5	5	-	16	1	5	6	27	**Y**
pH>6.5	100	-	7	5	18	68	33	N
Antimony (Sb)	---	-	23	0	0.5	2	25	N
Arsenic (As)	5	12.5	23	0	0.5	4	25	N
Barium (Ba)	---		7	0	20	31	100	N
Beryllium (Be)	---	-	23	0	0.5	4	50	N
Boron (B)	---	-	23	17	10	417	1800	**Y**
Cadmium (Cd)	0.017	0.12	23	3	0.017	0.17	0.146	**Y**
Calcium (Ca)	---		7	7	4180	22807	93800	(Y)
Chromium (Cr)	8.9	56	23	0	1	9	50	N
Chromium (Cr)	1	1.5	16	0	0.5	0.5	0.5	N
Cobalt (Co)	---	-	23	0	0.3	1.5	15	N
Copper (Cu)		-						
H: 0 - 120,000ug/L	2	-	23	4	1	2	6	**Y**
H: >180,000 ug/L	4	-	2	0	20	35	50	**Y**
Iron (Fe)	300	-	23	17	30	331	1400	**Y**
Lead (Pb)		-						
H: 0 - 60,000ug/L	1	-	23	3	0.5	0.75	1	N
H: 60 - 120,000ug/L	2	-	1	0	1	1	1	N
H: >180,000ug/L	0.007		2	0	10	18	25	N
Lithium (Li)	---		7	0	5	54	250	N
Magnesium (Mg)	---		7	7	1000	53076	248000	(Y)
Manganese (Mn)	---		7	7	0.75	19	104	(Y)
Mercury (Hg)	0.026	0.016	23	0	0.02	0.03	0.1	**Y**
Molybdenum (Mo)	73	-	23	7	1	5	50	N
Nickel (Ni)		-						
H: 0 - 60,000ug/L	25	-	20	1	1	1.55	10	N
H: 60 - 120,000ug/L	65	-	1	0	2	2	2	N
H: >180,000ug/L	0.15		2	0	20	35	50	N
Phosphorus		-	23	16	2	17	98	N
Potassium (K)	---		7	7	2000	18543	80000	N
Selenium (Se)	1	-	23	0	1	6	50	N
Silver (Ag)	0.1	-	23	1	0.02	0.17	0.1	N
Sodium (Na)	---		7	1	6900	477629	2080000	(Y)
Thallium (Tl)	0.8	-	23	7	0.05	0.73	10	N
Tungsten		-	16	0	1	2	10	N
Tin (Sn)	---		7	0	0.5	5	25	N
Titanium (Ti)	---		7	0	10	16	50	N
Uranium (U)	8.9	-	23	13	0.1	0.87	1	N
Vanadium (V)	---	-	23	4	1	6	2	(Y)
Zinc (Zn)	30	-	23	3	5	8	9	N
Zirconium	-	-	16	0	1	2	10	N

All units in ug/L, unless otherwise noted.

1 = CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Candaian water quality guidelines for the protection of aquatic life. Freshwater.

2= CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Candaian water quality guidelines for the protection of aquatic life. Marine.

RDL = Reportable Detection Limit

2.2.2.2 BTEX Compounds and PHCs

Concentrations of benzene, ethylbenzene and toluene in brackish waters were compared against CCME water quality guidelines for the protection of aquatic life in marine waters. All values were compliant. There are no marine or brackish water quality guidelines for total xylenes, or PHC fractions F1, F2, F3 or F4. These substances were eliminated in the chemical screening as concentrations in all samples were below detection limits. **No BTEX compounds or PHC fractions** were retained in the ecological risk assessment for brackish surface waters.

Results of the chemical screening of BTEX compounds and PHCs in brackish surface water are shown in Table 2.14 below.

Table 2.14 Results of chemical screening of BTEX compounds and PHCs (µg/L) in brackish surface water

Contaminant	CCME Freshwater[1]	CCME AW Marine[2]	No. of Samples	No. Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Volatiles								
Benzene	370	110	5	0	0.1	0.34	0.5	N
Ethylbenzene	90	25	5	0	0.1	0.34	0.5	N
Toluene	2	215	5	0	0.2	0.68	1	N
o-Xylene	---	---	5	0	0.1	0.34	0.5	N
m & p-Xylene	---	---	5	0	0.1	0.34	0.5	N
Xylenes (Total)	---	---	5	0	0.1	0.64	1	N
Extractable Petroleum Hydrocrabons								
CWS F2 (C10-C16)	---	---	4	0	100	250	300	N
CWS F3 (C16-C34)	---	---	4	0	100	250	300	N
F1-BTEX	---	---	4	0	100	100	100	N
CWS F1 (C06-C10)	---	---	4	0	100	100	100	N
F4 (C34-C50)		---	1	0	100	100	100	N

All units in ug/L, unless otherwise noted.

1 = CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Candaian water quality guidelines for the protection of aquatic life. Freshwater.

2 = CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Canadian water quality guidelines for the protection of aquatic life. Marine.

RDL = Reportable Detection Limit

2.2.2.3 PAHs

PAH concentrations in brackish waters were evaluated against CCME FWAL guidelines, except for naphthalene, for which a marine guideline exists. All values in all samples were below detection limits, with the exception of benzo(a)pyrene, which was detected in one sample but did not exceed the guideline.

Detection limits for anthracene, benza)anthracene, fluoranthene and pyrene exceeded CCME FWAL values in the single sample collected in 2009. However, the concentrations of these substances in the 2009 sample were below the detection limit, and none were detected in the two samples collected from the same area of concern in the previous year, when the detection limits were equivalent to the CCME FWAL guidelines. For these reasons, **all PAHs were eliminated** from the evaluation of brackish surface waters.

Results of the chemical screening of PAHs in brackish waters are presented in Table 2.15 below.

Table 2.15 Results of chemical screening of PAHs (µg/L) in brackish surface water

Parameters	CCME Freshwater [1]	CCME AW Marine [2]	Lowest RDL	No. of Samples	No. Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Polycyclic Aromatic Hydrocarbons									
Acenaphthene	5.8		0.05	3	0	0.050	0.050	0.05	N
Acenaphthylene			0.05	2	0	0.050	0.050	0.05	N
Acridine	4.4		0.05	3	0	0.050	0.067	0.10	N
Anthracene	0.012		0.012	3	0	0.012	0.025	0.05	N
Benz(a)anthracene	0.018		0.018	3	0	0.018	0.029	0.05	N
Benzo(a)pyrene	0.015		0.01	3	1	0.005	0.008	0.01	N
Benzo(b)fluoranthene			0.05	2	0	0.050	0.050	0.05	N
Benzo(g,h,i)perylene			0.05	2	0	0.050	0.050	0.05	N
Benzo(k)fluoranthene			0.05	2	0	0.050	0.050	0.05	N
Chrysene			0.05	2	0	0.050	0.050	0.05	N
Dibenz(a,h)anthracene			0.05	2	0	0.050	0.050	0.05	N
Fluoranthene	0.04		0.04	3	0	0.040	0.043	0.05	N
Fluorene	3		0.05	3	0	0.050	0.050	0.05	N
Indeno(1,2,3-c,d)pyrene			0.05	2	0	0.050	0.050	0.05	N
Naphthalene	1.1	1.4	0.05	3	0	0.050	0.050	0.05	N
Phenanthrene	0.4		0.05	3	0	0.050	0.050	0.05	N
Pyrene	0.025		0.025	3	0	0.025	0.033	0.05	N
Quinoline	3.4		0.05	2	0	0.050	0.050	0.05	N

All units in ug/L, unless otherwise noted.

1 = CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Candaian water quality guidelines for the protection of aquatic life. Freshwater.

2= CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Candaian water quality guidelines for the protection of aquatic life. Marine.

RDL = Reportable Detection Limit

2.2.2.4 PCBs

Concentrations of PCBs in brackish water were below detection limits in all samples, but the detection limit for total PCBs exceeded the CCME water quality guideline for both freshwater aquatic life and marine water (same value). For this reason, **total PCBs** were retained as a COPC in the qualitative evaluation.

Table 2.16 below, presents the results of the chemical screening of PCBs in brackish water.

Table 2.16 Results of chemical screening of PCBs (µg/L) in brackish surface water

Contaminant	CCME AW Freshwater[1]	CCME AW Marine[2]	Lowest RDL	No. of Samples	No. Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Polychlorinated Biphenyls									
PCB-1016	-		0.05	10	0	0.05	0.81	1	N
PCB-1221	-		0.1	10	0	0.1	0.82	1	N
PCB-1232	-		0.05	10	0	0.05	0.81	1	N
PCB-1242	-		0.05	10	0	0.05	0.81	1	N
PCB-1248	-		0.05	10	0	0.05	0.81	1	N
PCB-1254	-		0.05	10	0	0.05	0.81	1	N
PCB-1260	-		0.05	10	0	0.05	0.81	1	N
PCB-1262	-		0.05	10	0	0.05	0.81	1	N
PCB-1268	-		0.05	10	0	0.05	0.81	1	N
Total Polychlorinated Biphenyls	0.001	0.001	0.1	10	0	0.1	0.82	1	**Y**

All units in ug/L, unless otherwise noted

1 = CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Canadian water quality guidelines for the protection of aquatic life. Freshwater.

2 = CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Canadian water quality guidelines for the protection of aquatic life. Marine.

RDL = Reportable Detection Limit

2.2.2.5 Pesticides

All measured concencentrations of organochlorine pesticides were below detection limits in brackish surface waters. Since the detection limits for **lindane (gamma BHC), DDT plus metabolites, endrin and toxaphene** were above the CCME FWAL guidelines, however, these substances were carried forward in the qualitative assessment.

Results of the chemical screening of pesticides in brackish surface water are presented in Table 2.17 below.

Table 2.17 Results of chemical screening of pesticides (µg/L) in brackish surface water

Parameters	CCME Freshwater [1]	CCME Marine [2]	Lowest RDL	No. of Samples	No. Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Organochlorine Pesticides									
Aldrin	-	-	0.005	5	0	0.005	0.023	0.05	N
alpha-BHC		-	0.05	2	0	0.05	0.05	0.05	N
beta-BHC		-	0.1	2	0	0.1	0.1	0.1	N
Lindane (gamma - BHC)	0.01	-	0.05	2	0	0.05	0.05	0.05	**Y**
Chlordane	0.006	-	0.005	3	0	0.005	0.005	0.005	N
delta-BHC		-	0.05	2	0	0.05	0.05	0.05	N
cis-Chlordane (alpha)	-	-	0.005	5	0	0.005	0.023	0.05	N
trans-Chlordane (gamma)	-	-	0.005	5	0	0.005	0.023	0.05	N
2,4'-DDD	-	-	0.005	5	0	0.005	0.043	0.1	N
4,4'-DDD	-	-	0.005	5	0	0.005	0.023	0.05	N
DDD (total)	-	-	0.005	3	0	0.005	0.005	0.005	N
2,4'-DDE	-	-	0.005	5	0	0.005	0.043	0.1	N
4,4'-DDE	-	-	0.005	5	0	0.005	0.023	0.05	N
DDE (total)	-	-	0.005	3	0	0.005	0.005	0.005	N
2,4'-DDT	-	-	0.005	5	0	0.005	0.043	0.1	N
4,4'-DDT		-	0.005	5	0	0.005	0.043	0.1	N
DDT plus metabolites	0.001	-	0.005	3	0	0.005	0.005	0.005	**Y**
DDT (total)	-	-	0.005	3	0	0.005	0.005	0.005	N
Dieldrin	-	-	0.005	5	0	0.005	0.023	0.05	N
Endosulfan	0.02	-	0.005	3	0	0.005	0.005	0.005	N
Endosulfan I	0.02	-	0.005	5	2	0.005	0.023	0.05	N
Endosulfan II	0.02	-	0.005	5	2	0.005	0.023	0.05	N
Endosulfan Sulfate	0.02	-	0.005	5	2	0.005	0.023	0.05	N
Endrin	0.0023	-	0.005	5	2	0.005	0.083	0.2	**Y**
Endrin aldehyde	-	-	0.005	3	0	0.005	0.005	0.005	N
Endrin ketone	-	-	0.005	3	0	0.005	0.005	0.005	N
alpha-HCH	-	-	0.005	3	0	0.005	0.005	0.005	N
beta-HCH	-	-	0.005	3	0	0.005	0.005	0.005	N
delta-HCH	-	-	0.005	3	0	0.005	0.005	0.005	N
gamma-HCH	0.01	-	0.005	3	0	0.005	0.005	0.005	N
Heptachlor	-	-	0.005	5	2	0.005	0.043	0.1	N
Heptachlor Epoxide	0.01	-	0.005	5	2	0.005	0.023	0.05	N
Hexachlorobenzene	-	-	0.005	3	0	0.005	0.005	0.005	N
Methoxychlor	-	-	0.01	5	0	0.01	0.086	0.2	N
Mirex	-	-	0.005	5	0	0.005	0.023	0.05	N
cis-Nonachlor		-	0.05	2	0	0.05	0.05	0.05	N
trans-Nonachlor		-	0.05	2	0	0.05	0.05	0.05	N
Oxychlordane		-	0.05	2	0	0.05	0.05	0.05	N
Octachlorostyrene	-	-	0.005	3	0	0.005	0.005	0.005	N
Toxaphene	0.008	-	0.2	3	0	0.2	0.2	0.2	**Y**

All units in ug/L, unless otherwise noted.

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RDL = Reportable Detection Limit

2.2.2.6 VOCs

Concentrations of VOCs in brackish water were evaluated against CCME FWAL or marine water quality guidelines. **Cis-1,2-dichloroethylene and trichloroethylene** were present at levels that did not comply with corresponding guidelines, therefore these substances were retained in the qualitative assessment.

Table 2.18 below, presents the results of chemical screening of VOCs in brackish water.

Table 2.18 Results of chemical screening of VOCs (µg/L) in brackish surface water

Contaminant	CCME AW Freshwater[1]	CCME AW Marine[2]	Lowest RDL	No. of Samples	No. Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Volatile Organic Compounds									
Acetone	-	-	10	2	0	10	10	10	N
Benzene	370	110	0.1	4	0	0.1	0.3	0.5	N
Bromodichloromethane	-	-	0.1	4	0	0.1	0.55	1	N
Bromoform	-	-	0.2	4	0	0.2	0.6	1	N
Bromomethane	-	-	0.5	2	0	0.5	0.5	0.5	N
Carbon Tetrachloride	13.3	-	0.1	4	0	0.1	0.55	1	N
Chlorobenzene	1.3	-	0.1	4	0	0.1	0.55	1	N
Dibromochloromethane	-	-	0.2	4	0	0.2	0.6	1	N
Chloroethane			1	2	0	1	1	1	N
Chloroform	1.8	-	0.1	4	0	0.1	0.55	1	N
Chloromethane			1	2	0	1	1	1	N
1,2-Dichlorobenzene	0.7	42	0.2	4	0	0.2	0.45	0.7	N
1,3-Dichlorobenzene	150	-	0.2	4	0	0.2	0.6	1	N
1,4-Dichlorobenzene	26	-	0.2	4	0	0.2	0.6	1	N
1,1-Dichloroethane	-	-	0.1	4	0	0.1	0.55	1	N
1,2-Dichloroethane	100	-	0.2	4	0	0.2	0.6	1	N
1,1-Dichloroethylene	-	-	0.1	4	0	0.1	0.55	1	N
cis-1,2-Dichloroethylene	-	-	0.1	4	2	0.1	1.375	4	**Y**
trans-1,2-Dichloroethylene	-	-	0.1	4	0	0.1	0.55	1	N
Dichloromethane	98.1	-	0.5	4	2	0.5	2.75	5	N
1,2-Dichloropropane	-	-	0.1	4	0	0.1	0.55	1	N
cis-1,3-Dichloropropylene	-	-	0.2	4	0	0.2	0.6	1	N
trans-1,3-Dichloropropylene	-	-	0.2	4	0	0.2	0.6	1	N
Ethylbenzene	90	25	0.1	4	0	0.1	0.3	0.5	N
Ethylene dibromide	-	-	0.2	2	0	0.2	0.2	0.2	N
Hexachlorobenzene	-	-	0.005	3	0	0.005	0.005	0.005	N
Methyl ethyl ketone	-	-	5	2	0	5	5	5	N
Methyl isobutyl ketone	-	-	5	2	0	5	5	5	N
Methyl t-butyl ether (MTBE)	10000	5000	0.2	4	0	0.2	0.6	1	N
Styrene	72	-	0.2	4	0	0.2	0.35	0.5	N
1,1,1,2-Tetrachloroethane	-	-	0.1	4	0	0.1	0.55	1	N
1,1,2,2-Tetrachloroethane	-	-	0.2	4	0	0.2	0.6	1	N
Tetrachloroethylene	111	-	0.8	4	3	0.8	12.7	41.1	N
Toluene	2	215	0.2	4	0	0.2	0.6	1	N
1,1,1-Trichloroethane	-	-	0.1	4	0	0.1	0.55	1	N
1,1,2-Trichloroethane	-	-	0.2	4	0	0.2	0.6	1	N
Trichloroethylene	21	-	0.1	4	2	0.1	6.3	22.6	**Y**
Trichlorofluoromethane			1	2	0	1	1	1	N
Vinyl Chloride	-	-	0.2	4	0	0.2	0.6	1	N
ortho-Xylene	-	-	0.1	4	0	0.1	0.3	0.5	N
meta- & para-Xylene	-	-	0.1	4	0	0.1	0.3	0.5	N
Xylenes	-	-	0.1	4	0	0.1	0.55	1	N

All units in ug/L, unless otherwise noted.

1 = CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Candaian water quality guidelines for the protection of aquatic life. Freshwater.

2 = CCME (2007), Canadian Water Quality Guidelines for Protection of Aquatic Life, Update 7.1, Summary Table . Summary of Candaian water quality guidelines for the protection of aquatic life. Marine.

RDL = Reportable Detection Limit

2.3 Chemical Screening – COPCs in Sediments

Human site users were assumed not to come into contact with sediments (see Section 3.2.4), therefore no chemical screening was conducted of contaminants in freshwater or brackish sediments with respect to human receptors.

Further, as described in the pathway analysis (Section 3.2.4), it was assumed that ecological receptors would primarily come into contact with sediments in brackish environments; therefore no chemical screening was necessary for freshwater sediments.

2.3.1 Inorganic elements

Concentrations of inorganic elements in brackish sediments were compared against CCME guidelines for marine or freshwater sediments, using the most stringent value. Those substances with no CCME sediment guidelines were retained in the qualitative assessment, except where all values were below detection limits.

Accordingly, **arsenic, cadmium, total chromium, copper, lead, nickel and zinc** were retained in in the qualitative assessment because measured concentrations in site sediments exceeded CCME sediment quality guidelines. **Aluminum, antimony, barium, hexavalent chromium, calcium, cobalt, iron, magnesium, manganese, molybdenum, phosphorus, potassium, sodium, strontium, vanadium** were also carried forward, as there are no sediment quality guidelines that correspond to these substances.

Results of the chemical screening of inorganic elements in brackish sediments are presented in Table 2.19 below.

Table 2.19 Results of the chemical screening of inorganics (µg/g) in brackish sediment

Contaminant	CCME Marine Sediment [1] (ISQG)	CCME Marine Sediment [1] (PEL)	RDL	No. of Samples	No. Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Total Metals									
Aluminum			50	11	11	2600	3682	4600	(Y)
Antimony (Sb)			0.2	18	1	0.2	4.0	0.7	(Y)
Arsenic (As)	7.24E-12	4.16E-11	1	18	7	1	3.1	7	**Y**
Barium (Ba)			0.5	18	18	11	18	25.9	(Y)
Beryllium (Be)			0.2	18	2	0.2	0.3	0.3	N
Cadmium (Cd)	7.00E-13	4.20E-12	0.1	18	6	0.1	0.3	0.3	**Y**
Calcium			50	11	11	1500	2336	3500	(Y)
Chromium (Cr) - total	5.23E-11	1.60E-10	1	18	18	9.3	15.7	30	**Y**
Chromium (VI)			0.2	11	2	0.2	0.3	0.8	(Y)
Cobalt (Co)			0.1	18	18	2.3	3.3	5.7	(Y)
Copper (Cu)	1.87E-11	1.08E-10	0.5	18	18	4.6	6.9	18	**Y**
Iron			50	11	11	12000	24091	46000	(Y)
Lead (Pb)	3.02E-11	1.12E-10	1	18	12	2	19	63	**Y**
Magnesium			50	11	11	1900	2909	4800	(Y)
Manganese			1	11	11	54	92	230	(Y)
Mercury (Hg)	0.13	0.70	0.05	18	2	0.005	0.03	0.0091	N
Molybdenum (Mo)			0.5	18	11	0.8	3.7	11	(Y)
Nickel (Ni)			0.5	18	11	4.6	5.8	10	**Y**
Phosphorus			50	11	11	530	819	1300	(Y)
Potassium			200	11	11	520	1016	1800	(Y)
Selenium (Se)			0.5	18	0	0.5	1.1	2	N
Silver (Ag)			0.2	18	0	0.2	0.9	2	N
Sodium			100	11	11	260	2456.36	8800	(Y)
Strontium			1	11	11	7	12.5	37	(Y)
Thallium (Tl)			0.05	18	2	0.05	0.42	0.09	N
Tin (Sn)				7	0	5	5	5	N
Vanadium (V)			5	18	18	23.2	40.6	91	(Y)
Zinc (Zn)	124	271	5	18	18	21.8	43.3	130	**Y**

All units in ug/g, unless otherwise noted.

1 = CCME (2002), Canadian Sediment Quality Guidelines for Protection of Aquatic Life, Update 2002, Table 2. Interim marine sediment quality guidelines (ISQGs; dry weight), probable effect levels (PELs; dry weight).

RDL = Reportable Detection Limit

2.3.2 BTEX Compounds and PHCs

No criteria exist against which to compare concentrations of BTEX compounds or PHCs in sediments, and no reference values have yet been measured. Concentrations of all BTEX compounds in brackish sediments were below detection limits, therefore they were excluded from further assessment. Concentrations of PHC fractions F1, F3 and F4 were above detection limits. F1 compounds were detected at a level equivalent to the detection limit, therefore F1 PHCs were not carried forward for further assessment. The **F3 and F4 fractions**, however, were retained in the qualitative assessment.

Results of the chemical screening of BTEX compounds and PHCs are presented in Table 2.20.

Table 2.20 Results of chemical screening of BTEX and PHCs (µg/g) in brackish sediment (brackish)

Contaminant	CCME Freshwater Sediment [1] (ISQG)	Lowest RDL	No. of Samples	No. Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Volatiles								
Benzene	---	0.002	8	0	0.002	0.016	0.04	N
Ethylbenzene	---	0.002	8	0	0.002	0.021	0.05	N
Toluene	---	0.002	8	0	0.002	0.021	0.05	N
o-Xylene	---	0.002	8	0	0.002	0.021	0.05	N
m & p-Xylene	---	0.002	8	0	0.002	0.021	0.05	N
Xylenes (Total)	---	0.002	8	0	0.002	0.040	0.1	N
Extractable Petroleum Hydrocrabons								
CWS F1 (C06-C10)	---	10	8	1	10	19	50	
F1-BTEX	---	10	8	1	10	14	40	N
CWS F2 (C10-C16)	---	10	8	0	10	23	40	N
CWS F3 (C16-C34)	---	10	8	5	10	111	360	**Y**
CWS F4 (C34-C50)	---	10	8	4	10	120	470	**Y**

All units in ug/g, unless otherwised noted.

1 = CCME (2002), Canadian Sediment Quality Guidelines for Protection of Aquatic Life, Update 2002, Table 2. Interim marine sediment quality guidelines (ISQGs; dry weight), probable effect levels (PELs; dry weight).

RDL = Reportable Detection Limit

2.3.3 PAHs

Concentrations of PAHs in brackish sediments were compared with CCME ISQGs for marine sediment. All substances with CCME ISQGs were below the guidelines, although detection limits for one sample collected in 2009 exceeded guidelines for some substances. Since samples collected from the same area in 2008 were below detection limits for all substances, and detection limits were below or equivalent to CCME ISQGs, **no PAH compounds** were carried forward to the qualitative assessment for brackish sediments.

Results of the chemical screening of PAH compounds in brackish sediments are presented in Table 2.21.

Table 2.21 Results of chemical screening of PAHs (µg/g) in brackish sediment

Contaminant	CCME Marine Sediment[1] (ISQG)	CCME Marine Sediment [1] (PEL)	Lowest RDL	No. of Samples	No. Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Acenaphthene	0.00671	0.0889	0.007	3	0	0.007	0.011	0.0200	N
Acenaphthylene	0.00587	0.128	0.006	3	0	0.006	0.007	0.0100	N
Anthracene	0.0469	0.245	0.010	3	0	0.010	0.035	0.0469	N
Benzo(a)anthracene	0.0748	0.693	0.020	3	0	0.020	0.028	0.0317	N
Benzo(a)pyrene	0.0888	0.763	0.010	3	0	0.010	0.025	0.0319	N
Benzo(b)fluoranthene			0.050	2	0	0.050	0.050	0.0500	N
Benzo(g,h,i)perylene	-	-	0.040	3	0	0.040	0.047	0.0500	N
Benzo(k)fluoranthene	-	-	0.020	3	0	0.020	0.040	0.0500	N
Chrysene	0.108	0.846	0.020	3	0	0.020	0.040	0.0500	N
Dibenz(a,h)anthracene	0.00622	0.135	0.006	3	0	0.006	0.017	0.0400	N
Fluoranthene	0.113	1.494	0.010	3	0	0.010	0.037	0.0500	N
Fluorene	0.0212	0.144	0.010	3	0	0.010	0.017	0.0212	N
Indeno(1,2,3-cd)pyrene	-	-	0.040	3	0	0.040	0.047	0.0500	N
2-Methylnaphthalene	0.0202	0.201	0.010	3	0	0.010	0.017	0.0202	N
Naphthalene	0.0346	0.391	0.010	3	0	0.010	0.026	0.0346	N
Phenanthrene	0.0867	0.544	0.010	3	0	0.010	0.031	0.0419	N
Pyrene	0.153	1.398	0.010	3	0	0.010	0.037	0.0500	N

All units in ug/g, unless otherwise noted.

1= CCME (2002), Canadian Sediment Quality Guidelines for Protection of Aquatic Life, Update 2002, Table 2. Interim marine sediment quality guidelines (ISQGs; dry weight), probable effect levels (PELs; dry weight).

RDL = Reportable Detection Limit

2.3.4 PCBs

The total concentration of PCBs in brackish sediments exceeded the CCME ISQG for marine sediment, therefore **total PCBs** were retained in the qualitative assessment.

Table 2.22 shows the results of chemical screening of PCBs in brackish sediments.

Table 2.22 Results of chemical screening of PCBs (µg/g) in brackish sediment

Contaminant	CCME Marine Sediment [1] (ISQG)	Lowest RDL	No. of Samples	No. of Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Polychlorinated Biphenyls								
PCB-1016		0.01	11	0	0.01	0.017273	0.06	N
PCB-1221		0.01	11	0	0.01	0.023636	0.1	N
PCB-1232		0.01	11	0	0.01	0.017273	0.06	N
PCB-1242		0.01	11	0	0.01	0.017273	0.06	N
PCB-1248		0.01	11	0	0.01	0.017273	0.06	N
PCB-1254	0.0633	0.01	11	0	0.01	0.017273	0.06	N
PCB-1260		0.5	11	2	0.01	0.020364	0.014	N
PCB-1262		0.01	11	0	0.01	0.017273	0.06	N
PCB-1268		0.01	11	0	0.01	0.017273	0.06	N
Total Polychlorinated	0.0215	0.03	12	3	0.01	0.023667	0.09	**Y**

All units in ug/g, unless otherwise noted

1= CCME (2002), Canadian Sediment Quality Guidelines for Protection of Aquatic Life, Update 2002, Table 2. Interim marine sediment quality guidelines (ISQGs; dry weight), probable effect levels (PELs; dry weight).

RDL = Reportable Detection Limit

2.3.5 VOCs

There are no sediment guidelines against which to compare VOCs, therefore all VOC compounds with no detected values in brackish sediments were eliminated from the risk assessment in the chemical screening. The following substances were retained in the qualitative assessment, as measured values were above detection limits: **cis-1,2-dichloroethylene, tetrachloroethylene, trichloroethylene.**

Table 2.23 presents the results of chemical screening VOCs in brackish sediments.

Table 2.23 Results of chemical screening of VOCs (µg/g) in brackish sediment

Contaminant	CCME Marine Sediment[1] (ISQG)	CCME Marine Sediment[1]	Lowest RDL	No. of Samples	No. Detected	Minimum Concentration	Average Concentration	Maximum Concentration	Retained in Ecological Qualitative?
Acetone	-	-		5	0	0.1	0.100	0.1	N
Benzene	-	-	0.002	7	0	0.002	0.013	0.04	N
Bromodichloromethane	-	-	0.002	7	0	0.002	0.026	0.05	N
Bromoform	-	-	0.002	7	0	0.002	0.026	0.05	N
Bromomethane	-	-	0.003	5	0	0.003	0.003	0.003	N
Carbon tetrachloride	-	-	0.002	7	0	0.002	0.026	0.05	N
Chlorobenzene	-	-	0.002	7	0	0.002	0.026	0.05	N
Chlorodibromomethane	-	-	0.002	7	0	0.002	0.026	0.05	N
Chloroethane			0.1	2	0	0.1	0.100	0.1	N
Chloroform	-	-	0.002	7	0	0.002	0.051	0.1	N
Chloromethane			0.1	2	0	0.1	0.100	0.1	N
1,2-Dichlorobenzene	-	-	0.002	7	0	0.002	0.026	0.05	N
1,3-Dichlorobenzene	-	-	0.002	7	0	0.002	0.026	0.05	N
1,4-Dichlorobenzene	-	-	0.002	7	0	0.002	0.026	0.05	N
1,1-Dichloroethane	-	-	0.002	7	0	0.002	0.026	0.05	N
1,2-Dichloroethane	-	-	0.002	7	0	0.002	0.026	0.05	N
1,1-Dichloroethene	-	-	0.002	7	0	0.002	0.026	0.05	N
cis-1,2-Dichloroethylene	-	-	0.002	7	1	0.002	0.028	0.05	**Y**
trans-1,2-Dichloroethene	-	-	0.002	7	0	0.002	0.026	0.05	N
Dichloromethane	-	-	0.003	7	0	0.003	0.152	0.3	N
1,2-Dichloropropane	-	-	0.002	7	0	0.002	0.026	0.05	N
cis-1,3-Dichloropropene	-	-	0.002	7	0	0.002	0.026	0.05	N
trans-1,3-Dichloropropene	-	-	0.002	7	0	0.002	0.026	0.05	N
Ethylbenzene	-	-	0.002	7	0	0.002	0.017	0.05	N
Methyl t-butyl ether (MTBE)			0.2	2	0	0.2	0.200	0.2	N
Ethylene dibromide	-	-	0.002	5	0	0.002	0.002	0.002	N
Hexachlorobenzene	-	-	0.002	5	0	0.002	0.003	0.008	N
Hexachlorobutadiene	-	-	0.01	5	0	0.01	0.016	0.04	N
Methyl ethyl ketone	-	-	0.03	5	0	0.03	0.030	0.03	N
Methyl isobutyl ketone	-	-	0.03	5	0	0.03	0.030	0.03	N
Methyl-tert-butylether	-	-	0.002	5	0	0.002	0.002	0.002	N
Styrene	-	-	0.002	7	0	0.002	0.026	0.05	N
1,1,1,2-Tetrachloroethane	-	-	0.002	7	0	0.002	0.026	0.05	N
1,1,2,2-Tetrachloroethane	-	-	0.002	7	0	0.002	0.026	0.05	N
Tetrachloroethylene	-	-	0.002	7	1	0.002	0.121	0.38	**Y**
Toluene	-	-	0.002	7	0	0.002	0.017	0.05	N
1,1,1-Trichloroethane	-	-	0.002	7	0	0.002	0.026	0.05	N
1,1,2-Trichloroethane	-	-	0.002	7	0	0.002	0.026	0.05	N
Trichloroethylene	-	-	0.002	7	1	0.002	0.039	0.1	**Y**
Trichlorofluoromethane			0.1	2	0	0.1	0.100	0.1	N
Vinyl chloride	-	-	0.002	7	0	0.002	0.051	0.1	N
m+p-Xylene	-	-	0.002	7	0	0.002	0.017	0.05	N
o-Xylene	-	-	0.002	7	0	0.002	0.017	0.05	N
Xylenes (total)	-	-	0.002	7	0	0.002	0.031	0.1	N

All units in ug/g, unless otherwise noted.

1 = CCME (2002), Canadian Sediment Quality Guidelines for Protection of Aquatic Life, Update 2002, Table 2. Interim marine sediment quality guidelines (ISQGs; dry weight), probable effect levels (PELs; dry weight).

RDL = Reportable Detection Limit

2.4 Summary of COPCs in site media

Table 2.24 summarizes the results of the chemical screening of analytes in site soil, surface water and sediments.

Medium	**COPCs retained in the qualitative assessment following chemical screening**
Soil	Al, Cd, Ca, Cu, Fe, Mg, Mn, P, K, Se, Na, Sr, Sn, Zn, benzo(g,h,i)perylene, PHC F2, PHC F3, PHC F4, bromoform, 1,1,1,2-tetrachloroethane, vinyl chloride, total PCBs
Surface Water - Fresh	Al, Sb, B, Cd, Co, Cr6+, Cu, Fe, Ag, Sn, Zn, Pb, Hg, Se, Ca, Mg, Mn, K, Na, PHC F3, PHC F4, anthracene, benz(a)anthracene, fluoranthene, pyrene, total PCBs, DDT (plus metabolites), lindane, endrin, toxaphene, tetrachloroethylene, cis-1,2-dichloroethene, 1,1,2-trichloroethane, trichloroethylene
Surface Water - Brackish	Al, B, Cd, cu, Fe, Hg, Ca, Mg, Mn, Na, V, lindane (gamma BHC), DDT (plus metabolites), endrin, toxaphene, cis-1,2-dichloroethylene, trichloroethylene
Sediment - Brackish	As, Cd, Cr(total), Cr6+, Cu, Pb, Ni, Zn, Al, Sb, Ba, Ca, Co, Fe, Mg, Mn, Mo, P, K, Na, Sr, V, PHC F3, PHC F4, total PCBs, cis-1,2-dichloroethylene, tetrachloroethylene, trichloroethylene

3.0 HUMAN HEALTH RISK ASSESSMENT

3.1 Human Health Risk Assessment Objectives

The objective of the Human Health Risk Assessment (HHRA) is to provide a qualitative (screening level) and quantitative evaluation of human health risks associated with exposure to site contaminants in soil and food items.

In the qualitative assessment, the maximum concentrations of the identified COPCs were compared with pathway-specific values for protection of human health. The contaminants exceeding the pathway-specific values and COPCs for which no generic and/or pathway-specific values were available were carried forward to the quantitative risk assessment.

A deterministic quantitative assessment was conducted to estimate health risks associated with exposure to COPCs. Where possible, site-specific data were used; otherwise conservative default values adopted by the Ontario MOE, Health Canada, US EPA or other credible regulatory agencies were used to ensure that actual health risks were not underestimated.

3.2 Problem Formulation

3.2.1 Qualitative Assessment – Chemicals in Soil

Results of chemical screening of all soil metal concentrations against CCME guidelines for coarse-grained industrial soils indicated that the following inorganic elements were present in site soils in excess of applied guidelines: **cadmium, lead, and zinc.**

There were no generic criteria available against which to evaluate aluminum, calcium, iron, magnesium, manganese, phosphorus, potassium, sodium, tin, and strontium in the chemical screening. Aluminum, calcium, iron, magnesium, phosphorus, potassium, and sodium were not considered further in the quantitative human health risk assessment for the following reasons:

- Aluminum is the most abundant metal and constitutes approximately 88,000 µg/g in the earth's crust (ATSDR, 2006). Using the maximum detected concentration of 5,100 µg/g of aluminum in soil, a toddler would need to ingest more than 3 grams of soil per day to exceed the Minimum Risk Level established by the US Agency for Toxic Substances and Disease Registry (ATDSR). This is more than 160 times the default soil consumption rate of 0.02 g/day adopted by Health Canada (2008). Therefore, aluminum was not considered a COPC for the quantitative assessment.
- Calcium is the fifth most abundant element by mass in the Earth's crust, and essential for all living organisms. It is a major component of bones. Health Canada has established a dietary reference intake (DRI) for adults of 1000-1200 mg/d (AI or adequate intake value). Using the maximum detected concentration of 7,700 µg of Ca per gram of soil, an individual would have to consume over 155 g of soil per day to exceed the DRI. This is more than

7,700 times the default soil consumption rate of 0.02 g/day adopted by Health Canada (2008); therefore calcium was not retained as a COPC in the quantitative assessment.

- Iron is an essential element that is required for normal hemoglobin synthesis. A DRI of between 8 to 11 mg/day for adult males and 15 to 18 mg/day for adult females has been established by Health Canada (RDA, or recommended dietary allowance, and AI value), which equals 0.11 to 0.25 mg/kg/day, based on a body weight of 70.7 kg. Based on the maximum detected concentration of 29,000 $\mu g_{Fe}/g_{soil}$, an individual would need to ingest approximately 0.38 grams of soil per day to exceed the RDA. This is 19 times the default soil consumption rate of 0.02 g/day adopted by Health Canada (2008). For this reason, iron was not considered a COPC in the quantitative assessment.
- Magnesium is naturally present in soils. Health Canada adult Recommended Daily Allowance (RDA/AI value) for magnesium is 310 to 420 mg/day. Based on the maximum detected concentrations 3100 µg/g an individual would need to ingest at least 100 grams of soil per day to exceed the RDA. This more than 100 times the default soil consumption rate of 0.02 g/day adopted by Health Canada (2008). For this reason, magnesium was not considered a COPC in the quantitative assessment.
- Manganese is naturally present in soil at concentrations usually ranging from 40 to 900 µg/g (ATSDR, 2000). Health Canada's adult RDI (AI value) for manganese is 1.6 – 2.3 mg/d. Based on the maximum detected concentration in soil of 250 µg/g, an individual would need to ingest at least 9 grams of soil per day to exceed the dose normally obtained from the diet. This is more than 450 times the default soil consumption rate of 0.02 g/day adopted by Health Canada (2008). Based on the above, manganese was not considered a COPC for the quantitative assessment.
- Phosphorus is a component of DNA, RNA and ATP, as well as the phospholipids that form cell membranes, and is therefore essential to all living organisms. It is also widely used in explosives. The Health Canada RDA estimated average requirement (EAR) value for adults is 580 - 1055 mg of phosphorus per day. At the maximum measured concentration of 850 µg/g soil, an individual would have to consume over 1240 g of soil per day to exceed this limit, i.e. more than 62,000 times the soil consumption rate of 0.02 g/d adopted by Health Canada (2008). Phosphorus was therefore not retained in the quantitative assessment.
- Potassium occurs in nature as an ionic salt, and is consequently found dissolved in seawater and as part of many minerals. It is essential for the function of all living cells. The Health Canada's RDI (AI value) for adults is 4,700 mg/day. The maximum measured soil concentration was 960 µg/g soil, therefore an individual would have to consume approximately 4900 g of soil per day, or over 240,000 times the soil consumption rate adopted by Health Canada (2008) to exceed this limit. Potassium was therefore not evaluated in the quantitative risk assessment.
- Sodium is highly soluble and therefore present in large quantities in the oceans, and it also is found in many minerals. It is an essential element for all animal life, as it enables

transmission of nerve impulses. Health Canada's AI value for adults is 1,300 -1,500 mg of sodium per day. The maximum concentration of sodium measured in site soils was 280 µg per gram of soil, therefore an individual would have to consume over 5,300 grams of soil per day, or over 265,000 times the default soil consumption rate adopted by Health Canada (2008) to exceed the DRI. Sodium was therefore not carried forward to the quantitative risk assessment.

For the above reasons, the inorganic elements listed above were considered unlikely to present a health risk, particularly in light of the identified exposure pathways used in this risk assessment. They have, therefore, been eliminated from the risk assessment at the qualitative screening stage and are not included in the list of soil COPCs.

All other substances that failed the chemical screening were retained in the quantitative risk assessment.

3.2.1.1 COPCs Evaluated in the Quantitative Human Health Risk Assessment

As a result of the chemical screening of soil contaminants, the following substances were retained in the quantitative risk assessment, the concentrations of these chemicals were listed in the table 3.1 below, 95% upper confidence limit (95UCL) were used if there were over 10 detected values for each chemical; otherwise, maximum concentrations were used:

- Metals: cadmium, lead, strontium, tin, zinc
- BTEX and PHCs: Benzene, F1, F2, F3
- PCBs: total PCBs
- PAHs: acenaphthene, benz[a]anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene
- VOCs: bromoform, 1,1,1,2-tetrachloroethane, vinyl chloride.

Table 3.1 List of values for chemicals to be evaluated in the quantitative risk assessment (µg/g).

COCs	Maximum concentration	95UCL
Inorganic Elements		
Cadmium		2.78E+00
Lead		9.16E+01
Zinc		1.23E+02
Strontium		8.31E+00
Tin		8.86E+00
PHCs		
Benzene	0.04	
F1	180	
F2	1100	
F3		1.55E+04
PCBs		
Total PCBs	17.1	
PAHs		
Acenaphthene	0.1	
Benzo[a]anthracene	1.14	
Benzo(b+j)fluoranthene	1.78	
Benzo(k)fluoranthene	0.662	
Dibenz(a,h)anthracene	0.235	
VOCs		
Bromoform	0.05	
1,1,1,2-tetrachloroethane	0.05	
Vinyl Chloride	0.1	

3.2.2 Assessment Endpoints

Adverse effects to human health are considered unacceptable, therefore the human health assessment endpoint is to protect individual human receptors from adverse health effects that may result from exposure via multiple pathways to contaminants in site media.

Adverse health effects are categorized as carcinogenic (cancer-causing) and non-carcinogenic (non-cancerous toxic effects), for the purposes of assessing the potential for site COPCs to cause human health effects. Carcinogenic effect risks are assessed by calculating COPC-specific incremental lifetime cancer risks (ILCRs) for each receptor. The standard used to evaluate the acceptability of COPC-related cancer risks is 1.0×10^{-5} (i.e. one cancer case per 100,000 people exposed), the maximum ILCR recommended by Health Canada. Risks associated with non-carcinogenic effects are assessed by calculating COPC-specific hazard quotients (HQs) for each receptor. With the exception of PHC fractions F1 to F4, the standard used to evaluate the acceptability of COPC-related, non-cancer risks in this assessment is HQ =

0.2, the maximum HQ considered acceptable by Health Canada (2007). The target HQ for PHC fractions F1 to F4 was 0.5, as the CCME CWS (2008) Scientific Rationale, Supporting Technical Document provides soil allocation factors (or, in other words, HQs) of 0.5 for PHC F1 and F2, 0.6 for F3 and 0.8 for F4. The lowest of these values (0.5) was adopted for the risk assessment, as a conservative measure.

3.2.3 Identification of Potential Human Receptors

Site use was considered to be primarily recreational. Humans traverse the site to go fishing in the river, and they also gather berries on the site. As a conservative measure, potential risk to human health was calculated based on the most sensitive human receptor, a toddler, deemed to be at the site three days per week for 8 hours per day during the summer months. Table 3.2, below, summarizes the characteristics of human receptors, according to Health Canada (2009):

Table 3.2 Human Receptor Physical Characteristics

Parameters	Toddler	Adult
Age	7 mo. – 4 y	≥ 20 y
Body Weight (kg)	16.5	70.7
Soil Ingestion Rate (g/d)	0.08	0.02
Inhalation rate (m^3/d)	9.3	15.8
Water ingestion rate (L/d)	0.6	1.5
Time spent outdoors (hr/d)	8	8
Skin surface area (cm^2)		
Surface area (hands)	430	890
Surface area (arms)	890	2500
Surface area (legs)	1690	5720
Surface area (total)	6130	17640
Soil loading to exposed skin (kg/cm^2/event)		
Hands	$1x10^{-5}$	$1x10^{-4}$
Surfaces other than hands	$1x10^{-6}$	$1x10^{-5}$
Food ingestion (g/d)		
- Other vegetables	67	137
- Fish	95	111

3.2.4 Exposure Pathways, Frequency and Duration Assumptions

An exposure pathway is a mechanism by which a human receptor is exposed to chemicals from a source. Several possible exposure pathways to contaminants may exist at a site. The following four elements constitute a complete exposure pathway.

- A source and mechanism of chemical release;
- A retention or transport medium;
- A point of potential receptor contact with the affected medium; and
- A means of entry into the body (e.g. inhalation) at the contact point.

Complete pathways therefore represent situations where there is a potential for receptors to be exposed to the contaminants. Incomplete pathways represent situations where exposure or contact with the contaminant is unlikely to occur and there is therefore no risk to the receptor.

Ingestion of Groundwater or Surface Water

Groundwater at the site is non-potable, and surface water is not used for drinking water therefore the water ingestion pathway is not operable.

Dermal Contact with Contaminated Groundwater

This pathway was not considered operable for site users, as their activities do not include excavation of the soil beneath the top few centimetres.

Incidental Soil Ingestion

Although incidental soil ingestion was expected to be minimal, this pathway was deemed operable as a conservative measure, and assessed in the risk assessment.

Ingestion of Contaminated Food Items

Since individuals using the site are known to harvest fish and berries from the vicinity of the site, the food ingestion pathway was retained in the risk assessment. Measured concentrations of metals and PCBs in berries were entered into the risk assessment model. Concentrations of potential contaminants in fish, however, have not yet been measured in the vicinity of the site, therefore fish tissue concentrations used to estimate potential risk to humans were those estimated in the ecological risk assessment.

Dermal Contact with Contaminated Soil

Dermal contact with contaminated soil was considered to be a complete pathway for human receptors.

Inhalation of Particulate Matter

Inhalation of particulate matter was deemed an operable pathway for all human receptors evaluated in the risk assessment.

Inhalation of Contaminant Vapours in Outdoor Air

Since PHCs and PAHs were detected in soils at concentrations exceeding human health guidelines, the vapour inhalation pathway was deemed operable.

Inhalation of Contaminant Vapours in Indoor Air

There are no buildings on the site, therefore this pathway was considered incomplete and not included in the human health risk assessment.

Dermal Exposure to Contaminated Sediments and Surface Water

Site users were assumed not to have contact with sediments or surface water, therefore this pathway was eliminated from the risk assessment.

Table 3.3 summarizes exposure scenarios for site users:

Table 3.3 Exposure Duration and Frequency Assumptions for Human Health Risk Assessment

Exposure Details	Toddler, Adult
Hours on site per day	8
Days on site per week	3
Weeks on site per year	12
Years Exposed	60
Soil dermal exposure events per visit	1
Life Expectancy (years)	60
Days/year contaminated food ingestion	90

It was assumed that the toddler was protective of all other human receptors, as it is the most sensitive human receptor.

3.3 Exposure Assessment

For this SSRA, estimates of exposure were based on standard risk assessment equations used by Health Canada (2008). Sample calculations are presented in Appendix A and model printouts, including exposure estimates, are presented in and Appendix B. Equations used for all exposure calculations are provided below.

Exposure via Incidental Ingestion:

For non carcinogens - daily dose via the soil ingestion pathway was calculated using the following equation from US EPA 1998:

$$Dose\left(\frac{mg}{kg \cdot day}\right) = \frac{C_s * IR_s * RAF_{ORAL} * D_d * D_w}{BW}$$

Where:

Dose = Daily exposure of contaminant of concern per kilogram of body weight per day ($mg_{contaminant}/kg_{BW}$-day)
C_s = Soil concentration ($mg_{contaminant}/kg_{soil}$)
IR_s = Ingestion rate of soil (kg_{soil}/day)
RAF_{ORAL} = Relative absorption factor for oral exposure (unitless)
D_d = Days per week exposed/7 days/week (unitless)
D_w = Weeks per year exposed/52 weeks/year (unitless)
BW = Body weight (kg)

Dermal Exposure to Soil:

To estimate potential exposures associated with dermal contact with soil, the following equation was used:

$$\text{Dose (mg/kg-day)} = \frac{C_s \times \Sigma(SA_h \times AF_h) \times D_{abs} \times D_d \times D_w \times D_y \times E}{BW \times AT}$$

Where:

C_s	concentration of contaminant in soil or sediment (mg/kg)
$SA_{h,a}$	skin surface area exposed, for hands and arms (cm^2)
$AF_{h,o}$	adherence factor - soil loading to exposed skin on hands and other parts of the body (kg/cm^2-event)
D_{abs}	dermal absorption factor (unitless)
D_d	days per week exposed/7 days/week (unitless)
D_w	weeks per year exposed/52 weeks/year (unitless)
D_y	total years exposed to site – for carcinogens
E	exposure events (events/day)
BW	body weight (kg)
AT	averaging time (years) – for carcinogens

Inhalation of Particulate Matter: To estimate potential exposures associated with inhalation of particulate matter from on-site soil, the following equation was used:

$$\text{Dose (mg/kg-day)} = \frac{C_s \times AC \times InR \times AF_{Inh} \times D_h \times D_d \times D_w \times D_y}{BW \times AT}$$

Where:

C_s	concentration of contaminant in soil (mg/kg)
AC	airborne particulate concentration in air (kg/m^3)
InR	receptor air intake (inhalation) rate (m^3/d)
AF_{Inh}	inhalation absorption factor (unitless; assumed value = 1)
D_h	hours per day exposed/24 hours/day
D_d	days per week exposed/7 days/week
D_w	weeks per year exposed/52 weeks/year
D_y	total years exposed to site – for carcinogens
BW	body weight (kg)
AT	averaging time (years) – for carcinogens

A particulate matter concentration (PM10) of 250 µg/m^3 was adopted as the average airborne concentration of respirable particulate matter for remedial workers, and 0.76 µg/m^3 for all other human receptors. 250 µg/m^3 is the value recommended by Health Canada (2007) for heavy traffic areas, and 0.76 µg/m^3 is the value recommended for lower traffic areas.

Inhalation of Vapours: To estimate potential exposure associated with inhalation of vapours generated on-site from volatile COPCs, the following equation was used:

$$\text{Dose (mg/kg-day)} = \frac{C_{air} \times InR \times AF_{Inh} \times D_h \times D_d \times D_w \times D_y}{BW \times AT}$$

Where:

C_{air}	concentration of contaminant in ambient air (mg/m^3)
InR	receptor air intake (inhalation) rate (m^3/d)
AF_{Inh}	inhalation absorption factor (unitless; assumed value = 1)
D_h	hours per day exposed/24 hours/day
D_d	days per week exposed/7 days/week
D_w	weeks per year exposed/52 weeks/year
D_y	total years exposed to site – for carcinogens
BW	body weight (kg)
AT	averaging time (years) – for carcinogens

In calculating exposure via vapour inhalation, it was assumed that since no buildings were present on the site, exposure would result only from outdoor vapour inhalation.

3.3.1 Site Media Concentrations of COPCs used in the Human Health Risk Assessment

The concentrations used to estimate exposure follow guidance from Health Canada (2007). In most situations, it is not reasonable to assume that receptors are exposed to the maximum concentrations of soil contaminants because a receptor is assumed to have an equal chance of exposure to environmental media across the entire site (i.e. a spatial average). To be conservative, the 95% UCLM for each COPC was used for soil data to provide reasonable confidence that the true site average would not be underestimated. The maximum concentration was used when there were fewer than 10 data points for a given parameter in site soil.

3.3.1.1 Calculation of 95% UCLMs

ProUCL software version 4.00.04 (USEPA, 2009) was used to calculate the 95% upper confidence limit of the mean (95% UCLM) for each constituent in each medium evaluated in the

quantitative assessment. This software examines the distribution of available data, and tests assumptions associated with various methods for calculating the 95% UCLM, then recommends an appropriate value. Possible sources of bias in these calculations include the varying number of samples tested for each constituent, and in some cases, multiple detection limits reported by different authors and in different samples. Only the lowest detection limit was designated as a detection limit in the ProUCL input files used to calculated 95% UCLMs. This conservative approach may have resulted in somewhat elevated estimates of 95% UCLMs.

Appendix C includes output sheets for all UCLM calculations carried out in preparation for the quantitative risk assessment.

3.3.1.2 Ambient Air Concentrations for Volatile Contaminants

Ambient air concentrations for volatile contaminants were estimated using the Health Canada PQRA spreadsheet (2009) for surficial soils (< 1.5 m). The method is based on:

1. equilibrium partitioning between the contaminant in soil and vapour phases, where partitioning is a function of chemical and soil properties
2. steady-state diffusion through the soil to ground surface, with no biodegradation losses
3. atmospheric dispersion of the vapours into the breathing zone (described by a box model).

Chemical-specific parameters required for the calculation were taken from Health Canada's PQRA spreadsheet model (2009).

3.3.2 Relative Absorption Factors/Bioavailability

Bioavailability is the degree to which a chemical or other substance is absorbed or becomes physiologically available to cause an adverse effect. Bioavailability or absorption is generally less than 100% of the amount of contaminant to which a receptor is exposed. The amount of absorption will depend on the contaminant's chemical form, the exposure pathway, biological and individual susceptibility, and absorption characteristics. Health Canada (2009) indicates 100% absorption should be assumed for the ingestion and inhalation pathways, unless there is evidence to justify a lower value. The relative absorption factors used in the human health risk assessment are those recommended by Health Canada (2009).

3.3.3 Quantification of estimated exposure of each human receptor to each COPC

Model print-outs showing exposure of human receptors to site contaminants via incidental ingestion, particulate inhalation, dermal contact with soil, inhalation of vapours and consumption of contaminated food items are presented in Appendix B. These exposure concentrations were used in the calculation of hazard quotients and incremental lifetime cancer risks.

3.3.4 Dose-Response Assessment

TRVs should be exposure route-specific, therefore it is necessary to identify multiple TRVs for a single chemical when exposure occurs via multiple routes (i.e., inhalation, ingestion and dermal). However, few TRVs exist specifically for the dermal exposure pathway. Dermal exposure was therefore added to the oral dose, after adjustment for relative bioavailability or absorption; the result was subsequently compared to the oral TRV. This approach is considered acceptable when receptors are exposed to a single contaminant via multiple pathways (Health Canada, 2007). The most scientifically defensible and health-protective TRVs established by Health Canada and the US EPA were selected for each COPC. For PFOS, no Health Canada or US EPA TRVs were available, therefore the value used was drawn from a study presented at the Federal Contaminated Sites workshop held by Public Works and Government Services Canada (PWGSC) and Transport Canada (TC) in April, 2008. Although other TRVs have been used internationally, this is the only value put forward by a Canadian source, and was therefore used in this evaluation.

TRVs are commonly reported in several different formats, and it is possible to express the same degree of toxicity in different ways. While the different formats may represent equivalent toxicity, they are applied differently in risk characterization. TRVs used for the non-carcinogenic substances evaluated in this assessment include the Tolerably Daily Intake (or "reference dose"), and the Tolerable Concentration (or "reference concentration).

Tolerable Daily Intake or Reference Dose

The tolerable daily intake (TDI) or Reference Dose (RfD) represents the maximum dose (per kg of body weight) of a threshold substance to which an individual could be exposed daily over a lifetime without any expected deleterious effects (Health Canada, 2007). It is expressed as the amount of substance per unit body weight per unit time (e.g., mg/kg body weight/day).

Tolerable Concentration or Reference Concentration

The tolerable concentration (TC) or reference concentration (RfC) represents the maximum concentration (per unit volume - usually airborne) of a threshold substance to which a person may be continually exposed over a lifetime without any expected deleterious effects (Health Canada, 2007). It is expressed as a concentration (e.g. $\mu g/m^3$).

Slope Factor:

A slope factor relates the exposure dose of a non-threshold substance to the expected probability of developing cancer. It is expressed as the inverse of a dose (e.g., (mg/kg body weight/day)$^{-1}$) and quantifies the number of predicted cancers per unit dose. The exposure dose multiplied by the slope factor is the expected cancer risk. The slope factor is referred to by some agencies as a cancer potency factor, and denoted as q1*.

3.3.5 Determination of appropriate TRVs

Site-specific environmental conditions were considered in the selection of the most appropriate TRVs for the estimation of risks to human receptors. The TRVs used were sourced from Health Canada (2009), with the exception of five substances for which Health Canada values were not available (strontium, tin, acenaphthene, bromoform, 1,1,1,2-tetrachloroethane) (see table 3.4). Since no toxicity reference value was identified for acenaphthene, naphthalene was used as a surrogate. The TRVs used for bromoform and 1,1,1,2-tetrachloroethane were the reference doses for chronic oral exposure (RfDs) listed in the US EPA IRIS database. The TRVs used for strontium and tin were the minimum risk level (MRLs) listed by the US ATDSR (2009).

Table 3.4 Appropriate TRVs used for the estimation of risks to human receptors.

COCs	Non-Carcinogenic	Carcinogenic		TRV notes
	Health Canada TDI (mg/kg-d)	Oral slope factor (mg/kg-d)$^{-1}$	Inhalation slope factor (mg/kg-d)$^{-1}$	
Inorganic Elements				
Cadmium	0.0008		42.9	Health Canada 2009 [1]
Lead	0.0036			Health Canada 2009
Zinc	0.566			Health Canada 2009
Strontium	2			US ATDSR 2009 [2]
Tin	0.3			US ATDSR 2009
PHCs and BTEX compounds				
Benzene		0.226	0.0146	Health Canada 2009
F1				
Aliphatics C6-C8	5			Health Canada 2009
Aliphatics C8-C10	0.1			Health Canada 2009
Aromatics C8-C10	0.04			Health Canada 2009
F2				
Aliphatics C10-C12	0.1			Health Canada 2009
Aliphatics C12-C16	0.1			Health Canada 2009
Aromatics C10-C12	0.04			Health Canada 2009
Aromatics C12-C16	0.04			Health Canada 2009
F3				
Aliphatics C16-C21	2			Health Canada 2009
Aliphatics C21-C34	2			Health Canada 2009
Aromatics C16-C21	0.03			Health Canada 2009
Aromatics C21-C34	0.03			Health Canada 2009
PCBs				
Total PCBs	0.00013			Health Canada 2009
PAHs				
Acenaphthene	0.02*			Health Canada 2009
Benzo[a]anthracene		0.23	0.0137	Health Canada 2009
Benzo(b+j)fluoranthene		0.23	0.0137	Health Canada 2009
Benzo(k)fluoranthene		0.23	0.0137	Health Canada 2009
Dibenz(a,h)anthracene		0.23	0.0137	Health Canada 2009
VOCs				
Bromoform	0.02			US EPA IRIS database [3]
1,1,1,2-tetrachloroethane	0.03			US EPA IRIS database
Vinyl Chloride		0.26		Health Canada 2009

*=This TRV value is Naphthalene, which was used as a surrogate to represent Acenaphthene, because both chemical have similar chemical structure.

1= Health Canada (2009), Federal contaminated site risk assessment in Canada, part II: Health Canada toxicological reference values (TRVs).

2= Agency for Toxic Substances & Disease Registry, U.S Department of Health and Human Services. Atlanta, Georgia. Last updated, May18, 2010.http://www.atsdr.cdc.gov/

3= US Environmental protection agency, Intergrated Risk Information System (IRIS). Bromoform (CASRN 75-25-2), 1,1,1,2-Tetrachloroethane (CASRN 630-20-6). (http://www.epa.gov/ncea/iris/subst/0265.htm)

3.4 Risk Characterization

3.4.1 Calculation of hazard quotients and cancer risks

The risk characterization stage brings together all the previous components of the risk assessment into an overall quantitative assessment of the potential health effects to each human receptor.

For substances presenting risks other than cancer, a Hazard Quotient (HQ) is derived as the ratio of the estimated exposure to an appropriate toxicity reference value (TRV) according to the following equation:

$$\text{Hazard Quotient} = \frac{\text{Estimated Exposure}}{\text{Toxicity Reference Value}}$$

Specifically, in the context of this HH-SSRA, hazard quotients for contaminant vapours will be calculated as:

$$\text{Hazard Quotient} = \frac{\text{Concentration in air (mg/m}^3\text{ x fraction of time exposed)}}{\text{Health Canada TC (mg/m}^3\text{)}}$$

Hazard quotients for substances in soil and water will be calculated as:

$$\text{Hazard Quotient} = \frac{\text{Estimated Exposure (mg/kg/day)}}{\text{Health Canada TDI (mg/kg/day)}}$$

Risks are evaluated separately for each contaminant and pathway. For the purposes of this risk assessment, exposures associated with HQ ≤ 0.2 will be deemed negligible.

For simultaneous exposure to multiple COPCs, the HQ is assumed to be additive and the sum of the hazard quotients for each COPC and pathways with the same target organ should not exceed 0.2 to be considered acceptable (Health Canada, 2007).

For substances deemed to be carcinogenic, the estimated exposure is multiplied by the cancer slope factor or cancer unit risk to derive a conservative estimate of the potential incremental lifetime cancer risk (ILCR):

$$\text{ICLR} = \text{Exposure} \times \text{Cancer Slope Factor}$$

Cancer risks are considered negligible if the estimated ILCR is less than or equal to 1-in-100,000 or 10^{-5} (Health Canada, 2007).

3.4.2 Results of Risk Calculations

3.4.2.1 Threshold Contaminants (Non-carcinogens)

Calculated hazard quotient (HQ) values are shown in Table 3.5, below; example calculations are presented in Appendix A and outputs of the models used to perform these calculations are included in Appendix B.

Table 3.5 Hazard Quotients – Threshold Contaminants

COCs	Target HQ	HQ (Non-Carcinogens)	
		Toddler	Adults
Inorganic Elements			
Cadmium	2.00E-01	1.62E+00	8.76E-01
Lead	2.00E-01	2.11E+00	1.00E+00
Tin	2.00E-01	2.63E-05	7.90E-06
Zinc	2.00E-01	6.42E-03	2.54E-03
Strontium	2.00E-01	2.54E-04	1.21E-04
PHCs			
F1	5.00E-01	1.24E-03	7.18E-04
F2	5.00E-01	1.10E-02	1.10E-02
F3	5.00E-01	6.14E-02	6.14E-02
PCBs	2.00E-01	1.80E+02	9.72E+01
PAHs			
Acenaphthene	2.00E-01	6.22E-06	3.85E-06
VOCs			
Bromoform	2.00E-01	5.39E-06	1.74E-06
1,1,1,2-tetrachloroethane	2.00E-01	5.74E-05	2.26E-05

The target HQ of 0.5 was not exceeded for any of the PHC fractions (F1, F2, F3 or F4) in either the adult or the toddler receptor.

The target HQ of 0.2 was exceeded in the toddler and the adult for the following: cadmium, lead, and PCBs.

3.4.2.2 Non-Threshold Contaminants (Carcinogens)

The calculated incremental lifetime cancer risk (ILCR) values for the adult receptor are shown in Table 3.6, below, and the outputs from models used to calculate the values are presented in Appendix B.

Table 3.6 ILCR Values – Non-Threshold Contaminants

COCs	Target ILCR	ILCR (Carcinogens)
Inorganic		
Cadmium	1.00E-05	6.82E-10
BTEX compound		
Benzene	1.00E-05	3.23E-08
PAHs		
Benz[a]anthracene	1.00E-05	1.31E-04
Benzo(b)fluoranthene	1.00E-05	2.42E-08
Benzo(k)fluoranthene	1.00E-05	9.00E-09
Dibenz(a,H)anthracene	1.00E-05	3.19E-09
VOCs		
Vinyl Chloride	1.00E-05	1.16E-04

The Health Canada recommended target ILCR ($1.0x\ 10^{-5}$) was exceeded in the adult receptor for benz[a]anthracene and vinyl chloride.

The risks posed by cadmium, lead, benz[a]anthracene and PCBs result primarily from consumption of fish (see model printouts, Appendix B). Concentrations of contaminants in fish, however, are modeled values rather than measured concentrations, therefore the estimate of risk to humans from fish consumption may be overly conservative.

3.5 Uncertainty Analysis

Sources of uncertainty associated with modeling in risk assessment can include variability in input parameters due to spatial and temporal variation, lack of data for key parameters, and simplification and assumptions within the model.

The following discussion describes some of the uncertainties associated with this risk assessment.

3.5.1 Uncertainties in Site Characterization

There is always uncertainty associated with the collection and analysis of environmental sampling data. Sources of uncertainty typically include:

- Which samples are collected and assumed to represent actual site conditions; and
- Inherent variance in procedures for sample collection, shipment/storage and laboratory analysis.

The potential effects of uncertainty in site characterization on the risk assessment are unknown, however many of the known and highly toxic chemicals (such as PHCs, PAHs, cadmium) were

sampled in multiple locations distributed over the area of the site. Additionally, multiple samples were collected from known "hotspots", therefore it is reasonable to assume that the data on which the risk assessment was based was representative of the highest contaminant concentrations at the site. Concentrations across much of the site have been shown to be lower than those used in the calculations, therefore, risk estimates are conservatively high.

Another source of uncertainty is the conservative practice of including data from samples where contaminant concentrations were below their respective detection limits. In these situations, contaminant concentrations were assumed equal to the detection limit. In reality, these concentrations could be significantly lower.

3.5.2 Uncertainties in Exposure Assessment

There are several key uncertainties associated with the exposure assessment.

During winter months, exposure is likely to be insignificant due to snow cover and ground freezing which would immobilize contaminants and reduce volatilization from any exposed ground surfaces.

Bioavailability of COPCs was assumed to be 100%. This assumption would have resulted in conservatively high exposure doses as not all COPCs in soil and water are necessarily 100% bioavailable.

Fish tissue concentrations of potential contaminants were not measured directly, therefore concentrations entered into the risk assessment model for human health are those calculated in the environmental risk assessment. These values may be overly conservative. Any decisions to be made on the basis of potential levels of risk to humans resulting from waterborne contaminants should be considered with caution, unless fish tissue concentrations can be obtained. Further, contaminants detected in surface water but not in sediment may not originate from the site, as the Sylvia Grinnell River is fast-flowing and would transport substances from other locations. Long-range transport of PCBs and pesticides to northern climates from southern regions is also possible. Since no background data is available against which to compare surface water concentrations of these contaminants, it is not clear whether or not they originate from the site.

3.5.3 Uncertainties in Toxicity Assessment

Toxicity reference values used in this assessment are published by regulatory agencies based on animal studies. Uncertainties exist because toxicity reference values are derived by the extrapolation of the animal study data using toxicological models and/or epidemiological studies. Since humans and animals differ in their response to the absorption and distribution of chemicals, the extrapolated toxicity reference values are typically numerically adjusted to add

margins of conservatism (safety factors) that are built into the final toxicity reference values. Toxicity reference values have uncertainties spanning at least an order of magnitude (US EPA, 1989) and are likely to over-estimate risks to human health to provide a safety factor from exposure.

3.5.4 Uncertainties in Risk Estimates

3.5.4.1 Evaluation of Potential Toxic Interactions

In addition to the factors listed above, the approach of summing the HQ and ILCR values is very conservative and may be overly protective, as it assumes that substances interact on the same cellular target and via the same mechanism of action. Typically, criteria, guidelines, and standards developed by provincial and federal regulatory agencies do not account for potential interactions of chemicals. In reality, interactions (via synergism and/or antagonism) are typically considered to be rare at environmental concentrations. Two groups of chemicals considered to have the potential to act similarly are: 1) carcinogenic polycyclic aromatic hydrocarbons (PAHs), and 2) polychlorinated dibenzo-p-dioxins/furans and dioxin-like PCBs. Although several PAHs were identified as COPCs at the site, PCBs were well below applicable criteria and/or detection limits in all soil samples.

3.5.5 Identification of Major Factors Influencing Uncertainty

The major factors of uncertainty in this risk assessment are:

- Where contaminant concentrations were below detection limits, the detection limits were treated as measured values;
- Actual exposure of human receptors to site contaminants is likely lower than estimated, particularly for exposure via consumption of fish;
- COPCs are assumed 100% bioavailable from ingestion and inhalation exposure routes;
- TRVs are based on studies of organisms other than humans.

3.6 Summary of HHRA Findings

The target HQ of 0.5 was not exceeded for any of the PHC fractions (F1, F2, F3 or F4) in either the adult or the toddler receptor.

The target HQ of 0.2 was exceeded in the toddler and the adult for the following: cadmium, lead, and PCBs.

The Health Canada recommended target ILCR (1.0×10^{-5}) was exceeded in the adult receptor for benz[a]anthracene and vinyl chloride.

The risks posed by cadmium, lead, benz[a]anthracene and PCBs result primarily from consumption of fish (see model printouts, Appendix B). Concentrations of contaminants in fish,

however, are modeled values rather than measured concentrations, therefore the estimate of risk to humans from fish consumption may be overly conservative.

Any decisions to be made on the basis of potential levels of risk to humans resulting from waterborne contaminants should be considered with caution, unless fish tissue concentrations can be obtained. Further, contaminants detected in surface water but not in sediment may not originate from the site, as the Sylvia Grinnell River is fast-flowing and would transport substances from other locations. Long-range transport of PCBs and pesticides to northern climates from southern regions is also possible. Since no background data is available against which to compare surface water concentrations of these contaminants, it is not clear whether or not they originate from the site.

4.0 ECOLOGICAL RISK ASSESSMENT

This section presents the assumptions, methodologies and results of the site-specific ecological risk assessment (ERA) that was conducted to determine potential risks to ecological receptors based on the environmental conditions at the Iqaluit Vehicle Dump and Community Landfill. The ERA was based on the CCME's ecological risk assessment framework, and followed guidance set out on the CCME document entitled: "A Framework for Ecological Risk Assessment: General Guidance" (CCME 1996), and "A Framework for Ecological Risk Assessment: Technical Appendices" (CCME 1997). Other risk assessment guidance and technical documents from the MOE, US EPA and Oak Ridge National Laboratory (ORNL) were also employed, where applicable.

4.1 Problem Formulation

This section includes an evaluation of COPECs, ecological receptors, and relevant exposure pathways, leading to identification of substances with the potential to cause adverse effects to ecological receptors. This information was used to develop an ecological conceptual site model (ECSM) that represents current understanding of contaminant sources, release and transport mechanisms within and among environmental media, and exposure pathways by which ecological receptors may be exposed to contaminants.

4.1.1 Qualitative Evaluation

An initial "chemical screening" was performed in which concentrations of all potential contaminants in site media were screened against generic and/or ecological guidelines (see Section 2). Those substances that exceeded the guidelines were subjected to secondary chemical screening approach, referred to as a "qualitative assessment". This assessment employed toxicological benchmark values protective of ecological receptors for each environmental medium. As in the initial chemical screening process, maximum chemical concentrations detected in each environmental medium were compared with the applicable toxicological benchmarks. If a contaminant concentration was higher than both the EQG and the toxicological benchmark value, then the substance was evaluated further in the quantitative assessment. If the maximum concentration was higher than the EQG but lower than the benchmark value, then the substance was deemed not to present a potential risk to ecological receptors and was not evaluated further in the quantitative assessment.

COPECs in Soil

To identify COPECs in soil for ecological receptors, toxicological benchmark values from the following data sources were used in the qualitative assessment:

- R. A. Efroymson, M. E. Will and G. W. Suter II (1997). Toxicological Benchmarks for contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process, Oak Ridge National Laboratory;
- R. A. Efroymson, M. E. Will, G. W. Suter II and Wooten (1997). Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants, Oak Ridge National Laboratory;
- Ontario Ministry of the Environment (MOE) Standards Development Branch (2008). Rationale for the Development of Generic Soil and Groundwater Standards for Use at Contaminated Sites in Ontario, and
- U.S. Environmental Protection Agency (2007). ECOTOX User Guide: ECOTOXicology Database System. Version 4.0. Available at: http:/www.epa.gov/ecotox/

The threshold for significant effects for the benchmark values identified in the Efroymson reports was a twenty percent reduction in growth, reproduction or activity. This threshold value is consistent with other ecological screening benchmarks and is consistent with the objective of the risk assessment to protect the viability of the population and community of organisms within the ecosystem. The benchmarks selected for this screening were based on similar endpoints or on "lowest observable effect levels" (LOELs).

The significance of the qualitative screening assessment results for soil is discussed below.

Inorganic Elements

No benchmark values were found for calcium, magnesium, phosphorus, potassium, sodium or strontium in soil, but these elements were qualitatively eliminated from the risk assessment. These inorganic elements are major constituents of the Earth's crust, and essential nutrients for all living organisms. All of these elements were retained in the qualitative assessment because no criteria were available to screen them out. Although sodium and calcium concentrations may be augmented by anthropogenic activity, such as winter maintenance of roadways, these elements are of low concern to ecological receptors at the levels detected on site. Site concentrations of magnesium, phosphorus and potassium are less likely to originate from historical contamination than from natural sources, therefore they were not considered further in the risk assessment. Iron was present in site soils at high concentrations which may have resulted from anthropogenic activity. Since **iron** can be toxic at high concentrations, it was retained in the quantitative assessment. **Aluminum, cadmium, iron and zinc** concentrations in site soils surpassed available benchmark values and were consequently retained in the quantitative assessment. Strontium levels could not be evaluated as no benchmark values were found, but strontium was also qualitatively eliminated from the risk assessment, as it is a calcium analogue and plays an important role in hard tissues such as bones. Strontium is only

slightly more toxic than calcium, therefore it was not considered a COPC for the risk assessment. The results of the qualitative assessment of inorganic elements in soil are shown in Table 4.1.

Table 4.1 Results of qualitative assessment of inorganic elements in soil.

Chemicals	maximum concentration (ug/g)	Benchmarks applied in qualitative assessment					Retained in quantitative ?
		Efroymson et al., 1997. Plants [1]	**Efroymson et al., 1997.** Inverts [2]	**MOE 2008** (plants & invertebrates, agr/res, coarse soil)	**US EPA ECOTOX database[3] earthworm value (endpoint)**	**US EPA ERA protocol appendix E**	
Aluminum	5100	50	NV	NV	NV	NV	**Y**
Cadmium	22.4		20	12	NV		**Y**
Calcium	7700				NV	NV	N
Copper	103	100	50	140	NV		N
Iron	29000	NV	NV		NV	NV	**Y**
Magnesium	3100	NV	NV	NV	NV	NV	N
Manganese	250	500	NV	NV	NV	NV	N
Phosphorus	850				NV	NV	N
Potassium	960				NV	NV	N
Selenium	2			10	NV		N
Sodium	280	NV	NV	NV	NV	NV	N
Strontium	14	NV	NV	NV	NV	NV	N
Thallium	1	1	NV	1.4	NV	NV	N
Tin	9.8	50	NV	NV	NV	NV	N
Vanadium	68	2	NV	**200**	NV	NV	N
Zinc	488	50	200	400	NV	199	**Y**

1= Efroymson, R.A., M. E. Will, G. W. Suter II and Wooten (1997). Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants.

2= Efroymson, R.A., M. E. Will and G. W. Suter II (1997). Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process.

3= U.S. Environmental Protection Agency (2007). ECOTOX User Guide: ECOTOXicology Database System. Version 4.0. Available: http:/www.epa.gov/ecotox/

PHCs and BTEX

Concentrations of PHC fractions F2 to F4 were assessed against MOE ecological criteria for the protection of plant and soil invertebrates in coarse soil (agricultural/residential/park land use). All subfractions of **F2, F3 and F4** were retained in the quantitative risk assessment. The results of the qualitative assessment of PHCs and BTEX in soil are shown in Table 4.2.

Table 4.2 Results of qualitative assessment of PHCs and BTEX in soil

Chemicals	maximum concentration (ug/g)	Benchmarks applied in qualitative assessment	
		MOE 2008 [1]	Retained in Quantitative?
Benzene	NA	25	N
F2 (C10-C16)	1100	450	**Y**
F3 (C16-C34)	44400	400	**Y**
F4 (C34-C50)	6960	2800	**Y**

1= Ontario Minstry of the Environment, 2008. MOE rationale document; agricultural/residential/parkland; coarse soil; plants & soil invertebrates

PAHs

Benzo(g,h,i)perylene was eliminated after screening against the MOE (2008) benchmark value protective of plants and soil invertebrates in agricultural, residential and parkland soil (coarse grained). **No PAHs** were carried forward to the quantitative risk assessment. The results of the qualitative assessment of PAHs in soil are shown in Table 4.3.

Table 4.3 Results of qualitative assessment of PAHs in soil.

Chemicals	Maximum concentration (ug/g)	Benchmarks applied in qualitative assessment	
		MOE 2008 [1]	Retained in
Benzo(g,h,i)perylene	0.728	6.6	N

1= Ontario Minstry of the Environment, 2008. MOE rationale document;agricultural/residential/parkland; coarse soil; plants & soil invertebrates

PCBs

PCBs were eliminated after screening against he MOE (2008) benchmark value protective of plants and soil invertebrates in agricultural, residential and parkland soil (coarse grained). **No PCBs** were carried forward to the quantitative risk assessment. The results of the qualitative assessment of PCBs in soil are shown in Table 4.4.

Table 4.4 Results of qualitative assessment of PCBs in soil

PCBs	Maximum concentration (ug/g)	Benchmarks applied in qualitative assessment			Retained in quantitative?
		MOE 2008 [1] (plants and invertebrates)	Efroymson 1997 [2] plants	Efroymson 1997 [3] invertebrates	
Polychlorinated biphenyls	17.1	33	40	NV	N

1= Ontario Ministry of the Environment (MOE) Standards Development Branch (2008). Rationale for the Development of Generic Soil and Groundwater Standards for Use at Contaminated Sites in Ontario.

2= Efroymson, R.A., M. E. Will, G. W. Suter II and Wooten (1997). Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants.

3= Efroymson, R.A., M. E. Will and G. W. Suter II (1997). Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process.

VOCs

No benchmark values were identified for **bromoform or 1,1,1,2-tetrachloroethylene**, therefore these two compounds were retained in the quantitative risk assessment. Vinyl chloride was screened out after comparison of the maximum measured value with the MOE (2008) benchmark value protective of plants and soil invertebrates in agricultural, residential and parkland soil (coarse-grained). The results of the qualitative assessment of VOCs in soil are shown in Table 4.5.

Table 4.5 Results of the qualitative assessment of VOCs in soil

Chemicals	Maximum concentration (ug/g)	Benchmarks applied in qualitative assessment				Retained in quantitative ERA?	Notes
		MOE 2008 [1]	Efroymson et al. 97 (plants) [2]	Efroymson et al. 97 (invertebrates) [3]	US EPA Ecotox [4]		
Bromoform	0.05	NV	NV	NV	NV	**Y**	
1,1,1,2-Tetrachloroethane	0.05	NV	NV	NV	NV	**Y**	
Vinyl chloride	**0.1**	3.4	NV	NV	NV	N	MOE value is protective of plants and soil invertebrates; agricultural/residential/park land; coarse soil

All units in ug/g, unless otherwise noted.

1= Ontario Ministry of the Environment (MOE) Standards Development Branch (2008). Rationale for the Development of Generic Soil and Groundwater Standards for Use at Contaminated Sites in Ontario.

2= Efroymson, R.A., M. E. Will, G. W. Suter II and Wooten (1997). Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants.

3= Efroymson, R.A., M. E. Will and G. W. Suter II (1997). Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process.

4= U.S. Environmental Protection Agency (2007). ECOTOX User Guide: ECOTOXicology Database System. Version 4.0. Available: http:/www.epa.gov/ecotox/

COPECs in Fresh Surface Water

The following source of toxicological benchmark values was used for the qualitative screening assessment of contaminants in fresh water:

- G. W. Sutter II and C.L. Tsao (ORNL, 1996 Revision). Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota. Table 1. Summary of conventional benchmarks for priority contaminants in fresh water.
- Environment Canada. 2000. A Compendium of Environmental Quality Benchmarks.

- Ontario Ministry of the Environment (MOE) Standards Development Branch (2008). Rationale for the Development of Generic Soil and Groundwater Standards for Use at Contaminated Sites in Ontario

Inorganics

Qualitative assessment of inorganic elements in surface water against benchmark values eliminated the following substances: aluminum, antimony, cadmium, calcium, cobalt, lead, manganese, mercury, selenium and tin.

Magnesium, potassium and sodium exceeded benchmarks listed in Suter and Tsao (1996) in one or two samples. The samples in question was collected from a very shallow environment therefore elevated concentrations magnesium, potassium and sodium were attributed to accumulation of salts due to frequent wetting and drying of this shallow area.

The remaining elements were carried forward to the quantitative risk assessment, and include: **hexavalent chromium, copper, iron and zinc**.

The results of the qualitative assessment of inorganic elements in fresh surface water are shown in Table 4.6.

Table 4.6 Results of the qualitative assessment of inorganic elements in fresh surface water.

Chemicals	Maximum concentration (ug/L)	Benchmarks applied in qualitative assessment		Retained in quantitative?	Notes
		Suter & Tsao 1996[1] (all organisms - aquatic biota)	EC Compendium [2]		
pH<6.5	119	460		N	
pH>6.5	250				
Antimony (Sb)	25	610		N	
Boron (B)	920	8830		N	
Cadmium (Cd)	0.129	0.15		N	
Calcium (Ca)	91500	116000		N	
Chromium VI (Cr6+)	3.7	2		**Y**	
Cobalt (Co)	2.86	5.1		N	
Copper (Cu)					
H: 0 - 120,000ug/L	7.1	0.23		**Y**	
H: >180,000 ug/L	50				
Iron (Fe)	10000	158	300	**Y**	EC Compendium value = Ontario PWQO
Lead (Pb)					
H: 0 - 60,000ug/L	2	12.26		N	all measured values + DL for H > 180,000 (ignoring the one sample with DL at 25) = 9.77
H: 60 - 120,000ug/L	2.77				
H: >180,000ug/L	25				
Magnesium (Mg)	242000	82000	NV	N	two high values assumed due to accumulation of salts from repeated wetting & drying
Manganese (Mn)	151	<1100		N	
Mercury (Hg)	0.1	<0.23		N	
Potassium (K)	78000	53000	NV	N	one high value assumed due to accumulation of salts from repeated wetting & drying
Selenium (Se)	50	88.32		N	
Sodium (Na)	2040000	680000		N	two high values assumed due to accumulation of salts from repeated wetting & drying
Tin (Sn)	0.57	350		N	
Zinc (Zn)	163	30		**Y**	

1= Sutter II., G.W., and C.L. Tsao (1996). Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota.

2= Environment Canada. 2000. A Compendium of Environmental Quality Benchmarks.

PAHs

All PAHs were eliminated after comparison with benchmarks protective of aquatic biota (Suter & Tsao, 1996). No PAHs were carried forward to the quantitative assessment.

The results of the qualitative assessment for PAHs are shown in Table 4.7.

Table 4.7 Results of qualitative assessment of PAHs in fresh surface water.

Chemicals	Maximum Concentration (ug/L)	Benchmarks applied in qualitative assessment	Retained in quantitative?	Notes
		Suter Tsao 96 aquatic biota [1]		
Anthracene	0.05	0.09	N	
Benz(a)anthracene	0.05	0.65	N	
Fluoranthene	0.05	15	N	
Pyrene	0.05	0.3	N	Benzo[a]pyrene used as surrogate (no value for pyrene)

All units in ug/L, unless otherwise noted.

1= Sutter II., G.W., and C.L. Tsao (1996). Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota.

PCBs

Total PCBs were compared with the aquatic biota benchmark listed by Suter & Tsao (1996). Although the detection limit for total PCBs in one sample exceeded this benchmark, all values were below detection limits, and all other detection limits were less than or equal to the benchmark value (0.1 µg/L). PCBs were therefore eliminated from the quantitative risk assessment.

The results of the qualitative assessment for PCBs are shown in Table 4.8.

Table 4.8 The results of the qualitative assessment of PCBs in fresh surface water.

Chemicals	Maximum Concentration (ug/L)	Benchmarks applied in qualitative assessment	Retained in quantitative ?	Notes
		Suter & Tsao, 96, aquatic [1]		
Total Polychlorinated Biphenyls	1	0.1	N	all 2009 samples were below DL, which was 0.1 for all but one sample.

All units in ug/L, unless otherwise noted.

1= Sutter II., G.W., and C.L. Tsao (1996). Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota.

Pesticides

Qualitative assessment of pesticides in fresh surface water eliminated lindane, DDT and endrin from the risk assessment. **Toxaphene**, however, was retained as a conservative measure, as no benchmark values were identified.

The results of the qualitative assessment for pesticides are shown in Table 4.9.

Table 4.9 Results of qualitative assessment of pesticides in fresh surface water

Chemicals	Maximum Concentration (ug/L)	Benchmarks applied in qualitative	retained in quantitative?	Notes
		Suter & Tsao 96 [1]		
Lindane (gamma - BHC)	0.05	3.3	N	
DDT plus metabolites	0.03	0.3	N	
Endrin	0.03	0.061	N	NAWQ criteria - chronic
Toxaphene	1	NV	**Y**	

1= Sutter II., G.W., and C.L. Tsao (1996). Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota.

VOCs

All VOCs in fresh surface water that failed the initial chemical screening were eliminated from further assessment after comparison with benchmarks established by the Ontario MOE (2008). The results of the qualitative assessment for pesticides are shown in Table 4.10.

Table 4.10 Results of qualitative assessment of VOCs in fresh surface water

Chemicals	Maximum Concentration (ug/L)	Benchmarks applied in qualitative	Retained in quantitative?
		MOE 2008 aquatic receptor protection value [1]	
cis-1,2-Dichloroethylene	2	11,600	N
Tetrachloroethylene	210	840	N
1,1,2-Trichloroethane	3	9400	N
Trichloroethylene	62	21900	N

1= MOE 2008 rationale document: value protective of plants and soil invertebrates,agricultural/residential/ park land soil/coarse

COPECs in Brackish Surface Water

Inorganics

Concentrations of inorganic elements in brackish surface water were compared against benchmarks established in Suter & Tsao (1996, freshwater values), and/or values listed in the Environment Canada (2000) Compendium of Environmental Quality Benchmarks.

Although the maximum measured concentration of cadmium in brackish water on the site was below the value listed by Suter and Tsao (1996) for freshwater aquatic organisms, it surpassed the EC compendium values listed for marine waters in Canada. For this reason, **cadmium** was retained in the quantitative risk assessment. **Iron** and **copper** were also retained, as the maximum concentration exceeded all available benchmarks. **Manganese** slightly exceeded the EC (2000) benchmark for marine waters, and **magnesium** and **sodium** were retained as no benchmarks were found for marine waters and these elements exceeded freshwater benchmarks.

Table 4.11 presents the results of qualitative assessment of inorganic elements in brackish surface water.

Table 4.11 Results of qualitative assessment of inorganic elements in brackish surface water

Chemicals	Maximum concentration (ug/L)	Benchmarks applied in qualitative assessment			Retained in quantitative?	Notes
		EC compendium (marine water) [1]	EC compendium (freshwater) [1]	Suter & Tsao 1996 (freshwater) [2]		
Aluminum (Al)						
pH<6.5	27	NV	NV	460	N	
pH>6.5	32.7					
Boron (B)	836.8	1000		8830	N	NOTE RE QUALITATIVE: FWAL factsheet gives 4500 ug/L as normal for seawater (but no guideline).
Cadmium (Cd)	0.146	0.12		0.15	**Y**	EC compendium value for marine water = EC guideline, 1999 and NSDOE guideline (Nova Scotia, 1998)
Calcium (Ca)	93800	NV		116000	N	
Copper (Cu)						
H:0-120,000ug/L	5.7	2		0.23	**Y**	EC compendium value for marine water = BC (Warrington, 1987) average for Kitimat Arm)
H:>180,000 ug/L	50					
Iron (Fe)	1400	50	300	158	**Y**	EC compendium value for marine water = criterion; minimal risk for BC (Nagpal et al. 1995)
Magnesium (Mg)	248000	NV		82000	**Y**	
Manganese (Mn)	104	100		<1100	**Y**	EC compendium value for marine water = criterion to protect consumers of marine mollusks.
Mercury (Hg)	0.1	0.5		<0.23	N	EC compendium value for marine water = estuary waters arithmetic mean over a year for elemental mercury and its compounds, Europe (CEC, 1988)
Sodium (Na)	2080000	NV		680000	**Y**	
Vanadium (V)	2			80	N	

1= Environment Canada. 2000. A Compendium of Environmental Quality Benchmarks.

2= Sutter II., G.W., and C.L. Tsao (1996). Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota.

PCBs

Although all samples tested for total PCBs in brackish surface water were below detection limits, this parameter was evaluated against benchmarks listed for marine water in the Environment Canada (2000) compendium, as the detection limits surpassed CCME FWAL guidelines. **Total PCBs** were subsequently retained in the quantitative risk assessment. Table 4.12 presents the results of qualitative assessment of PCBs in brackish surface water.

Table 4.12 Results of qualitative assessment of PCBs in brackish surface water

Chemicals	Maximum Concentration (ug/L)	Benchmarks applied in qualitative assessment	Retained in qualitative?
		EC Compendium [1]	
Total Polychlorinated Biphenyls	1	0.00007	**Y**

All units in ug/L, unless otherwise noted

1=Environment Canada. 2000. A Compendium of Environmental Quality Benchmarks. Water quality objective for estuary condition.

Pesticides

After comparison with benchmarks listed for marine water in the Environment Canada (2000) compendium, **lindane, DDT (plus metabolites), endrin and toxaphene** were retained in the quantitative risk assessment for brackish surface water.

Results of the qualitative assessment of pesticides in brackish surface water are shown in Table 4.13.

Table 4.13 Results of qualitative assessment of pesticides in brackish surface water

Chemicals	Maximum Concentration (ug/L)	Benchmarks applied in qualitative assessment	Retained in quantitative?
		EC Compendium [1], marine or estuarine water	
Lindane (gamma - BHC)	0.05	<0.01	**Y**
DDT plus metabolites	0.005	0.001	**Y**
Endrin	0.2	0.0023	**Y**
Toxaphene	0.2	0.0002 - 0.008	**Y**

All units in ug/L, unless otherwise noted.

1=Environment Canada. 2000. A Compendium of Environmental Quality Benchmarks.

VOCs

Both **cis-1,2-dichloroethylene and trichloroethylene** were retained in the quantitative risk assessment, as no suitable benchmarks could be identified. Table 4.14 presents the results of qualitative assessment of VOCs in brackish surface water.

Table 4.14 Results of qualitative assessment of VOCs in brackish surface water

Chemicals	Maximum Concentration (ug/L)	Benchmarks applied in qualitative assessment		Retained in quantitative assessment?
		EC Compendium [1]; marine/estuarine values	Suter & Tsao (1996)[2] - freshwater values	
cis-1,2-Dichloroethylene	4	no values based on chronic effects	estimate only	**Y**
Trichloroethylene	22.6	no values based on chronic effects	estimate only	**Y**

1= Environment Canada. 2000. A Compendium of Environmental Quality Benchmarks.

2= Sutter II., G.W., and C.L. Tsao (1996). Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota.

COPECs in Sediment

Since contact with freshwater sediments was considered a relatively insignificant exposure pathway (compared with contact with brackish sediments) at the site, COPECs were only evaluated for brackish sediments.

To identify COPECs in sediment for ecological receptors, toxicological benchmark values from the following data sources were used:

- Jones DS, Sutter II GW and Hull RN. 1997. Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Sediment Associated Biota;
- Environment Canada. 2000. A Compendium of Environmental Quality Benchmarks; and
- Thompson PA, Kurias J and Mihok S. 2005. Derivation and Use of Sediment Quality Guidelines for Ecological Risk Assessment of Metals and Radionuclides released to the Environment from Uranium Mining and Milling Activities in Canada. Environmental Monitoring and Assessment 110: 71-85.
- United States Environmental Protection Agency (US EPA). 1993. Wildlife Exposure Factors Handbook.

The threshold for significant effects on which these benchmark values were based was a twenty percent reduction in growth, reproduction, or activity. This threshold value is consistent with other ecological screening benchmarks and is consistent with the objective of the risk

assessment to protect the viability of the population and community of organisms within the ecosystem. When selecting benchmarks for sediment toxicity investigation the organic content of the sediments (measured as Total Organic Carbon – TOC) was taken into consideration.

The equilibrium partitioning (EqP) approach was used to derive the sediment quality benchmarks in Table 3 of the above-cited reference (Jones et al., 1997). This methodology is not appropriate for sediments with less than 0.2% TOC (US EPA 1993).

Inorganics

After evaluation against sediment benchmarks as indicated above, the following inorganic elements were retained in the quantitative risk assessment based on their concentrations in brackish sediments: **barium, hexavalent chromium, iron, lead, and vanadium**.

The benchmark value used to evaluate aluminum concentrations was the Assessment and Remediation of Contaminated Sediments Program (USEPA, 1996) probable effect concentration (PEC = 58,030 mg/kg dry wt). An uncertainty factor of 10 was applied to approximate a lowest effect concentration (5,803 mg/kg dry wt.). Since measured values did not exceed this level, aluminum was eliminated from the quantitative risk assessment.
Although no guidelines or benchmarks were identified for calcium concentrations in brackish sediments, calcium was not included in the risk assessment, as marine sediments are often predominately composed of calcium carbonate, and calcium is a major nutrient in all aqueous systems. Similarly, there are no sediment guidelines or benchmarks for sodium or magnesium concentrations in sediments, but it is expected that concentrations of these metals would be detected at significant levels in brackish sediment.

It is noteworthy that sediment sample AEC3-SD09-3 had the maximum concentrations of many inorganic elements. No obvious drainage pathways lead from the main landfill area to Pond 3 where this sample was collected. The water at AEC3-SD09-3, however, was very shallow, and high concentrations of metals and other inorganics was attributed to the accumulation of salts in sediments as this area was repeatedly wetted and dried as the result of rainfall, run-off or flooding.

Results of the qualitative assessment of inorganic elements in brackish sediments are shown in Table 4.15.

Table 4.15 Results of qualitative assessment of inorganic elements in brackish sediments

Chemicals	Maximum Concentration (ug/g)	Benchmarks applied in qualitative assessment				Retained in quantitative?	Notes
		Jones et al., 1997 [1] ; marine and estuarine sediments	Jones et al., 1997 [1] ; freshwater sediments	EC Compendium [2] - freshwater values	Thompson et al., 2005 [3] ; freshwater sediments lowest effect level (closest observation method)		
Aluminum (Al)	4600		58030 = ARCS PEC level,			N	Al concentration is < 1/10 of this value.
Antimony (Sb)	0.7	2				N	NOAA ER-L value
Arsenic (As)	7	8.2				N	
Barium (Ba)	25.9	NV		20		**Y**	Non-polluted value, USEPA
Cadmium (Cd)	0.3	0.68 - 1.2				N	0.68 = FDEP TEL; 1.2 = NOAA ER-L
Calcium (Ca)	3500	NV				N	likely accumulated from precipitation of salts
Chromium (Cr) (total)	30	52.3 - 81				N	52.3 = FDEP TEL; 81 = NOAA ER-L
Chromium (VI)	0.8	NV				**Y**	
Cobalt (Co)	5.7	NV		50		N	OMOE criterion for dredged material, open water disposal
Copper (Cu)	18	18.7 - 34				N	18.7 = FDEP TEL; 34 = NOAA ER-L
Iron (Fe)	46000	NV	2% = 20,000 µg/g (OMOE LEL, freshwater sediments)	21200		**Y**	Compendium value = LEL, BC (Nagpal et al., 1995)
Lead (Pb)	63	30.2 - 46.7				**Y**	30.2 = FDEP TEL; 46.7 = NOAA ER-L
Magnesium (Mg)	4800	NV				N	likely accumulated from precipitation of salts
Manganese (Mn)	230	NV	460	460		N	Criterion, LEL, NY State (NYSDEC 1994) - freshwater or marine sediment
Molybdenum (Mo)	11	NV			8.3	N	all samples except 1 were ≤ the benchmark
Nickel (Ni)	10	15.9 - 20.9				N	15.9 = FDEP TEL; 20.9 = NOAA ER-L
Phosphorus (P)	1300			1000		N	OMOE dredged material criterion - open water disposal; only exceeds benchmark in 1 sample (AEC 3-SD09-3)
Potassium (K)	1800					N	likely accumulated from precipitation of salts
Sodium	8800					N	likely accumulated from precipitation of salts
Strontium (Sr)	37	NV				N	no benchmarks, but only slightly more toxic than Ca; used in bones and tissues
Vanadium (V)	91					**Y**	
Zinc (Zn)	130	124 - 150				N	124 = FDEP TEL; 150 = NOAA ER-L

1= Jones, D.S., Suter II, G.W., Hull, R.N., 1997. Toxicological benchmarks for screening contaminants of potential concern for effects on sediment-associated biota: 1997 revision. U.S. Department of Energy, Office of Environmental management.

2= Environment Canada. 2000. A Compendium of Environmental Quality Benchmarks.

3= Thompson, P.A., Kurias, J., and Mihok, S., 2005. Derivation and use of sediment quality guidelines for ecological risk assessment of metals and radionuclides released to the environment from uranium mining and milling activities in Canada. *Environmental monitoring and assessment* , 2005. 110 (71-85).

PHCs

No benchmark values exist against which to evaluate the toxicity of **PHC fractions F3 and F4** (carried forward from the chemical screening), therefore these substances were retained in the quantitative risk assessment. Table 4.16 presents the results of qualitative assessment of inorganic elements in sediment.

Table 4.16 Results of qualitative assessment of PHCs in brackish sediments

Chemicals	Maximum Concentration	Retained in quantitative?	Notes
CWS F3 (C16-C34)	360	**Y**	No benchmark values
CWS F4 (C34-C50)	470	**Y**	No benchmark values

PCBs

The maximum measured concentration of **total PCBs** in brackish sediments surpassed the available benchmark, therefore this parameter was retained in the quantitative risk assessment (see Table 4.17).

Table 4.17 Results of qualitative assessment of PCBs in brackish sediments

Chmicals	Maximum Concentration (ug/g)	Benchmarks applied in qualitative assessment	Retained in quantitative?
		Jones et al., 1997, [1]	
Total Polychlorinated Biphenyls	0.09	0.0216 - 0.0227	**Y**

1=Jones, D.S., Suter II, G.W., Hull, R.N., 1997. Toxicological benchmarks for screening contaminants of potential concern for effects on sediment-associated biota: 1997 revision. U.S. Department of Energy, Office of Environmental management.

VOCs

All VOCs were eliminated from the quantitative risk assessment after comparison with benchmark values (see Table 4.18).

Table 4.18 Results of qualitative assessment of VOCs in brackish sediments

Chemicals	Maximum Concentration (ug/g)	Benchmarks applied in qualitative assessment	Retained in quantitative?	Notes
		Jones et al., 1997, freshwater sediment value		
cis-1,2-Dichloroethene	0.05	0.4	N	secondary chronic value for 1,2-dichloroethene in freshwater sediments
Tetrachloroethene	0.38	0.41	N	secondary chronic value in freshwater sediments
Trichloroethene	0.1	0.22	N	secondary chronic value in freshwater sediments

All units in ug/g, unless otherwise noted.
1=Jones, D.S., Suter II, G.W., Hull, R.N., 1997. Toxicological benchmarks for screening contaminants of potential concern for effects on sediment-associated biota: 1997 revision. U.S. Department of Energy, Office of Environmental management.

4.1.1.1 Summary of COPCs

Tables 4.19, 4.20 and 4.21 below summarize the substances carried forward into the risk assessment, and indicates site media in which each COPC was detected, and the concentration used in the risk assessment.

Table 4.19 Soil COPCs Evaluated in the Quantitative Risk Assessment

Medium	Chemical Class	Chemical	Concentration (mg/kg)	Statistic
Soil	**Metals/Inorganics**	Aluminum	4677	95% UCLM
		Cadmium	2.777	95% UCLM
		Iron	23696	95% UCLM
		Zinc	122.5	95% UCLM
	PHCs	F2 - C>10-12 aliphatic	51.624	95% UCLM
		F2 - C>12-16 aliphatic	63.096	95% UCLM
		F2 - C>10-12 aromatic	12.906	95% UCLM
		F2 - C>12-16 aromatic	15.774	95% UCLM
		F3 - C>16-21 aliphatic	8655.92	95% UCLM
		F3 - C>21-34 aliphatic	3709.68	95% UCLM
		F3 - C>16-21 aromatic	2163.98	95% UCLM
		F3 - C>21-34 aromatic	927.42	95% UCLM
		F4 - C>34 aliphatic	1344	95% UCLM
		F4 - C>34 aromatic	336	95% UCLM
	VOCs	Bromoform	0.05	Detection Limit
		1,1,1,2-tetrachloroethane	0.05	Detection Limit

Table 4.20 Surface Water COPCs Evaluated in the Quantitative Risk Assessment

Medium	Chemical Class	Chemical	Concentration (mg/L)	Statistic
Surface Water (Fresh)	**Metals/Inorganics**	Chromium 6+	0.0037	Maximum
		Copper	0.004	95% UCLM
		Iron	10	Maximum
		Zinc	0.026	95% UCLM
	Pesticides	Toxaphene	0.001	Maximum
Surface Water (Brackish)	**Metals/Inorganics**	Cadmium	0.001	Maximum
		Copper	0.0057	Maximum
		Iron	1.4	Maximum
		Magnesium	248	Maximum
		Manganese	0.104	Maximum
		Mercury	0.0001	Detection Limit
		Sodium	2080	Maximum
		Vanadium	0.002	Maximum
	PAHs	Anthracene	0.00005	Detection Limit
		Pyrene	0.00005	Detection Limit
	PCBs	PCBs	0.001	Detection Limit
	Pesticides	DDT total	0.000005	Detection Limit
		Endrin	0.0002	Detection Limit
		Lindane (gamma HCH)	0.00005	Detection Limit
		Toxaphene	0.0002	Detection Limit
	VOCs	cis-1,2-Dichloroethene	0.004	Maximum
		Trichloroethene	0.0226	Maximum

Surface water values corresponding to soil COPCs and brackish sediment COPCs were also included in the quantitative evaluation. Freshwater values for soil COPCs and brackish surface water concentrations for sediment COPCs were added, to ensure exposure to these contaminants via all pathways was calculated.

Table 4.21 Sediment COPCs Evaluated in the Quantitative Risk Assessment

Medium	Chemical Class	Chemical	Concentration (mg/kg dry wt.)	Statistic
Sediment (Brackish)	**Metals/Inorganics**	Barium	20.21	95% UCLM
		Chromium 6+	0.8	Maximum
		Iron	46000	Maximum
		Lead	25.83	95% UCLM
		Vanadium	47.12	95% UCLM
	PCBs	PCBs	0.09	Maximum
	PHCs	F3 - C>16-21 aliphatic	201.6	Maximum
		F3 - C>21-34 aliphatic	86.4	Maximum
		F3 - C>16-21 aromatic	50.4	Maximum
		F3 - C>21-34 aromatic	21.6	Maximum
		F4 - C>34 aliphatic	376	Maximum
		F4 - C>34 aromatic	94	Maximum

4.2 Assessment Endpoints

In human health risk assessment, receptors must be protected at the individual level. In ecological risk assessment (ERA), some level of effect is considered to be acceptable. Unlike in human health risk assessment (HHRA), in which the goal is to protect individuals, the goal of ERA is to protect populations, with the exception of endangered or threatened species, for which the goal is to protect individuals.

4.3 Receptor Characterization

4.3.1 Biological site Characterization

Although the landscape appears to be barren, the flora of Iqaluit Island is abundant. The area is characterized by a combination of bare rocky outcrops, grasses, and lichens (FRANZ, 2010).

To determine if the site is part of or is near to a critical wildlife habitat, the network of protected areas administered by Environment Canada was reviewed. The network, which includes migratory bird sanctuaries, national wildlife areas, and marine wildlife areas, represents diverse habitats protected under federal legislation. In addition a territorial search for information related to critical wildlife habitat was also conducted. The distribution data provided by Environment Canada and the Government of Nunavut are based on limited available information. Due to the dynamic nature of species distribution, the data provided does not represent an exhaustive and comprehensive inventory of a species' current distribution. Results of the searches are presented in the following Table 4.22.

Table 4.22 Ecology of Iqaluit, Nunavut

Vegetation	Aquatic Wildlife
• Arctic Fireweed (*Epilobium angustifolium)* • flowers and berries o Crowberry (*Empetrum*), o Poppy (***Papaver***) o Saxifrage (*Saxifraga)* • numerous mushroom species • lichens o Pixie-cup (*Cladonia asahinae)* o Scurvy-grass (*Cochlearia sp.)*	• Seal (*Pinnipedia)* • Walrus (*Odobenus rosmarus*) • Beluga (*Delphinapterus leucas*) • Humpback Whale (*Megaptera novaeangliae*) • Arctic Char (*Salvelinus alpinus*)

Terrestrial Mammals	Birds
• Wolverine (rare) (*Gulo gulo*), • Lynx (*Lynx lynx*) • Mice • Marmot (*Marmota monax)* • Muskox (*Ovibos moschatus)* • Arctic Hare (*Lepus arcticus*) • Lemming (*Dicrostonyx torquatus)* • Caribou (*Rangifer tarandus*) • Grey Wolf (*Canis lupus nubilus)* • Arctic Fox (*Alopex lagopus)* • Red Fox (*Vulpes vulpes*) • Polar Bear (*Ursus maritimus*)	• Canada Goose (*Branta canadensis*) • Ptarmigan (*Lagopus muta*) • Arctic Tern (*Sterna paradisaea*) • Common Eider *(Somateria mollissima)* • Glaucous Gull (*Larus hyperboreus)* • Herring Gull (*Larus argentatus)* • Snowy Owl (*Bubo scandiacus*)

During the 2009 site visit, FRANZ personnel did not observe any wildlife. According to the Species at Risk web mapping application and the Nunavut Department of Environment website, no species are listed as threatened within the Iqaluit region. Based on the Nunavut Wild Species 2000 report, the subject sites is within the range of three sensitive species: the **wolverine, grey wolf** and the **polar bear**. Wolverines, however, have not been observed in the vicinity of the site.

Sylvia Grinnell Territorial Park, the oldest of Nunavut's territorial parks borders the site to the north-western extent. Sylvia Grinnell Park is divided in two by the Sylvia Grinnell River. The park plays a vital role in the community of Iqaluit by providing an important fishing ground for Arctic Char.

Sylvia Grinnell Park is also home to Arctic Hare, Arctic Fox, Caribou, lemmings and other small mammals. Polar Bear have even been sighted on occasion, although they do not frequent the area. The park also plays a significant role in bird migration and over 40 species have been recorded in the park at different times of the year. The park is also the most southern breeding ground for the Ringed Plover. The local vegetation above and below the cliff consists of wet grassland tundra species including mosses, grasses and sedges. On the cliff and bedrock outcrops vegetation is sparse and consists of lichens with patches of grasses and mosses.

The Sylvia Grinnell River is the principal drainage system in the region which discharges into Frobisher Bay. The river is influenced by the tidal action of the ocean which has some of the largest tides in Canada. The river is a major migratory route for Arctic Char.

Surface water in the Sylvia Grinnell River and along its floodplains is considered brackish, whereas upland ponds are freshwater.

4.3.2 Measurement Receptors

Measurement receptors were selected to represent each ecological guild including primary producers, primary consumers (e.g., herbivorous invertebrates), secondary consumers (e.g. small mammals) and tertiary consumers (e.g. Arctic Fox). Risks to these receptors were calculated in the risk assessment; these organisms can be considered surrogates for other species within their respective guilds.

The assessment endpoints selected for evaluation in this ERA included:

- maintenance of a terrestrial plant community that provides food to higher trophic levels;
- maintenance of a soil invertebrate community that provides food to avian, and mammalian wildlife;
- maintenance of avian populations, and
- maintenance of mammalian populations.

Measurement receptors were selected in order to represent, where possible, both taxonomic and/or ecological guilds. The following are descriptions of the measurement receptors selected for this ERA, with rationale for each selection. Where multiple similar species (e.g. mice and voles) were known to be present on or near the site, one representative species (e.g. deer mouse) was included in the risk assessment, and was designated as a surrogate for other species in the same guild. Multiple ecological receptors were selected to capture exposure from drinking water and consumption of plants and lichens, soil, and small animals.

Although the ERA focussed uniquely on risk associated with soil contaminants, some receptors (e.g. mink) consume food items from both terrestrial and aquatic sources, and all terrestrial receptors were assumed to ingest surface water. In order to assess risk to measurement receptors from a given substance, contributions from both aquatic and terrestrial sources were included.

4.3.2.1 Terrestrial Receptors

Primary Producers – Terrestrial Plants and Lichens:

Plants are a primary feature of terrestrial habitats and provide an important food source for herbivores. Exposure to COPCs may result in a loss of net ecosystem productivity by directly impacting the ability of plant species to photosynthesize and produce biomass and/or reproduce. Disruption of ecosystem function may also occur indirectly through negative health impacts for organisms that consume plant tissues contaminated by COPCs.

Soil Invertebrates:

Soil-dwelling invertebrates can be at considerable risk of negative impacts from continuous exposure to COPCs in soil. These organisms play an important role in the degradation of organic materials and constitute a significant food source for animals at higher trophic levels. Negative impacts to soil invertebrates could impair nutrient cycling and adversely impact the health and population dynamics of animals that feed on them. Soil invertebrates expected to inhabit the site include primarily insects. Although earthworms are not prevalent in northern environments, they have been found in NWT soils (Reynolds, 2003; Reynolds & Moore, 1996), and they were chosen to represent soil invertebrates for the purposes of this assessment, as toxicological benchmarks and reference values are more easily obtained for annelids than for other soil-dwelling organisms.

Terrestrial Birds:

Many terrestrial (herbivorous and insectivorous) birds inhabit the environs of the Colomac Mine site. Avian measurement receptors selected for the risk assessment included insectivorous and herbivorous birds, as well as raptors, including the Peregrine falcon.

The American Robin (*Turdis migratorius*) was considered a suitable measurement receptor to represent common terrestrial birds. A member of the thrush group, it is a medium-sized bird that eats worms, insects and fruit. Thrushes live in a variety of habitats, including woodlands, swamps, suburbs and parks, and build nests of mud and vegetation on the ground or in trees or shrubs. They forage primarily on the ground in open areas, along habitat edges, or the edes of streams, as well as above ground in shrubs and within the lower branches of trees (US EPA 1993), and migrate south in winter months. Complete information was available regarding the characteristics of the American robin (US EPA 1993).

The red-tailed hawk was selected to represent raptors in the vicinity of the site that might consume small mammals.

Terrestrial Mammals:

Mammals may be exposed to COPCs by consuming contaminated vegetation or soil invertebrates exposed to contaminated soil, by inhaling or ingesting soil particulates, or by coming into direct dermal contact with contaminated soil when digging or burrowing.

Small mammals that may be expected to inhabit or feed at the site include mice, lemmings and snowshoe hare. From an ecological viewpoint, small mammals play important roles in insect control, seed dispersal and as prey for higher trophic level predators. Larger mammals, such as caribou, foxes and wolves may inhabit the study area, and have been observed or are expected to be transient or local inhabitants of the property.

The mammals selected as measurement receptors in the risk assessment are described below. Some of these organisms may not inhabit the area where the site is located, but have been chosen as surrogates for native species on the basis of their diet, body size and taxonomic group.

Small Herbivorous Mammals:

- The deer mouse (*Permyscus maniculatus*) is primarily granivorous and lives in a large variety of habitats including woodland, prairies, rocky habitats, tundra and desert. They eat principally seeds, arthropods, green vegetation, roots, fruits and fungi as available. The deer mouse was selected to represent a terrestrial herbivorous mammal because of its feeding habits. It is a suitable surrogate for other herbivorous rodents and toxicological data are readily available.
- The meadow vole (*Microtus pennsylvanicus*) is a small, grazing, herbivorous rodent, which was included as a receptor in the ecological risk assessment to represent the lemming. The meadow vole is considered a sensitive species and toxicological data are readily available; such data is not available for lemmings.
- The Arctic hare (*Lepus arcticus*) feeds on flowers and plants, and its main food is the Arctic willow (*Salix arctica*). It eats all parts of the plant, including twigs and roots. The flowers of purple saxifrage (*Saxifraga oppositifolia*) are a favourite food in late spring and early summer. Hares in winter usually feed in areas where snow is shallow or plants are exposed by wind. Predators include both mammals and birds, such as wolves, foxes, peregrine falcons and owls (Canadian Museum of Nature web page “Ukaliq: the Arctic Hare” - http://nature.ca/ukaliq/index_e.cfm, accessed

January 7, 2010). The Snowshoe Hare (*Lepus americanus*) was selected as a measurement receptor representing the Arctic Hare, as toxicological data are available for the Snowshoe Hare, but no such data was found for the Arctic Hare. Both are herbivorous.

Small Insectivorous Mammals:

- The short-tailed shrew (*Blarina brevicauda*) was chosen to represent a terrestrial insectivorous mammal because of its feeding habits. Shrews are small, insectivorous mammals that range throughout the north-central and northeastern United States and Canada. It eats insects, worms, snails, and other invertebrates. Shrews are an important component of the diet of many owls and are also prey for other raptors, fowl, weasels, and other carnivorous mammals. They are suitable surrogates for other insectivorous rodents and toxicological data are readily available.

Carnivorous Mammals:

- The grey wolf (*Canis lupis*) is a carnivorous pack hunter that primarily preys on large herbivores such as deer, moose, caribou, elk, bison and muskox. They also eat a variety of smaller mammals and birds. (Hinterland Who's Who Wolf Fact Sheet - http://www.hww.ca/hww2.asp?id=96, accessed January 7, 2010). They have been included in the risk assessment, as other species do not adequately represent their diet and feeding behaviour.

Large Herbivores:

- The barren-ground caribou (*Rangifer tarandus granti*) is a large herbivore inhabiting the environs of the site. The ability of caribou to use lichens as a primary winter food distinguishes them from all other large mammals and has enabled them to survive on harsh northern rangeland. In southern coniferous forests they are also able to forage on tree lichens. Although lichens are a good source of energy, they are not a good source of nitrogen/protein. In spring, caribou eat fresh green vegetation such as sedges, flowers and the leaves of willow and other shrubs, and mushrooms, all of which are rich in nitrogen. Caribou were included in the quantitative risk assessment, as they represent an important food source for people in this area, as well as for other top predators such as wolves.

4.3.2.2 Aquatic Receptors

The following aquatic receptors were identified and selected for evaluation in the quantitative assessment.

Aquatic Primary Producers – Macrophytes

Primary producers occupy the lowest level in the food chain. These organisms are photosynthetic organisms that use solar radiation and inorganic molecules to produce biomass that serves as a food source for higher trophic levels. Macrophytes, or vascular aquatic plants can take up contaminants from both the water column and sediment, and serve as food many primary and secondary consumers including fish and invertebrates, waterfowl, and aquatic and terrestrial mammals (e.g. muskrat, mallards and other ducks). Aquatic plants in most aquatic ecosystems constitute the largest part of primary producer biomass, and serve both as a food source and as habitat to aquatic organisms such as fish and invertebrates.

Benthic Invertebrates

Benthic invertebrates, i.e. organisms that inhabit sediments, play an essential role in degradation of organic material and cycling of nutrients in aquatic environments. They live and feed within the sediments, consuming decaying organic matter. They in turn are preyed upon by fish and waterfowl, and since many benthic invertebrates are the larvae of flying insects, they are also consumed by insectivorous animals such as birds, bats and small mammals.

Fish

Fish may be at risk from exposure to COPECs that migrate via surface runoff or groundwater transport into the Sylvia Grinnell River. Soil from the site may also be transported to the river via surface runoff. Fish are exposed to contaminants primarily through the gills, and also by ingestion of contaminated sediment and food items including benthic invertebrates and other fish.

Waterfowl

The Mallard duck (*Anas platyrhynchos*) been included in the risk assessment as it represents common species likely to be found near the site. It is a common benthivorous species of ‘dabbling’ duck, which feeds by dabbling with its bill on the surface of the water, and is ubiquitous tthroughout North America. Its primary habitat is marshes, wooded swamps and other wetlands, ponds, rivers and lakes. While its diet is fairly opportunistic, the mallard was chosen as a surrogate to represent a range of benthivorous birds because toxicity data were readily available (US EPA, 1993).

Semi-Aquatic Mammals

Semi-aquatic mammals may be exposed to COPECs via direct contact with contaminated surface water and sediment, and via consumption of other organisms (e.g., fish, insects and/or vegetation) that have taken up contaminants originating from the site.

The mink (*Mustela vison*) is an abundant and widely distributed carnivorous mammal in North America and lives in or near various types of aquatic habitats including lakes, rivers, streams and swamps. It is a primarily nocturnal hunter, preying on mammals, fish, crustaceans, birds, and insects. The mink was chosen as a representative semi-aquatic mammalian measurement receptor because it feeds on prey items that would inhabit the river and terrestrial environment at the site. As a carnivore that feeds on aquatic organisms, biomagnification of some contaminants would affect the mink. It is a suitable surrogate for other carnivorous mammals and semi-aquatic mammals, and toxicity data are readily available.

The muskrat (*Ondatra zibethicus*) is a fairly large rodent commonly found in the wetlands and waterways of North America. Of all plants available in marshes, cattails are most preferred as a food item. However, muskrats also eat bulrushes, horsetails, or pondweeds and a variety of other plants, including sedges, wild rice, and willows. When their normal food items are scarce or unavailable, and food of animal origin is abundant, muskrats may consume animals such as fish and invertebrates. However, muskrats rarely do well on this type of diet and consuming such foods is generally taken to be evidence of hard times. (Hinterland Who's Who Muskrat Fact Sheet – http://www.hww.ca/hww2.asp?id=96). The muskrat was chosen as a measurement receptor for the risk assessment as it represents herbivorous semi-aquatic mammals, and toxicity data were readily available (US EPA, 1993).

4.3.2.3 Receptor Characteristics

Parameters including body weight, dietary composition, soil, sediment, and water ingestion rates for the selected mammalian and avian receptors considered in the quantitative assessment were obtained from the US EPA (1993) Wildlife Exposure Factors Handbook, and from Sample and Suter (1994), and are summarized in Table 4.23, below.

Table 4.23 Receptor Characteristics

Receptor	Body Weight (kg)	Home Range (ha)	Time On Site (proportion)	Food or Medium	Total Ingestion Rate - Food or Medium (kg/d)	Proportion
Grey Wolf	43	23200	0.000312	Caribou	5.456	0.578
				Snowshoe Hare	5.456	0.277
				Water (Fresh)	2.9	1
				Soil	0.046	1
Mink	1	14	0.5	Fish	0.218	0.656
				Aquatic Vegetation	0.218	0.05
				Benthic Invert	0.218	0.09
				Mallard	0.218	0.05
				Snowshoe Hare	0.218	0.05
				Water (Brackish)	0.1	1
				Sediment (Brackish	0.0022	1
				Muscrat	0.218	0.1
Red-Tailed Hawk	1.13	700	0.010357	Deer_Mouse	0.0987	0.24
				Snowshoe Hare	0.0987	0.26
				Mallard	0.0987	0.16
				Robin	0.0987	0.1
				ST_Shrew	0.0987	0.24
				Water (Fresh)	0.0672	1
				Soil	1.8	1
Arctic Fox	2.5	250	0.029	Meadow Vole	0.45	90
				Water (Fresh)	0.38	1
				Soil	0.0126	1
				Browse	0.45	0.045
Deer_Mouse	0.022	0.059	1	Forage	0.0049	0.5
				Terrestrial Invertebr	0.0049	0.5
				Soil	0.000068	1
				Water (Fresh)	0.004	1
Meadow Vole	0.044	0.037	1	Terrestrial Invertebr	0.005	0.05
				Soil	0.00012	1
				Water (Fresh)	0.006	1
				Forage	0.005	0.95
Robin	0.077	0.42	0.5	Water (Fresh)	0.014	1
				Terrestrial Invertebr	0.093	0.32
				Berries	0.093	0.68
				Soil	0.00138	1
Mallard	1.08	400	0.02	Benthic Invertebrate	0.25	0.75
				Sediment (Brackish	0.0017	1
				Water (Brackish)	0.06	1
				Aquatic Vegetation	0.25	0.25
Caribou	105	25000	0.00029	Browse	7.64	0.002
				Water (Fresh)	9.5	1
				Forage	7.64	0.003
				Soil	0.24	1
				Lichen	7.64	0.984
ST_Shrew	0.015	0.39	1	Water (Fresh)	0.0033	1
				Soil	0.00117	1
				Terrestrial Invertebr	0.009	0.705
				Forage	0.009	0.295
Snowshoe Hare	1.4	8	0.90625	Browse	0.034	0.6
				Soil	0.007	1
				Water (Fresh)	0.13	1
				Forage	0.034	0.4
Muscrat	1.2	0.5	1	Water (Brackish)	0.12	1
				Sediment (Brackish	0.0024	1
				Aquatic Vegetation	0.358	0.99
				Benthic Invertebrate	0.358	0.01
Merganser	0.82	400	0.02	Water (Brackish)	0.08	1
				Fish	0.369	1
				Sediment (Brackish	0.0015	1

The fraction of time spent on site for each measurement receptor was estimated on the basis of the organism's typical home range area, the size of the contaminated portion of the site, and previously reported observations of wildlife behaviour at the site.

4.3.3 Ecological Conceptual Site Model

The Ecological Conceptual Site Model (ECSM) is a description of how ecological receptors may be exposed to contaminants present on the site. The ERA was conducted for species known or likely to be onsite, or in the immediate vicinity of the site. This model was prepared based on current use of the site and incorporates current knowledge of site characteristics and environmental conditions.

4.4 Exposure Assessment

4.4.1 Pathway Analysis

Pathway analysis identifies all possible exposure routes through which on-site and off-site ecological receptors may come into contact with COPECs detected at the site. Ecological receptors may be exposed to chemicals via multiple exposure pathways, such as ingestion, inhalation, dermal contact and ingestion of contaminated food items. The exposure pathways considered in the quantitative assessment are described below.

4.4.1.1 Direct Contact with Soil

Plants, soil microorganisms, soil invertebrates and various animals that burrow or dig for food may come into direct contact with COPECs present in the soil. COPECs can be accumulated by dermal absorption (plants and animals), soil particle inhalation (animals) or soil particle ingestion (animals). Of these pathways, soil particle ingestion (animals) and direct absorption (plants) were considered the most significant exposure pathways. Direct contact with soil COPECs is only relevant for surficial soil, as the majority of animal activity and plant fine root colonization is relevant to the upper 1.0 to 1.5 meters. The following paragraphs describe how ecological receptors may be exposed to COPECs detected in soil at the site.

Terrestrial Plants

All plants on the site were assumed to be exposed to impacted soil, as their roots have the potential to take up materials from the soil. This was considered the most relevant and significant exposure pathway to COPECs in soil by plants. Exposure to COPECs by off-site plants was not considered because entrainment and migration of dust from the site to off-site locations is an intermittent process and would not contribute significantly to contaminant concentrations off-site.

Soil Invertebrates

Soil invertebrates may be exposed to contaminants in soil through ingestion of contaminated soil or via direct dermal contact. Dermal contact was considered relevant only for surficial soil as the vast majority of soil invertebrates reside in upper 1.0 to 1.5 metres of soil.

Terrestrial Birds and Mammals:

Birds and mammals may be exposed to COPECs in soil via ingestion, inhalation and dermal contact. Exposure via inhalation of vapours or particles was assumed to be minor for birds and mammals relative to other exposure pathways such as soil ingestion.

While dermal exposure is possible, it was also assumed to be a minor exposure pathway because it has been reported that feathers or fur effectively reduce dermal exposure by limiting the contact of skin with chemicals (Sample et al. 1997). By far the most significant exposure pathway identified was ingestion (direct or inadvertent) of contaminated soil. This is consistent with Environment Canada (1994) and US EPA (2005) guidance, which acknowledges that soil ingestion is the major exposure pathway to soil for avian and mammalian receptors.

4.4.1.2 Direct Contact with Groundwater

Direct contact with groundwater was not considered an important exposure pathway for the quantitative ecological risk assessment because the majority of plant root colonization typically occurs in the upper meter of soil, i.e. well above the water table (approximately 2 m), and the animal species identified as VECs generally do not exploit soil depths to this level.

Aquatic plants, benthic invertebrates and fish could be exposed to COPECs in areas of groundwater upwelling, but contaminant impacts on these receptors were evaluated on the basis of concentrations in sediments and surface water.

For these reasons, direct contact with groundwater by ecological receptors was deemed an incomplete exposure pathway and was not considered further in the quantitative ERA.

4.4.1.3 Direct Contact with Surface Water and Sediment

Direct contact with surface water was determined to potentially pose a risk for ecological receptors, particularly for aquatic organisms (fish, benthic invertebrates, aquatic plants, waterfowl and semi-aquatic mammals), but also for terrestrial species that may ingest water directly by drinking or inadvertently when foraging for food (i.e. small- and medium-sized terrestrial mammals, and small and predatory birds).

Burrowing invertebrates (e.g. oligochaetes), filter-feeders and fish that feed upon these organisms would potentially be exposed to unacceptable risk from COPECs in sediment directly through dermal absorption and ingestion. The relative contribution of these two pathways is

dependent upon the life history of the various species. Animals that eat fish (e.g., mink) or benthic invertebrates and aquatic plants (e.g., mallard ducks) may inadvertently ingest sediment along with food items. Incidental ingestion of sediment was deemed a potentially significant pathway, in particular for the mallard, as it spends much of its foraging time in shallow waters grubbing in the sediment.

It was assumed that any aquatic or semi-aquatic receptors would primarily be exposed to sediments and water from the "brackish" areas, i.e. the Sylvie Grinnell River (which is a tidal river), and the low-lying land and ponds that border it. Terrestrial receptors were assumed to consume freshwater from ponded water on the site, as a conservative measure.

Aquatic Plants:
Aquatic plants are primarily exposed to COPECs in surface water and sediment via diffusion of chemicals through the cell membrane. Estimated exposures to aquatic plants were predicted through the use of media-to-receptor bioconcentration factors, and comparison of COPEC concentrations in surface water and sediment to the applicable benchmark concentrations, as previously described.

Benthic Invertebrates:
The feeding and burrowing habits of benthic invertebrates exposes these organisms directly or indirectly to COPECs present in sediments. To assess exposure and risk to benthic invertebrates, measured concentrations in surface water and sediment were compared with the appropriate benchmark concentrations.

Fish:
Fish may be at risk from diffusion of COPECs across the gill membrane or by the consumption of contaminated food or prey items. Dermal exposure is also an important exposure pathway for COPECs that may be absorbed through the skin from water or sediment. To assess exposure and risk to fish, measured concentrations in surface water were compared with appropriate benchmark concentrations.

Waterfowl and Semi-Aquatic Mammals:
Waterfowl and semi-aquatic mammals are exposed to COPECs via ingestion, inhalation and dermal contact. Chemicals may be ingested by consumption of food and water, and by incidental ingestion of soil. Inhalation and dermal contact were considered negligible exposure pathways relative to the direct ingestion of surface water and sediment. Exposure via ingestion was considered the most significant exposure pathway for waterfowl, muskrat and mink, which is consistent with guidance provided by Environment Canada (1994) and the US EPA (2005).

4.4.1.4 Ingestion of Contaminated Food Items

Ingestion of food items (including terrestrial and aquatic plants and animals) potentially contaminated with COPECs by any of the previously described routes also represents a potential exposure pathway for herbivores and predators. This is especially true for COPECs that bioaccumulate or biomagnify within the food chain (e.g. mercury, PFOS) and for higher trophic level consumers (e.g. mink and red-tailed hawk).

4.4.1.5 Pathway Summary

Based on the information presented in this exposure route analysis, pathways to be assessed for risk posed to VECs are depicted in the ECSM (Figure A-2.2) and included the following:

- dermal contact with surficial soil (plants, soil invertebrates),
- dermal contact with surface water and sediments (aquatic plants, benthic invertebrates, and fish), and
- ingestion of terrestrial plants, surficial soil, sediment, surface water and animal tissue (birds, mammals, as appropriate to each receptor).

4.4.2 Estimated exposure of each measurement receptor to each COEC

The approaches used to estimate and quantify exposure to COPECs for each evaluated exposure pathway and the results of the quantitative exposure assessment are described below.

4.4.2.1 Exposure Equations

The exposure estimations for wildlife are based on the generic equations provided in the CCME guidance document (CCME, 1996). The exposure equations used to estimate uptake of COPECs from soil, surface water, sediment and contaminated food items are described below. Sample calculations are presented in Appendix A.

Exposure via Ingestion:

$$E_{ingestion} = E_{food} + E_{water} + E_{soil}$$

Where:

$E_{ingestion}$	=	total ingestion exposure (mg/kg/day)
E_{food}	=	exposure from food consumption (mg/kg/day)
E_{water}	=	exposure from water (mg/kg/day)
E_{soil}	=	exposure from soil/sediment (mg/kg/day)

Food Ingestion:

$$E_{food} = (C_{food} * IR_{food})$$

Where:

E_{food} = exposure from food consumption ($mg/kg_{BW}/day$)
C_{food} = COPEC concentration in food (mg/kg_{food})
IR_{food} = food ingestion rate (kg_{food}/kg_{BW}-day)

Water Ingestion:

$$E_{water} = (C_{water} * IR_{water})$$

Where:

E_{water} = exposure from water ($mg/kg_{BW}/day$)
C_{water} = COPEC concentration in water (mg/L)
IR_{water} = water ingestion rate (L/kg_{BW}-day)

Ingestion of Soil/Sediment:

$$E_{soil/sediment} = (C_{soil/sediment} * IR_{soil/sediment})$$

Where:

$E_{soil/sediment}$ = exposure from soil ($mg/kg_{BW}/day$)
$C_{soil/sediment}$ = COPEC concentration in soil or sediment ($mg/kg_{soil, sed}$)
$IR_{soil/sediment}$ = ingestion rate of soil or sediment ($kg_{soil, sed}/kg_{BW}$-day)

Total daily doses of each COPEC to each measurement receptor were calculated as the sum of each COPEC to which a receptor was exposed through food, water and soil or sediment consumption.

Tissue Concentration Estimation

In order to estimate exposure via ingestion of contaminated food items, it was first necessary to estimate tissue concentrations of COPECs in terrestrial plants, soil invertebrates, aquatic vascular plants, benthic invertebrates and fish. These were estimated as follows.

- ***Plant tissue cconcentrations:*** Plant tissue concentrations were estimated by multiplying the 95% UCLM of the measured concentration of a COPEC in soil or sediment with chemical-specific bioconcentration factors (BCFs) obtained from literature. For terrestrial plants, a soil-to-plant BCF value was used, and for aquatic plants sediment-to-plant BCFs were used for vascular aquatic plants. BCFs were obtained from the US EPA (2005), Travis and Arms (1988), Beyer and Stafford (1993), Bechtel Jacobs (1988), Baes et al. (1984) and Sample et al. (1998).

$$C_{plants} = C_{soil/sediment/water} * BCF$$

For inorganic chemicals without literature-based BCFs, a BCF of 1.0 was assumed. For organic chemicals without literature-based BCFs, medium-to-plant BCFs were estimated using the algorithm provided in Travis and Arms (1988):

$$\log BCF = 1.588 - (0.578)(\log Kow)$$

Where:
log BCF = soil-to-plant, water-to-plant, or sediment-to-plant BCF (unitless)
K_{ow} = octanol-water partitioning coefficient (unitless)

- ***Tissue concentrations in invertebrates*** were estimated by multiplying the maximum concentration of each COPEC by chemical-specific biota-soil and -sediment accumulation factors (BSAFs), obtained from the literature, using the following equation:

$$C_{\text{invertebrate tissue}} = C_{\text{sediment/soil}} * BSAF$$

Where:
$C_{\text{invertebrate tissue}}$ = invertebrate tissue concentration (mg/kg)
$C_{\text{sediment/soil}}$ = COPEC concentration in soil/sediment (mg/kg)
BSAF = bioaccumulation factor

Since these bioaccumulation factors consider take into account exposure to soil and sediment as well as exposure via diet, these values were deemed appropriate for estimating invertebrate tissue concentrations.

- ***Tissue concentrations in fish*** were estimated by multiplying the maximum measured concentration of each COPEC in surface water with the chemical-specific water-fish BCF in accordance with the methodology described by Sample et al. (1996). The following equation was used:

$$C_{\text{fish tissue}} = C_{\text{surface water}} * BCF$$

Where:
$C_{\text{fish tissue}}$ = fish tissue concentration (mg/kg)
$C_{\text{surface water}}$ = COPEC concentration in surface water (mg/L)
BCF = bioconcentration factor

Bioconcentration Factors and Transfer Factors

Bioconcentration factors and transfer factors are listed in Tables 4.24 to Table 4.26 below.

Table 4.24 Bioconcentration Factors – Surface Water

Chemical	From (Medium)	To (Food Item)	BCF or BAF
Chromium 6+	Surface Water (Fresh)	Aquatic Vegetation	4.41E+03
Copper	Surface Water (Fresh)	Aquatic Vegetation	1.00E+03
Zinc	Surface Water (Fresh)	Aquatic Vegetation	5.50E+02
Cadmium	Surface Water (Brackish)	Benthic Invertebrates	2.72E+02
		Aquatic Vegetation	7.60E+02
Copper	Surface Water (Brackish)	Benthic Invertebrates	1.00E+03
		Aquatic Vegetation	1.00E+03
Mercury	Surface Water (Brackish)	Benthic Invertebrates	5.25E+02
		Aquatic Vegetation	5.30E+02
Vanadium	Surface Water (Brackish)	Benthic Invertebrates	1.00E+02
		Aquatic Vegetation	1.00E+00

Table 4.25 Bioconcentration Factors – Sediment

Chemical	From (Medium)	To (Food Item)	BCF or BAF
Barium	Sediment (Brackish)	Benthic Invertebrates	9.70E-03
		Aquatic Vegetation	6.33E+02
Chromium 6+	Sediment (Brackish)	Benthic Invertebrates	3.90E-01
		Aquatic Vegetation	7.50E-03
Iron	Sediment (Brackish)	Aquatic Vegetation	4.00E-01
		Benthic Invertebrates	9.00E-01
Lead	Sediment (Brackish)	Benthic Invertebrates	2.20E-01
		Aquatic Vegetation	9.00E-02
Vanadium	Sediment (Brackish)	Benthic Invertebrates	2.20E-01
		Aquatic Vegetation	6.33E+02
F3 - C>16-21 aliphatic	Sediment (Brackish)	Aquatic Vegetation	3.17E-04
		Benthic Invertebrates	4.49E-01
F3 - C>16-21 aromatic	Sediment (Brackish)	Aquatic Vegetation	1.45E-01
		Benthic Invertebrates	1.78E+00
F3 - C>21-34 aliphatic	Sediment (Brackish)	Aquatic Vegetation	5.55E-08
		Benthic Invertebrates	1.28E+01
F3 - C>21-34 aromatic	Sediment (Brackish)	Aquatic Vegetation	4.37E-02
		Benthic Invertebrates	1.36E+00
F4 - C>34 aliphatic	Sediment (Brackish)	Benthic Invertebrates	7.36E+02
		Aquatic Vegetation	1.00E+00
F4 - C>34 aromatic	Sediment (Brackish)	Aquatic Vegetation	1.00E+00
		Benthic Invertebrates	1.44E+01
PCBs	Sediment (Brackish)	Aquatic Vegetation	1.00E-02
		Benthic Invertebrates	5.30E-01

Table 4.26 Bioconcentration Factors – Soil

Chemical	From (Medium)	To (Food Item)	BCF or BAF
Aluminum	Soil	Berries	4.00E-03
		Browse	4.00E-03
		Forage	4.00E-03
		Terrestrial Invertebrates	2.20E-01
		Lichen	1.97E-05
Cadmium	Soil	Berries	3.80E-02
		Forage	3.64E-01
		Browse	3.64E-01
		Terrestrial Invertebrates	9.60E-01
		Lichen	1.97E-05
Iron	Soil	Berries	1.00E-03
		Lichen	1.97E-05
		Terrestrial Invertebrates	2.20E-01
		Forage	4.00E-01
		Browse	4.00E-01
Zinc	Soil	Terrestrial Invertebrates	5.60E-01
		Berries	9.90E-01
		Forage	1.20E-12
		Browse	1.20E-12
		Lichen	1.97E-05
F2 - C>10-12 aliphatic	Soil	Terrestrial Invertebrates	1.24E+00
		Forage	2.93E-02
		Browse	2.93E-02
		Terrestrial Invertebrates	1.24E+00
		Lichen	1.97E-05
F2 - C>10-12 aromatic	Soil	Terrestrial Invertebrates	2.26E+00
		Lichen	1.97E-05
		Browse	4.20E-01
		Forage	4.20E-01
F2 - C>12-16 aliphatic	Soil	Terrestrial Invertebrates	8.41E-01
		Lichen	1.97E-05
		Forage	5.19E-03
		Browse	5.19E-03
F2 - C>12-16 aromatic	Soil	Terrestrial Invertebrates	2.06E+00
		Lichen	1.97E-05
		Forage	2.81E-01
		Browse	2.81E-01
F3 - C>16-21 aliphatic	Soil	Lichen	1.97E-05
		Browse	3.17E-04
		Terrestrial Invertebrates	4.49E-01
		Forage	3.17E-04
F3 - C>16-21 aromatic	Soil	Forage	1.45E-01
		Lichen	1.97E-05
		Browse	1.45E-01
		Terrestrial Invertebrates	1.78E+00
F3 - C>21-34 aliphatic	Soil	Terrestrial Invertebrates	1.28E+01
		Browse	5.55E-08
		Forage	5.55E-08
		Lichen	1.97E-05
F3 - C>21-34 aromatic	Soil	Terrestrial Invertebrates	1.36E+00
		Forage	4.37E-02
		Lichen	1.97E-05
		Browse	4.37E-02

Table 4.26 Bioconcentration Factors – Soil (continued)

Chemical	From (Medium)	To (Food Item)	BCF or BAF
F4 - C>34 aliphatic	Soil	Browse	1.30E-12
		Terrestrial Invertebrates	7.36E+02
		Forage	1.30E-12
		Lichen	1.97E-05
		Browse	1.57E-03
F4 - C>34 aromatic	Soil	Lichen	1.97E-05
		Terrestrial Invertebrates	1.44E+01
		Forage	1.57E-03
1,1,1,2-tetrachloroethane	Soil	Forage	7.84E-01
		Lichen	1.97E-05
		Browse	7.84E-01
		Terrestrial Invertebrates	2.29E+01
Bromoform	Soil	Browse	1.59E+00
		Forage	1.59E+00
		Lichen	1.97E-05
		Terrestrial Invertebrates	2.18E+01

Estimated Tissue Concentrations

The estimated tissue concentrations for the various ecological receptors considered in this assessment are presented in Appendix D.

4.5 Toxicity Assessment

4.5.1 Hazard Assessment

The purpose of the hazard assessment is to determine the concentration (or dose) of contaminant that is associated with an adverse effect. As previously discussed, these concentrations or doses are referred to as TRVs and, by definition, represent the exposure dose (or concentration) that is considered to pose negligible risk of adverse effect for short- and long-term exposure. For ecological risk assessment, it is important to emphasize that the goal is not to protect each individual organism, but rather to protect enough individuals so that a viable population and community of organisms can be maintained. The TRVs adopted for this assessment are summarized in the following sections.

4.5.1.1 Determination of Appropriate TRVs and Benchmarks

Toxicological reference values represent the concentrations of COPECs that are considered to be protective of sensitive ecological receptors, assuming continuous exposure for an entire lifetime.

Exposure limits were adopted from various information sources. In general, the Lowest Observable Adverse Effect Levels (LOAELs) were used. These values represent the lowest dose of chemical associated with a given adverse effect. Where a LOAEL was not available, the no-observed-adverse-effect level (NOAEL) concentration, multiplied by 10, was used. In ERA, the LOAEL is used because some level of effect is considered to be acceptable, unlike in human health risk assessment, where the goal is to protect individuals, as opposed to protecting populations.

If a suitable TRV for a specific mammalian or avian measurement receptor was not available, surrogate data was used from another receptor from the same class of animal, but without allometric scaling for body mass. Recent developments in ecological risk assessment indicate that allometric body-mass scaling should not be used when assessing chronic toxicity between species (Azimuth, 2007).

Tables 4.27 to Table 4.31, below present TRVs used for all measurement receptors evaluated in the quantitative risk assessment, as well as available information regarding toxicological endpoints (mortality, reproduction, growth, etc.) and indicators (e.g., EC_{20}, LOEL) of toxicity.

Table 4.27 Toxicity Reference Values – Terrestrial Plants and Soil Invertebrates

Chemical	PHC Fraction	Receptor Type	TRV value (mg/kg)	TRV Notes
Aluminum	NA	Plant	50	Efroymson et al. 1997 (plants); primary source = Mackay et al., 1990; same study referenced in US EPA SLERA 1999
Cadmium	NA	NA	12	OMOE 2008 - plants and soil invertebrates; agricultural/residential/parkland
Zinc	NA	NA	400	OMOE 2008 - plants and soil invertebrates; agricultural/residential/parkland
PHC F1 total	F1	Plant	2520	CCME 2008
PHC F1 total	F1	Invertebrate	2890	CCME 2008
PHC F2 total	F2	Plant	1370	CCME 2008
PHC F2 total	F2	Invertebrate	1470	CCME 2008
PHC F3 total	F3	Plant	2100	CCME 2008
PHC F3 total	F3	Invertebrate	2000	CCME 2008
PHC F4 total	F4	Invertebrate	2800	CCME 2008

Table 4.28 Toxicity Reference Values – Sediment

Chemical	PHC Fraction	Receptor Type	TRV value (mg/kg)	TRV Notes
Barium	NA	NA	20	US EPA SLERA 1999 Appendix E marine/estuarine sed tox reference values
Chromium 6+	NA	NA	8.1	ERL value for total Cr from Long et al. 1995, as cited in US EPA SLERA 1999.
Iron	NA	NA	20000	Lowest value listed for protection of marine & estuarine aquatic life, EC Compendium (1999).
Lead	NA	NA	21	US EPA SLERA Appendix E marine/estuarine sed tox reference values
PCBs	NA	NA	0.0227	ERL value for Total PCB from Long et al. (1995), as cited in US EPA SLERA 1999.

Table 4.29 Toxicity Reference Values – Surface Water

Medium	Chemical	PHC Fraction	TRV value (mg/L)	TRVNotes
Surface Water (Brackish)	Cadmium	NA	0.0093	US EPA SLERA 1999 (marine/estuarine water)
	Copper	NA	0.0031	US EPA SLERA 1999 (marine/estuarine water)
	Magnesium	NA	82	Nothing in EC Compendium (1999); Nothing in US EPA SLERA 1999; TRV value = freshwater benchmark listed in Suter & Tsao (1996)
	Mercury	NA	0.00094	US EPA SLERA 1999 (marine/estuarine water)
	Sodium	NA	680	No marine/estuarine value available. TRV = freshwater benchmark listed in Suter & Tsao (1996).
	PCBs	NA	0.000014	OMOE 2008 spreadsheet aquatic receptor protection value; US EPA SLERA uses 0.00003 for Aroclors 1016 and 1254
	cis-1,2-Dichloroethene	NA	11.6	OMOE 2008 aquatic receptor protection value; no value in US EPA SLERA 1999
	Anthracene	NA	0.0001	OMOE 2008 aquatic receptor protection value; no value in US EPA SLERA 2000
	Benz[a]anthracene	NA	0.00018	OMOE 2008 aquatic receptor protection value; US EPA SLERA 1999 uses 0.0005 (B[a]P = surrogate)
	Pyrene	NA	0.0004	OMOE 2008 aquatic receptor protection value; no value in US EPA SLERA 1999
	DDT total	NA	0.000001	OMOE 2008 aquatic receptor protection value; no value in US EPA SLERA 2000
	Endrin	NA	0.000036	OMOE 2008 aquatic receptor protection value; no value in US EPA SLERA 2001
	Lindane (gamma HCH)	NA	0.00008	OMOE 2008 aquatic receptor protection value; no value in US EPA SLERA 2002
Surface Water (Fresh)	Aluminum	NA	0.087	OMOE 2008 aquatic receptor protection value; no value in US EPA SLERA 2003
	Chromium 6+	NA	0.011	OMOE 2008 aquatic receptor protection value; no value in US EPA SLERA 2004
	Cadmium	NA	0.0022	US EPA SLERA 1999 freshwater TRV (hardness = 100 mg/L)
	Copper	NA	0.009	OMOE 2008 aquatic receptor protection value; same value in US EPA SLERA
	Zinc	NA	0.12	OMOE 2008 aquatic receptor protection value; same value in US EPA SLERA (.118)
	PHC F2 total	F2	0.0152	weighted average based on CWS 2008 toxicity aquatic life benchmarks for CCME subfractions (subfractions are in table 3.7)

Table 4.30 Toxicity Reference Values – Mammals

Chemical_Class	Chemical	TRV value (mg/kg-d)	Test Species	Endpoint	TRV Notes
Metals/Inorganics	Manganese	284	Rat	LOAEL	ERD 1999
	Lead	80	Rat	LOAEL	ERD 1999
	Copper	15.4	Mink	LOAEL	ERD 1999
	Mercury	10	Mink	LOAEL	ERD 1999
	Cadmium	10	rat	LOAEL	ERD 1999 Terrestrial TRVs
	Aluminum	19.3	Mouse	LOAEL	ERD 1999
	Barium	19.8	rat	LOAEL	ERD 1999
	Zinc	320	rat	LOAEL	ERD 1999
	Chromium 6+	27400	rat	LOAEL	ERD 1999; assumed same as Cr total
PAHs	Pyrene	750	Mouse	LOAEL	ERD 1999
	Anthracene	1000	Mouse	LOAEL	ERD 1999
PCBs	PCBs	0.1	Rhesus monkey	LOAEL	ERD 1999; no value for total DDT; this value is for Aroclor 1248 (lowest of four aroclors listed)
pest/herb	Lindane (gamma HCH)	80	Rat	LOAEL	ERD 1999
	DDT total	4	Rat	LOAEL	ERD 1999
	Endrin	0.92	Mouse	LOAEL	ERD 1999
	Toxaphene	80	Rat	LOAEL	ERD 1999
PHCs	PHC F1 total	2170	mouse		Toxicity value not available. N-hexane used as surrogate.
	PHC F2 total	460	rat		Toxicity value not available. Naphthalene used as surrogate for aromatic fraction (PER ccme csqg Carcinogenic and Other PAHs, CCME 2008). TRV for aliphatic fraction = from TPHCWG series Vol. 4, 1997.
	PHC F3 total	1625	rat		Toxicity value not available. Pyrene used as surrogate for aromatic fraction (CCME 2008). The TRV for aliphatic was obtained from the TPHCWG series Volume 4, 1997.
	PHC F4 total	20000	rat		NOAEL x 10, from TPHCWG series Volume 4, 1997.
VOCs	Bromoform	50	Rat	LOAEL	ERD 1999
	Trichloroethene	7	Mouse	LOAEL	ERD 1999
	cis-1,2-Dichloroethene	452	mouse, rat	LOAEL	ERD 1999; value is for 1,2-dichloroethene (or 1,2-dichloroethylene) - two different studies, different test species, same value

Table 4.31 Toxicity Reference Values – Birds

Chemical_Class	Chemical	TRV value (mg/kg-d)	Test Species	Endpoint	TRV Notes
Metals/Inorganics	Mercury	0.9	Japanese quail	LOAEL	ERD 1999
	Chromium 6+	5	black duck	LOAEL	ERD1999; assumed same as Cr total
	Zinc	130.9	white leg-horn hens	LOAEL	ERD 1999
	Copper	61.7	chick	LOAEL	ERD 1999
	Cadmium	20	mallard	LOAEL	ERD 1999
	Aluminum	1100	Ringed dove	LOAEL	ERD 1999
	Barium	41.7	chick	LOAEL	ERD 1999
	Manganese	9770	Japanese quail	LOAEL	ERD 1999
	Lead	11.3	Japanese quail	LOAEL	ERD 1999
	Vanadium	114	mallard	LOAEL	ERD 1999
PCBs	PCBs	1.8	Ring-necked pheasant	LOAEL	ERD 1999; this is for Aroclor 1254; no value for total PCBs; Aroclor 1242 = 4.1 (higher)
pest/herb	DDT total	280	Brown pelican	LOAEL	ERD 1999
	Endrin	0.1	Screech owl	LOAEL	ERD 1999
	Toxaphene	10	Black duck	LOAEL	ERD 1999
	Lindane (gamma HCH)	20	mallard	LOAEL	ERD 1999

4.6 Risk Characterization

4.6.1 Hazard Quotients and Determination of Acceptability of Risks

4.6.1.1 Ecological Risks for Aquatic Receptors Associated with COECs in Sediment

The risk quotient (RQ) method was used to calculate risk to aquatic receptors exposed to COPECs in sediment. The RQ for each contaminant of potential concern was calculated by dividing the Estimated Exposure (EE) by the Toxicity Reference Value (TRV expressed in terms of sediment concentrations for aquatic plants and invertebrates). An RQ of less than 1 indicates that adverse effects are not likely.

RQ = EE/TRVs

The 95% UCLM of the concentration of each evaluated COPEC in sediment (or maximum concentration, as appropriate) was used as the exposure estimate. The RQs for aquatic receptors exposed to COPECs in sediment are presented in Table 4.32, below, and calculations are shown in Appendix D.

Table 4.32 Risk Quotients – Sediment-Associated Biota

Chemical Class	Chemical	PHC fraction	Receptor Type	Risk Quotient (Unitless)
Metals/Inorganics	Barium	NA	NA	1.01E+00
	Chromium 6+	NA	NA	9.88E-02
	Iron	NA	NA	1.49E+00
	Lead	NA	NA	1.23E+00
PCBs	PCBs	NA	NA	3.96E+00

The quantitative risk assessment identified potentially unacceptable risk levels to sediment-associated plants and invertebrates resulting from the presence of **barium, iron, lead and PCBs** in brackish sediments.

4.6.1.2 Ecological Risks to Aquatic Receptors Associated with COPECs in water

Risk to aquatic receptors exposed to COPECs in water was calculated for each COPEC by dividing the estimated exposure (EE) by the TRV, expressed in terms of surface water concentrations. An RQ of less than 1 was interpreted to indicate that adverse effects to aquatic receptors were unlikely.

RQ = EE/TRVs

The RQs for aquatic receptors exposed to COPECs in surface water are presented in Table 4.33 below, and in model printouts included in Appendix D.

Table 4.33 Risk Quotients – Aquatic Biota in Surface Water

Medium Name	Chemical Class	Chemical	PHC fraction	Receptor Type	Risk Quotient (Unitless)
Surface Water (Brackish)	Metals/Inorganics	Cadmium	NA	NA	1.08E-01
		Copper	NA	NA	1.84E+00
		Iron	NA	NA	6.48E-01
		Magnesium	NA	NA	3.02E+00
		Mercury	NA	NA	1.06E-01
		Sodium	NA	NA	3.06E+00
	PAHs	Anthracene	NA	NA	5.00E-01
		Pyrene	NA	NA	1.25E-01
	PCBs	PCBs	NA	NA	7.14E+01
	pest/herb	DDT total	NA	NA	5.00E+00
		Endrin	NA	NA	5.56E+00
		Lindane (gamma HCH)	NA	NA	6.25E-01
	VOCs	cis-1,2-Dichloroethene	NA	NA	3.45E-04
Surface Water (Fresh)	Metals/Inorganics	Aluminum	NA	NA	1.37E+00
		Cadmium	NA	NA	5.86E-02
		Chromium 6+	NA	NA	3.36E-01
		Copper	NA	NA	4.44E-01
		Iron	NA	NA	3.50E+00
		Zinc	NA	NA	2.17E-01
	PHCs		F2	NA	1.97E+01

The results of the quantitative assessment indicated potentially unacceptable levels of risk to aquatic biota in brackish surface water from exposure to **copper, magnesium, sodium, PCBs, DDT (and its metabolites), and endrin**. Potentially unacceptable risk levels for aquatic biota were also calculated for **aluminum, iron and the F2 fraction of PHCs** due to their respective concentrations in fresh surface water. However, since the majority of surface water on the site is brackish due to periodic inundation of the river floodplain, it is unlikely that contaminants in fresh surface water would result in deleterious effects on aquatic biota at the population level.

4.6.1.3 Ecological Risks for Terrestrial Plants and Invertebrates

The risk quotient (RQ) method was used to calculate the risk to terrestrial plants and invertebrates. The RQ for each combination of contaminant and receptor of concern (plants or invertebrates) was calculated by dividing the estimated exposure (EE) by the TRV, expressed in terms of soil concentration. An RQ of less than 1 was interpreted to mean that adverse effects were unlikely.

$$RQ = EE/TRVs$$

The calculated RQs for terrestrial plants and invertebrates are summarized in Table 4.34 below, and calculations are presented in Appendix D.

Table 4.34 Risk Quotients – Terrestrial Plants and Invertebrates

Chemical Class	Chemical	PHC fraction	Receptor Type	Risk Quotient (Unitless)
Metals/Inorganics	Aluminum	NA	Plant	9.35E+01
	Cadmium	NA	NA	2.31E-01
	Zinc	NA	NA	3.06E-01
PHCs		F2	Plant	1.05E-01
		F2	Invertebrate	9.76E-02
		F3	Plant	7.36E+00
		F3	Invertebrate	7.73E+00
		F4	Invertebrate	6.00E-01

Potentially unacceptable levels of risk to terrestrial plants and/or soil invertebrates were calculated for aluminum and the F3 fraction of PHCs.

4.6.1.4 Ecological Risks to Mammals and Birds

Potential risks to mammals and birds were determined using a Hazard Quotient (HQ) approach. As summarized below, HQs were calculated by comparing the estimated exposure with the appropriate TRV, as follows:

$$HQ = \frac{EE}{TRV}$$

Where:

HQ = hazard quotient (unitless)
EE = dose (mg/kg$_{bw}$-day)
TRV = toxicity reference exposure limit (mg/kg$_{bw}$-day)

An HQ of less than 1 was interpreted to mean that adverse effects were not expected. In the interpretation of results, it is important to reiterate that the assessment endpoint chosen for the ecological risk assessment was a sustainable level of ecological health. As such, HQ values greater than 1 indicate that adverse effects to individual receptors are possible, but not necessarily probable; it does not necessarily indicate that adverse effects to receptors will translate into risk at the population level.

The calculated HQs for mammals and birds are summarized in Table 4.35 and Table 4.36 below, and presented in Appendix D.

Table 4.35 Hazard Quotients – Birds

Chemical Class	Chemical	Receptor	Hazard Quotient (unitless)
Metals/Inorganics	Aluminum	Red-Tailed Hawk	7.02E-02
	Aluminum	Robin	2.26E-01
	Barium	Mallard	3.55E-01
	Barium	Merganser	2.24E-05
	Barium	Red-Tailed Hawk	5.55E-05
	Cadmium	Mallard	5.56E-08
	Cadmium	Merganser	4.08E-04
	Cadmium	Red-Tailed Hawk	2.29E-03
	Cadmium	Robin	2.92E-02
	Chromium 6+	Mallard	2.23E-04
	Chromium 6+	Merganser	6.05E-06
	Chromium 6+	Red-Tailed Hawk	5.13E-07
	Chromium 6+	Robin	6.73E-05
	Copper	Mallard	1.03E-07
	Copper	Merganser	5.91E-04
	Copper	Red-Tailed Hawk	4.19E-08
	Copper	Robin	5.89E-06
	Lead	Mallard	2.06E-03
	Lead	Merganser	8.38E-05
	Lead	Red-Tailed Hawk	3.21E-07
	Manganese	Mallard	1.18E-08
	Manganese	Merganser	2.08E-08
	Manganese	Red-Tailed Hawk	1.85E-12
	Mercury	Mallard	1.23E-07
	Mercury	Merganser	3.53E-03
	Mercury	Red-Tailed Hawk	1.93E-11
	Vanadium	Mallard	3.03E-01
	Vanadium	Merganser	1.15E-04
	Vanadium	Red-Tailed Hawk	4.74E-05
	Zinc	Red-Tailed Hawk	1.54E-02
	Zinc	Robin	4.90E-01
PCBs	PCBs	Mallard	9.48E-05
	PCBs	Merganser	8.20E-02
	PCBs	Red-Tailed Hawk	1.48E-08
pest/herb	DDT total	Mallard	1.98E-11
	DDT total	Merganser	1.26E-06
	DDT total	Red-Tailed Hawk	3.10E-15
	Endrin	Mallard	2.22E-06
	Endrin	Merganser	1.30E-01
	Endrin	Red-Tailed Hawk	3.47E-10
	Lindane (gamma HCH)	Mallard	2.78E-09
	Lindane (gamma HCH)	Merganser	2.12E-05
	Lindane (gamma HCH)	Red-Tailed Hawk	4.34E-13
	Toxaphene	Mallard	2.22E-08
	Toxaphene	Merganser	9.18E-04
	Toxaphene	Red-Tailed Hawk	6.46E-08
	Toxaphene	Robin	9.09E-06

Results of the quantitative risk assessment indicated that all hazard quotients for terrestrial and semi-aquatic birds were representative of essentially negligible risk levels.

Table 4.36a Hazard Quotients – Metals / Mammals

Chemical	Receptor	Hazard Quotient (unitless)
Aluminum	Arctic Fox	5.76E-02
Aluminum	Caribou	1.61E-04
Aluminum	Deer_Mouse	6.80E+00
Aluminum	Grey Wolf	9.86E-05
Aluminum	Meadow Vole	1.07E+00
Aluminum	Mink	8.54E-03
Aluminum	Snowshoe Hare	1.12E+00
Aluminum	ST_Shrew	4.16E+01
Barium	Mink	2.50E+00
Barium	Muscrat	1.91E+02
Cadmium	Arctic Fox	3.13E-04
Cadmium	Caribou	1.95E-07
Cadmium	Deer_Mouse	4.18E-02
Cadmium	Grey Wolf	1.47E-07
Cadmium	Meadow Vole	1.32E-02
Cadmium	Mink	6.51E-03
Cadmium	Muscrat	1.00E-05
Cadmium	Snowshoe Hare	3.48E-03
Cadmium	ST_Shrew	1.52E-01
Chromium 6+	Arctic Fox	9.76E-10
Chromium 6+	Caribou	3.54E-12
Chromium 6+	Deer_Mouse	2.46E-08
Chromium 6+	Grey Wolf	3.02E-12
Chromium 6+	Meadow Vole	1.84E-08
Chromium 6+	Mink	2.40E-09
Chromium 6+	Muscrat	1.59E-07
Chromium 6+	Snowshoe Hare	1.14E-08
Chromium 6+	ST_Shrew	2.97E-08
Copper	Arctic Fox	1.88E-06
Copper	Caribou	6.82E-09
Copper	Deer_Mouse	4.72E-05
Copper	Grey Wolf	5.82E-09
Copper	Meadow Vole	3.54E-05
Copper	Mink	1.88E-02
Copper	Muscrat	3.70E-05
Copper	Snowshoe Hare	2.19E-05
Copper	ST_Shrew	5.71E-05
Lead	Mink	1.25E-04
Lead	Muscrat	9.44E-03
Manganese	Mink	4.81E-07
Manganese	Muscrat	3.66E-05
Mercury	Mink	2.52E-03
Mercury	Muscrat	1.00E-06
Zinc	Arctic Fox	1.03E-04
Zinc	Caribou	2.56E-07
Zinc	Deer_Mouse	2.51E-02
Zinc	Grey Wolf	1.57E-07
Zinc	Meadow Vole	2.27E-03
Zinc	Mink	1.33E-05
Zinc	Snowshoe Hare	1.74E-03
Zinc	ST_Shrew	1.21E-01

Table 4.36b. Hazard Quotients – Organic COPCs / Mammals

Chemical Class	Chemical	Receptor	Hazard Quotient (unitless)
PAHs	Anthracene	Mink	6.33E-06
	Anthracene	Muscrat	5.00E-09
	Pyrene	Mink	1.95E-05
	Pyrene	Muscrat	6.67E-09
PCBs	PCBs	Mink	1.17E+01
	PCBs	Muscrat	6.88E-03
pest/herb	DDT total	Mink	6.99E-04
	DDT total	Muscrat	1.25E-07
	Endrin	Mink	1.12E-01
	Endrin	Muscrat	2.17E-05
	Lindane (gamma HCH)	Mink	4.21E-05
	Lindane (gamma HCH)	Muscrat	6.25E-08
	Toxaphene	Arctic Fox	9.03E-08
	Toxaphene	Caribou	3.28E-10
	Toxaphene	Deer_Mouse	2.27E-06
	Toxaphene	Grey Wolf	2.80E-10
	Toxaphene	Meadow Vole	1.70E-06
	Toxaphene	Mink	9.12E-04
	Toxaphene	Muscrat	2.50E-07
	Toxaphene	Snowshoe Hare	1.05E-06
	Toxaphene	ST_Shrew	2.75E-06
PHCs	F2	Arctic Fox	1.87E-04
	F2	Caribou	2.27E-07
	F2	Deer_Mouse	6.27E-02
	F2	Grey Wolf	1.49E-07
	F2	Meadow Vole	6.68E-03
	F2	Mink	1.55E-05
	F2	Snowshoe Hare	2.03E-03
	F2	ST_Shrew	2.52E-01
	F3	Arctic Fox	6.50E-03
	F3	Caribou	6.34E-06
	F3	Deer_Mouse	3.92E+00
	F3	Grey Wolf	3.93E-06
	F3	Meadow Vole	2.47E-01
	F3	Mink	4.40E-04
	F3	Muscrat	4.39E-03
	F3	Snowshoe Hare	4.80E-02
	F3	ST_Shrew	1.55E+01
	F4	Arctic Fox	5.85E-03
	F4	Caribou	5.60E-08
	F4	Deer_Mouse	5.54E+00
	F4	Grey Wolf	3.43E-08
	F4	Meadow Vole	2.83E-01
	F4	Mink	9.21E-04
	F4	Muscrat	4.85E-02
	F4	Snowshoe Hare	3.83E-04
	F4	ST_Shrew	2.10E+01
VOCs	Bromoform	Arctic Fox	6.61E-06
	Bromoform	Caribou	1.88E-09
	Bromoform	Deer_Mouse	2.62E-03
	Bromoform	Grey Wolf	1.84E-09
	Bromoform	Meadow Vole	3.04E-04
	Bromoform	Mink	3.27E-07
	Bromoform	Snowshoe Hare	4.29E-05
	Bromoform	ST_Shrew	9.61E-03
	cis-1,2-Dichloroethene	Mink	8.30E-06
	cis-1,2-Dichloroethene	Muscrat	8.85E-07
	Trichloroethene	Mink	7.58E-03
	Trichloroethene	Muscrat	3.23E-04

Potentially unacceptable levels of risk to mammals were identified for **aluminum, barium, PCBs and the F3 and F4 PHC fractions**. Aluminum and F3 concentrations were associated with potentially unacceptable risk to terrestrial mammals (aluminum: deer mouse, meadow vole, snowshoe hare, short-tailed shrew; PHC F3 and F4: deer mouse, short-tailed shrew), and resulted predominately from exposure to these contaminants in soil.

Barium represented a potential risk to mink and muskrat due to the elevated concentrations of barium in brackish sediments.

The hazard quotient associated with exposure of mink to total PCBs was primarily derived from consumption of fish. The modeled concentration of PCBs in fish, however, was based on an assumed concentration of total PCBs in brackish surface water equivalent to the detection limit, which was very likely a sizeable overestimate, and not reflective of actual conditions on the site.

All hazard quotients for terrestrial and semi-aquatic birds were representative of essentially negligible risk levels.

4.6.1.5 Risk Characterization Results Summary

The results of the risk quotient calculations indicated that **aluminum and F3 PHCs** are present in **soil** at concentrations that may present an unacceptable level of risk to terrestrial plants and soil invertebrates. **Barium, iron, lead and total PCBs** were were present in **brackish sediments** at concentrations that could represent an unacceptable level of risk to benthic invertebrates and/or aquatic vegetation. **Brackish surface water** contained concentrations of **copper, magnesium, sodium, PCBs, DDT (and its metabolites), and endrin**. Potentially unacceptable risk levels for aquatic biota were also calculated for **aluminum, iron and the F2 fraction of PHCs** due to their respective concentrations in fresh surface water. However, since the majority of surface water on the site is brackish due to periodic inundation of the river floodplain, it is unlikely that contaminants in fresh surface water would result in deleterious effects on aquatic biota at the population level. Freshwater sediments were not evaluated; it was assumed that aquatic receptors would primarily inhabit the areas of brackish water on the site, as smaller freshwater ponds are relatively inaccessible.

Potentially unacceptable risk levels to mammals were also estimated for the following substances due to their concentrations in site soil:

- Aluminum (deer mouse, meadow vole, snowshoe hare, short-tailed shrew)
- PHC F3 and F4 (deer mouse, short-tailed shrew).

Barium concentrations in brackish sediment represented a potentially unacceptable risk to muskrat and mink. An unacceptably high hazard quotient was also calculated for exposure of

mink to PCBs, but this HQ was primarily driven by the water-fish-mink pathway, which was based on a highly conservative estimate of the concentration of PCBs in brackish surface water.

Risk quotients could not be calculated for the following contaminants, as no suitable TRV benchmark values were available for these parameters for comparison:

Chemical	Receptor Type	Medium
Aluminum	Invertebrate	Soil
Barium	Invertebrate	Soil
Bromoform		Soil
Iron	Plant	Soil
Iron	Invertebrate	Soil
Iron	Bird	
Iron	Mammal	
Magnesium	Bird	
Magnesium	Mammal	
Manganese	NA	Surface Water (Brackish)
Sodium	Bird	
Sodium	Mammal	
Strontium	NA	Sediment (Brackish)
Vanadium		Surface Water (Brackish)
Vanadium	NA	Sediment (Brackish)
1,1,1,2-tetrachloroethane	Mammal	
1,1,1,2-tetrachloroethane	NA	Soil
Toxaphene	NA	Surface Water (Brackish)
Toxaphene	NA	Surface Water (Fresh)

The unquantified risks of these substances to receptors are considered to be a source of uncertainty in the risk assessment.

4.6.2 Evaluation of Uncertainty

Major sources of uncertainty associated with quantitative ecological risk assessments often include factors such as environmental conditions, chemical toxicity and hazard data, and assumed receptor characteristics. The major sources of uncertainty as they pertain to the site-specific conditions discussed in this report are outlined below.

4.6.2.1 Ecological TRVs

One source of uncertainty is the applicability of the selected TRVs to the various exposure pathways and ecological receptors identified in this report. By definition, these values are considered to be protective of all ecological receptor populations that may be present in a given location. However, they are likely to overestimate potential risk as they are designed to ensure

comprehensive protection to even the most sensitive species. Further, in order to avoid introducing uncertainty associated with scaling factors, TRVs were not allometrically scaled for the body weight of the various mammals and birds selected as measurement receptors. This is a conservative approach recommended by the Ontario MOE, but likely leads to overestimation of risks to wildlife.

The lack of TRV values for combinations of receptors and COPECs also represents an important source of uncertainty, and the use of established benchmark values for comparison with contaminant concentrations in environmental media may lead to an overestimation of the actual risks. In general, these values have been developed using highly conservative assumptions regarding chemical fate and transport characteristics, physicochemical properties, ecotoxicological endpoints and exposure calculations.

4.6.2.2 Chemical Interactions

Finally, there is uncertainty regarding the potential chemical interaction of the various COECs identified at the site. It is accepted that chemical interactions can cause antagonistic, additive or synergistic toxic effects. Although interactions have been described in the literature for specific endpoints of specific receptors for simple combinations of some of the COECs identified in this report, the nature and effect of the vast majority of possible interactions is unknown. However, given the fact that the HQs used to assess risk are based upon very conservative TRVs, this uncertainty is not likely to affect overall conclusions.

4.6.2.3 Assumptions Regarding Bioconcentration and Bioaccumulation

Use of transfer factors to predict contaminant concentrations in food sources results in significant uncertainty. Transfer factors were taken from reputable sources, each of which was based on review of a large body of information. Transfer factors are highly dependent on the form of the constituent (ie dissolved in water, associated with a mineral form, complexed with organic matter, etc.) and many are derived from field or laboratory studies.

The uptake and bioconcentration of PHC and other organic chemicals is generally considered a minor concern. Most PHCs are readily metabolized by vertebrates, modified into a more excretable form, and thus do not tend to accumulate in tissues. PHCs are not readily absorbed into and accumulated into plant tissues. The net result is that the consumption of either plants or other animals (as opposed to soil ingestion) does not tend to constitute an important component of exposure of wildlife and livestock populations to PHCs (CCME, 2008).

4.6.2.4 Uncertainty Associated with Selection of Measurement Receptors

No evidence of mink was recorded near the site, but mink were included as measurement receptors to ensure that a higher-trophic-level animal was evaluated in the risk assessment. As

such, the mink was selected to represent any mammal that could reasonably be expected to use the area as a source of food.

Muskrats were not actually observed at the site, but represent herbivorous semi-aquatic mammals.

4.6.2.5 Uncertainty Associated with Sampling and Site Conditions

PCBs and pesticide concentrations in surface waters cannot be attributed to on-site sources with any degree of certainty. These substances can be subject to long-range transport to northern environments from more southern regions. Since background (upstream) data for these substances in surface waters has not yet been collected, remedial action with respect to PCBs and pesticides at the site should be considered with caution.

5.0 SITE-SPECIFIC TARGET LEVELS (SSTLS)

Site-specific target levels were developed for site soil and brackish sediments, as described below.

5.1 Risk-Based Maximum Allowable Value

The risk-based maximum allowable values (MAVs) were developed using the same assumptions used in the ERA, including the use of the 95% UCLM concentration (or maximum concentration, as appropriate) of COECs.

The following equations were used to calculate the MAVs:

- For threshold (non-carcinogenic) contaminants

$$MAV = (C_{sediment\ or\ soil}/RQ_{calculated}) \times RQ_{target}$$

Where:

MAV = risk-based maximum allowable value
C_{soil} = 95% UCLM concentration (or maximum concentration, as appropriate) of COEC concentration in soil or sediment
RQ_{Target} = 1
$RQ_{calculated}$ = Highest risk (or hazard) quotient value based on exposure assessment

- For non-threshold (carcinogenic) contaminants

$$MAV = (C_{soil}/ILCR_{calculated}) \times ILCR_{target}$$

Where:

MAV = risk-based maximum allowable value
C_{soil} = 95% UCLM concentration (or maximum concentration, as appropriate) of COEC concentration in soil
$ILCR_{Target}$ = 10^{-5}
$ILCR_{calculated}$ = Highest ILCR value for humans based on exposure assessment

The food chain modeling approach indicates that ingestion of contaminated food is the predominant exposure pathway affecting risk levels in mammals and birds, and that direct contact with contaminated media (i.e., sediment and soil) play a minor role in overall exposure, and consequently, risk. For chemicals for which the highest calculated HQ or RQ corresponded to an ecological receptor, MAV values were developed to protect viable populations of aquatic and terrestrial plants and invertebrates given that they make up the base of the food chain

which supports consumers at higher trophic levels. MAVs for chemicals for which the highest HQ (or ILCR) corresponded to a human receptor were developed to protect all human receptors, as potential risk levels to ecological receptors were found to be essentially negligible.

5.2 Site-Specific Target Levels (SSTLs)

Site-specific target levels (SSTLs) were chosen for each substance according to the following criteria, presented below in the order they were considered:

1. Greater than or equal to the corresponding environmental or human health criterion (EQG) used in the identification of COPCs (see Section 2);
    - Values lower than the EQG were not recommended, as EQG are based on extensive analysis of the available toxicological research and are generally accepted by the federal and/or Ontario provincial government as protective of ecological receptors;
2. Greater than or equal to the detection limit;
    - If the detection limit was higher that the generic criterion, values lower than the detection limit were not recommended;
3. Less than or equal to the MAV;
    - If the MAV was higher than the generic criterion and the detection limit, and lower than the maximum concentration detected in the relevant site medium, the risk-based MAV was recommended;
4. Less than or equal to the maximum COEC concentration;
    - If the maximum measured concentration was lower than the risk-based MAV and higher than the EQG, the maximum measured concentration was recommended.

Tables 5.1, 5.2 and 5.3 summarize recommended preliminary target concentrations in soil and sediment, respectively, for COECs assessed in this study.

Table 5.1 Site-Specific Target Levels of Threshold Contaminants in Soil

Chemical (Threshold)	Concentration in soil used in RA (mg/kg)	Highest HQ	Receptor	Target HQ	Risk-based maximum allowable value	Maximum concentration in soil	Guidelines (mg/kg dry wt.)				Lowest detection limit	Site-specific target level
							Ecological		Human health			
Aluminum	4.68E+03	9.35E+01	Plant	1	5.00E+01	5.10E+03	NV		NV		5.00E+01	**5.00E+01**
Cadmium	2.78E+00	1.62E+00	Toddler	0.2	3.43E-01	2.24E+01	n/a		1.40E+01	1	1.00E-01	**1.40E+01**
Lead	9.16E+01	2.11E+00	Toddler	0.2	8.68E+00	2.56E+02	n/a		1.40E+02	1	1.00E+00	**1.40E+02**
F3	4.68E+03	1.55E+01	ST_Shrew	1	3.02E+02	4.44E+04	3.00E+02	1	n/a		1.00E+01	**3.02E+02**
F4	4.68E+03	2.10E+01	ST_Shrew	1	2.22E+02	6.96E+03	2.80E+03	1	n/a		1.00E+01	**2.80E+03**
PCBs	1.71E+01	9.72E+01	Adult	0.2	3.52E-02	1.71E+01	n/a		1.30E+00	1	1.00E-02	**1.30E+00**

1 - Canadian Council of Ministers of the Environment (CCME). 2007. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.

Table 5.2 Site-Specific Target Levels of Non-Threshold Contaminants in Soil

Chemical (Non-threshold)	Concentration in soil used in RA (mg/kg)	Highest ILCR	Receptor	Target ILCR	Risk-based maximum allowable value	Maximum concentration in soil	Guidelines (mg/kg dry wt.)				Lowest detection limit	Site-specific target level
							Ecological		Human health			
Benz[a]anthracene	1.14E+00	1.31E-04	Adult	1.00E-05	8.70E-02	1.14E+00	n/a		3.30E-01	1	1.00E-02	**3.30E-01**
Vinyl chloride	1.00E-01	1.16E-04	Adult	1.00E-05	8.62E-03	1.00E-01	n/a		3.00E-03	2	2.00E-03	**8.62E-03**

1 - Canadian Council of Ministers of the Environment (CCME). 2007. Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health.
2 - Ministry of the Environment (MOE). 2004. Soil, Groundwater and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act. Queen's Printer for Ontario, March 2004. Table 1.

Table 5.3 Site-Specific Target Levels of Contaminants in Brackish Sediment

Chemical	Concentration in sediment used in RA (mg/kg)	Highest HQ	Receptor	Target HQ	Risk-based maximum allowable value	Maximum concentration in sediment	Guidelines (mg/kg dry wt.)				Lowest detection limit	Site-specific target level
							Ecological		Human health			
Ba	2.02E+01	1.91E+02	Muscrat	1	1.06E-01	2.59E+01	NV		n/a		5.00E-01	**5.00E-01**
Fe	2.98E+04	1.49E+00	NA	1	2.00E+04	4.60E+04	NV		n/a		5.00E+01	**2.00E+04**
Pb	2.58E+01	1.23E+00	NA	1	2.10E+01	6.30E+01	3.02E-11	1	n/a		1.00E+00	**2.10E+01**
PCBs	9.00E-02	3.96E+00	NA	1	2.27E-02	9.00E-02	2.15E-02	1	n/a		3.00E-02	**2.15E-02**

1 - CCME (2002). Canadian Sediment Quality Guidelines for Protection of Aquatic Life, Update 2002, Table 2. Interim marine sediment quality guidelines (ISQGs).

6.0 LIMITATIONS

Franz Environmental Inc. performed the work referred to in this document and prepared this report for Public Works and Government Services Canada (PWGSC). It is intended for the sole and exclusive use of PWGSC, its affiliated departments, agencies, companies and partners and their respective insurers, agents, employees and advisors.

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The investigation undertaken by Franz Environmental Inc. with respect to this report and any conclusions or recommendations made in this report reflect Franz Environmental Inc.'s judgment based on the site conditions observed at the time of the site inspection on the date(s) set out in this report and on information available at the time of the preparation of this report. This report also relies upon data collected by others. PWGSC and Franz Environmental Inc. make no representation or warranty to anyone with regard to data or information from others presented in this report, and they accept no duty of care to any other person or any liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of use or reliance on data or information from other parties presented in this report, or of any decision made or action taken based on these data. None of the data collected by others have been verified and they are subject to the limitations outlined in reports by others.

This report has been prepared for specific application to this site and it is based, in part, upon visual observation of the site, subsurface investigation at discrete locations and depths, and specific analysis of specific chemical parameters and materials during a specific time interval, all as described in this report. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, portions of the site which were unavailable for direct investigation, subsurface locations which were not investigated directly, or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the site, substances addressed by the investigation may exist in areas of the site not investigated and concentrations of substances addressed which are different than those reported may exist in areas other than the locations from which samples were taken.

If site conditions or applicable standards change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this report may be necessary.

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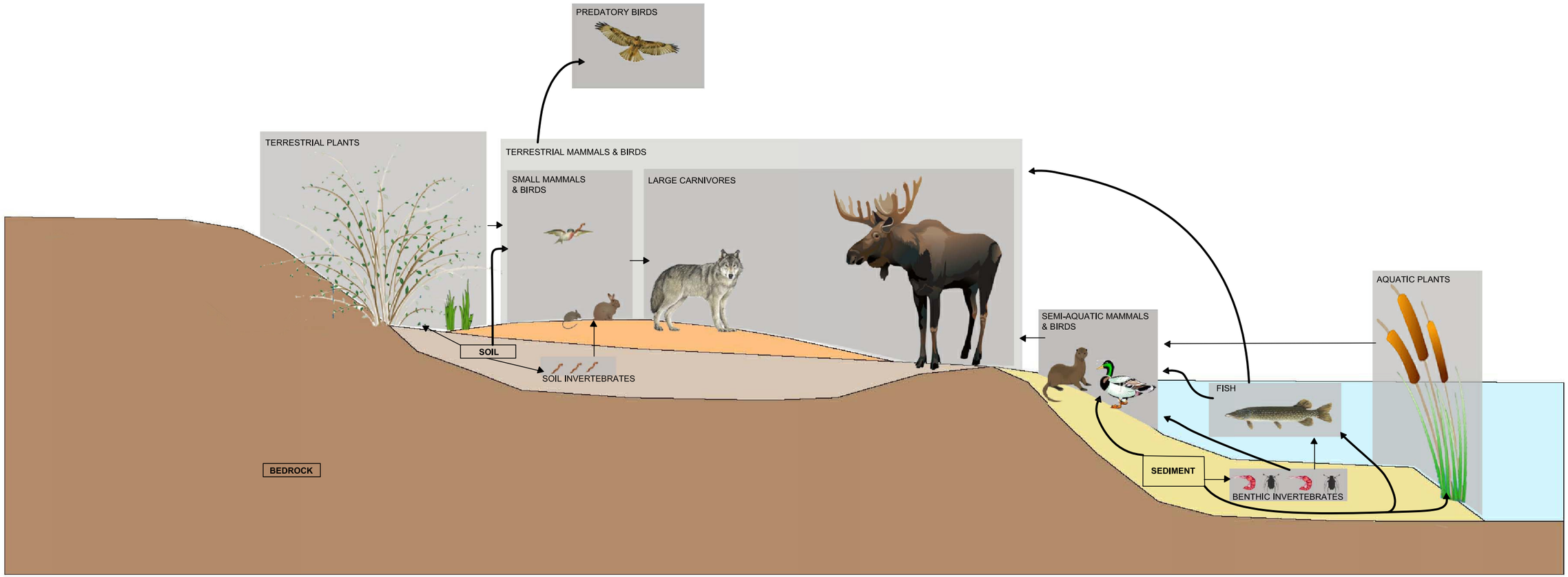
Figure



Title: ECOLOGICAL CONCEPTUAL SITE MODEL

FRANZ ENVIRONMENTAL INC.
♦ CONSULTING ♦ ENGINEERING ♦ TECHNOLOGIES ♦

Project: IQALUIT LANDFILL & VEHICLE DUMP
1584 - 0901

Date: MARCH 2010

Client: PWGSC/ TRANSPORT CANADA

NOT TO SCALE

FIGURE 1

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APPENDIX A

Sample Calculations – Human Health and Ecological

Appendix A
Sample Calculations for Estimated Parameters, Exposure and Risk Estimates

Human Health Risk Assessment:

Example calculation showing calculation of daily dose, hazard quotient and incremental lifetime cancer risk for an adult site user exposed to contaminants in soil.

Non Carcinogenic Exposure:

For non-carcinogens, daily dose via the soil ingestion pathway was calculated using the following equation from US EPA 1998:

$$Dose\left(\frac{mg}{kg \cdot day}\right) = \frac{C_s * IR_s * RAF_{ORAL} * D_d * D_w}{BW}$$

Where:

Dose = Daily exposure of contaminant of concern per kilogram of body weight per day (mg/kg-day)
C_s = Soil concentration (mg/kg)
IR_s = Ingestion rate of soil (kg/day)
RAF_{ORAL} = Relative absorption factor for oral exposure (unitless)
D_d = Days per week exposed (days/week)
D_w = Weeks per year exposed (weeks/year)
BW = Body weight (kg)

For an adult site user exposed to cadmium, the following values were used in the calculation of daily dose:

Value	Source
C_s = 2.777 mg/kg_{soil}	95% UCLM soil concentration for cadmium for the site
IR_s = 0.00002 kg_{soil}/day	Health Canada 2007
RAF_{ORAL} = 1 (unitless)	Health Canada 2007
D_d = 3 days/week	Estimated exposure time for adult site user
D_w = 12 weeks/year	Estimated exposure time for adult site user
BW = 70.7 kg	Health Canada 2007

Therefore:

$$Dose_{CADMIUM}\left(\frac{mg}{kg_{bw} \cdot day}\right) = \frac{2.777\frac{mg}{kg_{soil}} * 0.00002\frac{kg_{soil}}{day} * 1 * \left(\frac{3\,day/week}{7\,day/week}\right) * \left(\frac{12\ \ weeks/yr}{52\ \ weeks/yr}\right)}{70.7_{bw}}$$

$Dose_{CADMIUM}$ = 7.7 x 10^{-8} mg/kg_{bw}-day

Hazard quotients for threshold contaminants were calculated using the following equation.

$$Hazard\ Quotient = \frac{Dose}{TRV}$$

Where:
Hazard Quotient (unitless) = Ratio of estimated exposure via all pathways to appropriate TRV

Dose = Daily exposure to contaminant of concern calculated from all pathways above equation (mg/kg_{bw}-day)

TRV = Toxicity Reference Value (mg/kg_{bw}-day)

For an adult site user exposed to cadmium, the following values were used in the calculation of hazard quotient:

Dose = $E_{ingestion}$ + E_{dermal} + E_{food} + $E_{inhalation}$
= (7.77 x 10^{-8} + 6.65 x 10^{-9} + 7.01 x 10^{-4} + 1.55 x 10^{-11}) mg/kg_{bw}-day
HQ = 7.01 x 10^{-4} / 8.00 x 10^{-4}
= 8.76 x 10^{-1}

Carcinogenic Exposure:

For carcinogens (non-threshold contaminants), the daily dose via ingestion was calculated using the following equation from US EPA 1998:

$$Dose\left(\frac{mg}{kg \cdot day}\right) = \frac{C_s * IR_s * RAF_{ORAL} * D_d * D_w * D_y}{LE * BW}$$

Where:

Dose = Daily exposure of contaminant of concern per kilogram of body weight per day (mg/kg_{bw}-day)
C_s = Soil concentration (mg/kg)
IR_s = Ingestion rate of soil (kg/day)
RAF_{ORAL} = Relative absorption factor for oral exposure (unitless)
D_d = Days per week exposed (days/week)
D_w = Weeks per year exposed (weeks/year)
D_y = Total years exposed (years)
LE = Life expectancy (years)

BW = Body Weight (kg)

For an adult site user exposed to benzo(b)fluoranthene, the following values were used in the calculation of daily dose:

Value	Source
C_s = 1.78 mg/kg_{soil}	95% UCLM soil concentration for benzo(b)fluoranthene
IR_s = 0.00002 kg_{soil}/day	Health Canada 2007
RAF_{ORAL} = 1 (unitless)	Health Canada 2007
D_d = 3 days/week	Estimated exposure time for adult site user
D_w = 12 weeks/year	Estimated exposure time for adult site user
D_y = 60 years	Estimated exposure time for adult site user
LE = 60 years	Estimated exposure time for adult site user
BW = 70.7 kg	Health Canada 2007

Therefore:

$$Dose_{BENZO(B)FLUORANTHENE}\left(\frac{mg}{kg\cdot day}\right)=\frac{1.78\frac{mg}{kg_{soil}}*0.00002\frac{kg_{soil}}{day}*1*\left(\frac{3 days/wk}{7 days/week}\right)*\left(\frac{12 weeks/year}{52 weeks/year}\right)*60 years}{60 years*70.7 kg_{bw}}$$

$Dose_{BENZO(B)FLUORANTHENE}$ = 4.98 x 10^{-8} mg/kg-day

Incremental Lifetime Cancer Risks (ILCR) for carcinogens were calculated using the following equation:

$$ILCR = Dose * SlopeFactor$$

Where:
ILCR = Incremental lifetime cancer risk to exposure of contaminant of concern (unitless)
Dose = Daily exposure to contaminant of concern (mg/kg-day)
Slope Factor = Cancer slope factor $(mg/kg\text{-}day)^{-1}$

For an adult site user exposed to benzo(b)fluoranthene via incidental ingestion of soil particles, the following values were used in the calculation of ILCR:

Dose = 4.98 x 10^{-8} mg/kg-day
Slope Factor = 0.23

ILCR = 4.98 x 10^{-8} mg/kg-day x 0.23 $(mg/kg\text{-}day)^{-1}$
= 1.15 x 10^{-8}

Therefore the incremental lifetime cancer risk to an adult site user from exposure to benzo(b)fluoranthene via the soil ingestion pathway was 1.15×10^{-8}.

Ecological Risk Assessment:

Concentrations of COPECs resulting from medium-to-receptor transfers, e.g. soil to terrestrial invertebrates, were calculated according to the following formula:

$$C_{\text{invertebrate tissue}} = C_{\text{soil}} * \text{BSAF}$$

Where:

$C_{\text{invertebrate tissue}}$	= invertebrate tissue concentration (mg/kg)
C_{soil}	= COPEC concentration in soil/sediment (mg/kg)
BSAF	= bioaccumulation factor

The tissue concentration of cadmium in soil invertebrates was calculated as follows:

$$C_{invertebrate} = 2.777\, mg / kg_{soil} * 0.96$$

The concentration of cadmium in soil invertebrates, therefore, was 2.66 mg/kg.

Exposure concentrations of COPECs for Wildlife

Exposure of wildlife to COPECs from soil, surface water, sediment and contaminated food items was calculated according to the following equation:

Exposure via Ingestion:

$$E_{\text{ingestion}} = E_{\text{food}} + E_{\text{water}} + E_{\text{soil}}$$

Where:

$E_{\text{ingestion}}$	=	total ingestion exposure (mg/kg/day)
E_{food}	=	exposure from food consumption (mg/kg/day)
E_{water}	=	exposure from water (mg/kg/day)
E_{soil}	=	exposure from soil/sediment (mg/kg/day)

- **Food Ingestion:**

$$E_{\text{food}} = (C_{\text{food}} * IR_{\text{food}})$$

Where:

E_{food}	=	exposure from food consumption (mg/kg_{BW}/day)
C_{food}	=	COPEC concentration in food (mg/kg_{food})

IR_{food} = food ingestion rate (kg_{food}/kg_{BW}-day)

- **Water Ingestion:**

$$E_{water} = (C_{water} * IR_{water})$$

Where:

E_{water} = exposure from water (mg/kg_{BW}/day)

C_{water} = COPEC concentration in water (mg/L)

IR_{water} = water ingestion rate (L/kg_{BW}-day)

- **Ingestion of Soil/Sediment:**

$$E_{soil/sediment} = (C_{soil/sediment} * IR_{soil/sediment})$$

Where:

$E_{soil/sediment}$ = exposure from soil (mg/kg_{BW}/day)

$C_{soil/sediment}$ = COPEC concentration in soil or sediment ($mg/kg_{soil, sed}$)

$IR_{soil/sediment}$ = ingestion rate of soil or sediment ($kg_{soil, sed}/kg_{BW}$-day)

For example, exposure of the deer mouse to cadmium via all pathways was calculated as follows:

$E_{ingestion} = E_{food} + E_{water} + E_{soil}$

$= E_{forage} + E_{terrestrialinverts} + E_{water} + E_{soil}$

$= 0.00248 + 0.00653 + 0.000000416 + 0.00019$

$= 0.00965$ mg/d

Total intake was then calculated as:

Total intake (mg/kg-d) = $E_{ingestion}$ (mg/d) / body weight (kg)

$= 0.00920$ mg/d / 0.022 kg

$= 0.418$ mg/kg-d

The hazard quotient was then calculated as:

$$Hazard\ Quotient = \frac{Dose}{TRV}$$

The hazard quotient for the deer mouse's exposure to cadmium was:

$$Hazard\ Quotient = \frac{0.418 mg/kg-d}{10\, mg/kg-d}$$

The hazard quotient for exposure of the deer mouse to cadmium from all sources was 0.0418. Since this value was less than 1, it was concluded that there was no risk to the mouse from exposure to cadmium in site media.

APPENDIX B

Model Print-Outs – Human Health Risk Assessment

HEALTH CANADA PQRA SPREADSHEET
USER INPUT SHEET

User Name:		Site:	
Proponent:		File #:	
Date:		Comment:	

PROBLEM FORMULATION

Potential Land Uses (Yes/No)		Default
Agricultural	No	Yes
Residential/urban parkland		Yes
Commercial	No	Yes
Industrial	No	Yes
Occupational - outdoors	No	Yes
Recreational	Yes	Yes
Other		No
specify:		

Operative Pathways (Yes/No)		Default
Inadvertent ingestion of soil		Yes
Inhalation of soil particles		Yes
Inhalation of indoor contaminant vapours	No	Yes
Inhalation of outdoor contaminant vapours		Yes
Ingestion of drinking water	No	Yes
Dermal contact with soil		Yes
Dermal contact with water	No	Yes
Ingestion of contaminated food	Yes	No

Exposure Scenario	User-Defined	Residential

Vapour Transport Modelling		
Vapour source for exposure calculations		Most Conservative

Receptor Groups (Yes/No)		Default
General public or residents	Yes	Yes
Employees		Yes
Canadian native communities	Yes	No
Other		No
specify:		

Active Critical Receptors (Yes/No)		Default
Infant	No	Yes
Toddler		Yes
Child	No	Yes
Teen	No	Yes
Adult	Yes	Yes
Other		No
specify:		

Contaminant Concentrations

Chemical Name	required	Cadmium	Lead	Tin (Sn)	Zinc	Strontium	
Soil (mg/kg)	required	2.777	91.62	8.86E+00	122.5	8.312	
Groundwater - source (mg/L)	optional						
Drinking water (mg/L)	optional						
Bathing/swimming water (mg/L)	optional						
Indoor air - vapours (mg/m^3)	optional						
Outdoor air - vapours (mg/m^3)	optional						
Outdoor air - particulate (mg/m^3)	optional						
Root vegetables (mg/kg wet weight)	optional						
Other vegetables (mg/kg wet weight)	optional	0.01	7.53		3	0.5	
Fish (mg/kg wet weight)	optional	0.907					
Wild game (mg/kg wet weight)	optional						

Risk Assessment Endpoints		Default
Acceptable hazard index:		0.2
Acceptable cancer risk:		1.00E-05

Precluding Conditions for Fate and Transport Models

Are non-aqueous phase liquids (NAPL) present?	No
Is groundwater contamination present in fractured bedrock?	No
Is groundwater contamination migrating through a confined aquifer?	No
Is there active pumping or drawdown of groundwater at the site?	No
Is contamination present within 1 m of building foundation?	No
Do any buildings within 5 m of contamination have earthen foundations?	No
Are any buildings constructed on very high permeability media?	No
Are there preferential vapour flow pathways connecting contamination to a building?	No

Fate and Transport Model Input

	Value	Default	Models Affected
Soil Type		coarse-grained	PS, V-I, V-O, GW
Significant vehicle traffic on unpaved roads?		No	P-O
Site Characteristics			
Depth to Groundwater (m)		3	GW, V-O
Depth from Surface to Contamination (m)		0	GW, V-O
Distance - Contaminated Soil to Building (m)		1	V-I
Distance - Contaminated GW to Building (m)		1	V-I
Distance to potable water user (m)		0	GW
Distance to Bathing/Swimming Water (m)		0	GW
Particulate Concentration in Air (ug/m^3)		0.76	P-O
Building Type		Residential	V-I

Optional Sections

User-defined Chemicals

Note: user-defined chemicals should be named in this section before being selected in the 'Contaminant Concentrations' table above

Enter all applicable and appropriate toxicity benchmarks; values must be referenced and justified in the PQRA report.

	Chemical 1	Chemical 2	Chemical 3
Name	Strontium	Tin (Sn)	
CAS Number			
Chemical class (organic/inorganic)			
Tolerable daily intake (mg/kg/d) - infant			
Tolerable daily intake (mg/kg/d) - toddler	2	0.3	
Tolerable daily intake (mg/kg/d) - child			
Tolerable daily intake (mg/kg/d) - teen			
Tolerable daily intake (mg/kg/d) - adult	2	0.3	
Tolerable concentration (mg/m^3)			
Oral slope factor (mg/kg/d)$^{-1}$			
Inhalation slope factor (mg/kg/d)$^{-1}$			
Inhalation unit risk (mg/m^3)$^{-1}$			
Relative dermal absorption factor			
Organic carbon partitioning coefficient (mL/g) - Koc			
Log Kow (unitless)			
Henry's Law constant at 25°C (unitless) - H'			
Henry's Law constant at 25°C (atm-m3/mol) - H			
Water Solubility at 25°C (mg/L)			
Molecular Weight (g/mol)			
Vapour Pressure at 25°C (atm)			

Note: values in grayed cells will not be used; Health Canada default values are applied.

User-defined Receptor

Name		Defaults
Age group		Toddler
Body weight (kg)		16.5
Soil ingestion rate (g/d)		0.08
Inhalation rate (m^3/d)		9.3
Water ingestion rate (L/d)		0.6
Skin surface area (cm^2)		
- hands		430
- arms		890
- legs		1690
- total		6130
Soil loading to exposed skin (g/cm^2/event)		
- hands		0.0001
- surfaces other than hands		0.00001
Food ingestion (g/d)		
- root vegetables		105
- other vegetables		67
- fish		95
- wild game		85
Evaluate Cancer Risks (Yes/No)?		No

User-defined Land-Use / Exposure Scenario

Scenario name	User-Defined	Defaults
Hours per day (indoors)	0	22.5
Hours per day (outdoors)	8	1.5
Days per week	3	7
Weeks per year	12	52
Dermal exposure events/day		1
Water contact events per day		1
Duration of water contact event (h)		1
Days/year contaminated food ingestion	90	365
Exposure duration (years)		60
Years for carcinogen amortization		60

SUMMARY OF PQRA RESULTS Version: March 16, 2009

User Name: **Site:**
Proponent: **File #:**
Date: **Comment:**

		Maximum Hazard/Risk Estimates					
		Cadmium	**Lead**	**Tin (Sn)**	**Zinc**	**Strontium**	
Hazard Quotient - Oral/Dermal		1.62E+00	2.11E+00	2.63E-05	6.42E-03	2.54E-04	NA
Hazard Quotient - Inhalation		4.90E-08	3.59E-07	4.17E-10	3.62E-09	5.87E-11	NA
Hazard Index - Total		1.62E+00	2.11E+00	2.63E-05	6.42E-03	2.54E-04	NA
Target Hazard Index:	0.2	**Target Hazard Index Exceeded**	**Target Hazard Index Exceeded**				
Cancer Risk - Oral		NA	NA	NA	NA	NA	NA
Cancer Risk - Dermal		NA	NA	NA	NA	NA	NA
Cancer Risk - Oral + Dermal		NA	NA	NA	NA	NA	NA
Cancer Risk - Inhalation		6.82E-10	NA	NA	NA	NA	NA
Cancer Risk - Total		6.82E-10	NA	NA	NA	NA	NA
Target Cancer Risk:	1.00E-05						

	Critical Receptors					
	Cadmium	**Lead**	**Tin (Sn)**	**Zinc**	**Strontium**	
Oral/Dermal - non-cancer effects	Toddler	Toddler	Toddler	Toddler	Toddler	NA
Inhalation - non-cancer effects	Toddler	Toddler	Toddler	Toddler	Toddler	NA
Total - non-cancer effects	Toddler	Toddler	Toddler	Toddler	Toddler	NA
Oral - cancer effects	NA	NA	NA	NA	NA	NA
Dermal - cancer effects	NA	NA	NA	NA	NA	NA
Oral + Dermal - cancer effects	NA	NA	NA	NA	NA	NA
Inhalation - cancer effects	Adult	NA	NA	NA	NA	NA
Total - cancer effects	Adult	NA	NA	NA	NA	NA
Source of indoor air vapours	NA	NA	NA	NA	NA	NA
Model used for vapour transport	NA	NA	NA	NA	NA	NA

Key Calculated Model Parameters						
Vapour Intrusion Model Parameters	Note: parameters show as "NA" if relevant exposure pathways are inoperative or if user-input concentration is used instead of modelled value					
Qsoil/Qbuilding	NA	NA	NA	NA	NA	NA
Soil alpha	NA	NA	NA	NA	NA	NA
Groundwater alpha	NA	NA	NA	NA	NA	NA
Groundwater model dilution factors						
DF1 (soil to leachate)	NA	NA	NA	NA	NA	NA
DF2 (leachate at source to water table):	NA	NA	NA	NA	NA	NA
DF3 (leachate at water table to groundwater):	NA	NA	NA	NA	NA	NA
DF4 (source to receptor) - drinking water:	NA	NA	NA	NA	NA	NA
DF4 (source to receptor) - bathing/swimming water:	NA	NA	NA	NA	NA	NA

Notes/Comments

Vapour Intrusion Model

Chemical Interactions
All chemicals of concern present at the site should be evaluated for potential additive effects based on target organs and mechanisms of effect.

Concentration Checks

Precluding Conditions

Other Notes

HEALTH CANADA PQRA SPREADSHEET Version: March 16, 2009
OUTPUT SHEET - TODDLER

User Name: **Site:**
Proponent: **File #:**
Date: **Comment:**

Exposure Scenario: **User-Defined**
Native population considered

Chemical Properties	Units	Cadmium	Lead	Tin (Sn)	Zinc	Strontium	
Tolerable daily intake	mg/kg/d	0.0008	0.0036	0.3	0.478	2	NA
Tolerable concentration	mg/m^3	NA	NA	NA	NA	NA	NA
Relative dermal absorption factor	unitless	0.01	0.006	1	0.1	1	1

Chemical Concentrations	Units	Cadmium	Lead	Tin (Sn)	Zinc	Strontium	
Soil	mg/kg	2.78E+00	9.16E+01	8.86E+00	1.23E+02	8.31E+00	0.00E+00
Drinking water	mg/L	NA	NA	NA	NA	NA	NA
Bathing/swimming water	mg/L	NA	NA	NA	NA	NA	NA
Indoor air vapours	mg/m^3	NA	NA	NA	NA	NA	NA
Outdoor air vapours	mg/m^3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Outdoor air particulate	mg/m^3	2.11E-09	6.96E-08	6.73E-09	9.31E-08	6.32E-09	0.00E+00
Amortized total air concentration	mg/m^3	6.96E-11	2.30E-09	2.22E-10	3.07E-09	2.08E-10	0.00E+00
Root vegetables	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Other vegetables	mg/kg wet wt	1.00E-02	7.53E+00	not evaluated	3.00E+00	5.00E-01	not evaluated
Fish	mg/kg wet wt	9.07E-01	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Wild game	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated

RESULTS

	Exposure (mg/kg/d)					
	Cadmium	Lead	Tin (Sn)	Zinc	Strontium	
Inadvertent ingestion of contaminated soil	1.33E-06	4.39E-05	4.25E-06	5.87E-05	3.99E-06	0.00E+00
Inhalation of contaminated soil particles	3.92E-11	1.29E-09	1.25E-10	1.73E-09	1.17E-10	0.00E+00
Inhalation of contaminant vapours - indoor	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inhalation of contaminant vapours - outdoor	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ingestion of contaminated drinking water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dermal contact with contaminated soil	1.15E-08	2.27E-07	3.65E-06	5.05E-06	3.43E-06	0.00E+00
Dermal contact with water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ingestion of contaminated food	1.30E-03	7.54E-03	0.00E+00	3.00E-03	5.01E-04	0.00E+00
Total ingestion exposure	1.30E-03	7.58E-03	4.25E-06	3.06E-03	5.05E-04	0.00E+00
Total dermal exposure	1.15E-08	2.27E-07	3.65E-06	5.05E-06	3.43E-06	0.00E+00
Ingestion + dermal exposure	1.30E-03	7.58E-03	7.90E-06	3.07E-03	5.08E-04	0.00E+00
Total inhalation exposure	3.92E-11	1.29E-09	1.25E-10	1.73E-09	1.17E-10	0.00E+00
Total Exposure (all pathways)	1.30E-03	7.58E-03	7.90E-06	3.07E-03	5.08E-04	0.00E+00

	Hazard/Risk Estimates					
	Cadmium	Lead	Tin (Sn)	Zinc	Strontium	
Hazard Quotient - Oral/Dermal	1.62E+00	2.11E+00	2.63E-05	6.42E-03	2.54E-04	NA
Hazard Quotient - Inhalation	4.90E-08	3.59E-07	4.17E-10	3.62E-09	5.87E-11	NA
Hazard Index - Total	1.62E+00	2.11E+00	2.63E-05	6.42E-03	2.54E-04	NA
Target Hazard Index: 0.2	**Target Hazard Index Exceeded**	**Target Hazard Index Exceeded**				

HEALTH CANADA PQRA SPREADSHEET Version: March 16, 2009
OUTPUT SHEET - ADULT

User Name: **Site:**
Proponent: **File #:**
Date: **Comment:**

Exposure Scenario: **User-Defined**
Native population considered

Chemical Properties	Units	Cadmium	Lead	Tin (Sn)	Zinc	Strontium	
Tolerable daily intake	mg/kg/d	0.0008	0.0036	0.3	0.566	2	NA
Tolerable concentration	mg/m^3	NA	NA	NA	NA	NA	NA
Oral slope factor	$(mg/kg/d)^{-1}$	NA	NA	NA	NA	NA	NA
Inhalation slope factor	$(mg/kg/d)^{-1}$	42.9	NA	NA	NA	NA	NA
Inhalation unit risk	$(mg/m^3)^{-1}$	9.8	NA	NA	NA	NA	NA
Dermal slope factor	$(mg/kg/d)^{-1}$	NA	NA	NA	NA	NA	NA
Critical oral exposure benchmark		TDI	TDI	TDI	TDI	TDI	NA
Critical inhalation exposure benchmark		unit risk	NA	NA	NA	NA	NA
Relative dermal absorption factor	unitless	0.01	0.006	1	0.1	1	1

Chemical Concentrations	Units	Cadmium	Lead	Tin (Sn)	Zinc	Strontium	
Soil	mg/kg	2.78E+00	9.16E+01	8.86E+00	1.23E+02	8.31E+00	0.00E+00
Drinking water	mg/L	NA	NA	NA	NA	NA	NA
Bathing/swimming water	mg/L	NA	NA	NA	NA	NA	NA
Indoor air vapours	mg/m^3	NA	NA	NA	NA	NA	NA
Outdoor air vapours	mg/m^3	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Outdoor air particulate	mg/m^3	2.11E-09	6.96E-08	6.73E-09	9.31E-08	6.32E-09	0.00E+00
Amortized total air concentration	mg/m^3	6.96E-11	2.30E-09	2.22E-10	3.07E-09	2.08E-10	0.00E+00
Root vegetables	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Other vegetables	mg/kg wet wt	1.00E-02	7.53E+00	not evaluated	3.00E+00	5.00E-01	not evaluated
Fish	mg/kg wet wt	9.07E-01	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Wild game	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated

RESULTS

	Exposure (mg/kg/d)					
	Cadmium	Lead	Tin (Sn)	Zinc	Strontium	
Inadvertent ingestion of contaminated soil	7.77E-08	2.56E-06	2.48E-07	3.43E-06	2.33E-07	0.00E+00
Inhalation of contaminated soil particles	1.55E-11	5.13E-10	4.96E-11	6.86E-10	4.65E-11	0.00E+00
Inhalation of contaminant vapours - indoor	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inhalation of contaminant vapours - outdoor	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ingestion of contaminated drinking water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dermal contact with contaminated soil	6.65E-09	1.32E-07	2.12E-06	2.93E-06	1.99E-06	0.00E+00
Dermal contact with water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ingestion of contaminated food	7.01E-04	3.60E-03	0.00E+00	1.43E-03	2.39E-04	0.00E+00
Total ingestion exposure	7.01E-04	3.60E-03	2.48E-07	1.44E-03	2.39E-04	0.00E+00
Total dermal exposure	6.65E-09	1.32E-07	2.12E-06	2.93E-06	1.99E-06	0.00E+00
Ingestion + dermal exposure	7.01E-04	3.60E-03	2.37E-06	1.44E-03	2.41E-04	0.00E+00
Total inhalation exposure	1.55E-11	5.13E-10	4.96E-11	6.86E-10	4.65E-11	0.00E+00
Total Exposure (all pathways)	7.01E-04	3.60E-03	2.37E-06	1.44E-03	2.41E-04	0.00E+00

		Hazard/Risk Estimates					
		Cadmium	Lead	Tin (Sn)	Zinc	Strontium	
Hazard Quotient - Oral/Dermal		8.76E-01	1.00E+00	7.90E-06	2.54E-03	1.21E-04	NA
Hazard Quotient - Inhalation		1.94E-08	1.43E-07	1.65E-10	1.21E-09	2.33E-11	NA
Hazard Index - Total		8.76E-01	1.00E+00	7.90E-06	2.54E-03	1.21E-04	NA
Target Hazard Index:	0.2	**Target Hazard Index Exceeded**	**Target Hazard Index Exceeded**				
Cancer Risk - Oral		NA	NA	NA	NA	NA	NA
Cancer Risk - Dermal		NA	NA	NA	NA	NA	NA
Cancer Risk - Oral + Dermal		NA	NA	NA	NA	NA	NA
Cancer Risk - Inhalation		6.82E-10	NA	NA	NA	NA	NA
Cancer Risk - Total		6.82E-10	NA	NA	NA	NA	NA
Target Cancer Risk:	1.00E-05						

HEALTH CANADA PQRA SPREADSHEET
USER INPUT SHEET

User Name:		Site:	
Proponent:		File #:	
Date:		Comment:	

PROBLEM FORMULATION

Potential Land Uses (Yes/No)		Default
Agricultural	No	Yes
Residential/urban parkland		Yes
Commercial	No	Yes
Industrial	No	Yes
Occupational - outdoors	No	Yes
Recreational	Yes	Yes
Other		No
specify:		

Exposure Scenario	User-Defined	Residential

Receptor Groups (Yes/No)		Default
General public or residents	Yes	Yes
Employees		Yes
Canadian native communities	Yes	No
Other		No
specify:		

Operative Pathways (Yes/No)		Default
Inadvertent ingestion of soil		Yes
Inhalation of soil particles		Yes
Inhalation of indoor contaminant vapours	No	Yes
Inhalation of outdoor contaminant vapours		Yes
Ingestion of drinking water	No	Yes
Dermal contact with soil		Yes
Dermal contact with water	No	Yes
Ingestion of contaminated food	Yes	No

Vapour Transport Modelling		
Vapour source for exposure calculations		Most Conservative

Active Critical Receptors (Yes/No)		Default
Infant	No	Yes
Toddler		Yes
Child	No	Yes
Teen	No	Yes
Adult	Yes	Yes
Other		No
specify:		

Contaminant Concentrations

Chemical Name	required	Benz[a]anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Polychlorinated Biphenyls (total)	Acenaphthene	Dibenz(a,h)anthracene
Soil (mg/kg)	required	1.14	1.78	0.662	17.1	0.1	0.235
Groundwater - source (mg/L)	optional						
Drinking water (mg/L)	optional						
Bathing/swimming water (mg/L)	optional						
Indoor air - vapours (mg/m^3)	optional						
Outdoor air - vapours (mg/m^3)	optional						
Outdoor air - particulate (mg/m^3)	optional						
Root vegetables (mg/kg wet weight)	optional						
Other vegetables (mg/kg wet weight)	optional				0.1		
Fish (mg/kg wet weight)	optional	0.745			16.4		
Wild game (mg/kg wet weight)	optional						
		PAH-Carcinogenic	PAH-Carcinogenic	PAH-Carcinogenic			PAH-Carcinogenic

Risk Assessment Endpoints		Default
Acceptable hazard index:		0.2
Acceptable cancer risk:		1.00E-05

Precluding Conditions for Fate and Transport Models

Are non-aqueous phase liquids (NAPL) present?	No
Is groundwater contamination present in fractured bedrock?	No
Is groundwater contamination migrating through a confined aquifer?	No
Is there active pumping or drawdown of groundwater at the site?	No
Is contamination present within 1 m of building foundation?	No
Do any buildings within 5 m of contamination have earthen foundations?	No
Are any buildings constructed on very high permeability media?	No
Are there preferential vapour flow pathways connecting contamination to a building?	No

Fate and Transport Model Input

	Value	Default	Models Affected
Soil Type		coarse-grained	PS, V-I, V-O, GW
Significant vehicle traffic on unpaved roads?		No	P-O
Site Characteristics			
Depth to Groundwater (m)		3	GW, V-O
Depth from Surface to Contamination (m)		0	GW, V-O
Distance - Contaminated Soil to Building (m)		1	V-I
Distance - Contaminated GW to Building (m)		1	V-I
Distance to potable water user (m)		0	GW
Distance to Bathing/Swimming Water (m)		0	GW
Particulate Concentration in Air (ug/m^3)		0.76	P-O
Building Type		Residential	V-I

Optional Sections

User-defined Chemicals

Note: user-defined chemicals should be named in this section before being selected in the 'Contaminant Concentrations' table above

		Chemical 1		Chemical 2	Chemical 3
Name		Acenaphthene	*Health Canada values*		
CAS Number			83-32-9		
Chemical class (organic/inorganic)			organic		
Tolerable daily intake (mg/kg/d) - infant	*Enter all applicable and appropriate toxicity benchmarks; values must be referenced and justified in the PQRA report.*	0.02			
Tolerable daily intake (mg/kg/d) - toddler		0.02			
Tolerable daily intake (mg/kg/d) - child		0.02			
Tolerable daily intake (mg/kg/d) - teen		0.02			
Tolerable daily intake (mg/kg/d) - adult		0.02			
Tolerable concentration (mg/m^3)		0.003			
Oral slope factor (mg/kg/d)$^{-1}$					
Inhalation slope factor (mg/kg/d)$^{-1}$					
Inhalation unit risk (mg/m^3)$^{-1}$					
Relative dermal absorption factor			0.13		
Organic carbon partitioning coefficient (mL/g) - Koc			8912.509381		
Log Kow (unitless)			3.92		
Henry's Law constant at 25°C (unitless) - H'			0.004909315		
Henry's Law constant at 25°C (atm-m3/mol) - H			0.000120109		
Water Solubility at 25°C (mg/L)			3.8		
Molecular Weight (g/mol)			154.207		
Vapour Pressure at 25°C (atm)			2.96077E-06		

Note: values in grayed cells will not be used; Health Canada default values are applied.

User-defined Receptor

Name		Defaults
Age group		Toddler
Body weight (kg)		16.5
Soil ingestion rate (g/d)		0.08
Inhalation rate (m^3/d)		9.3
Water ingestion rate (L/d)		0.6
Skin surface area (cm^2)		
- hands		430
- arms		890
- legs		1690
- total		6130
Soil loading to exposed skin (g/cm^2/event)		
- hands		0.0001
- surfaces other than hands		0.00001
Food ingestion (g/d)		
- root vegetables		105
- other vegetables		67
- fish		95
- wild game		85
Evaluate Cancer Risks (Yes/No)?		No

User-defined Land-Use / Exposure Scenario

Scenario name	User-Defined	Defaults
Hours per day (indoors)	0	22.5
Hours per day (outdoors)	8	1.5
Days per week	3	7
Weeks per year	12	52
Dermal exposure events/day		1
Water contact events per day		1
Duration of water contact event (h)		1
Days/year contaminated food ingestion	90	365
Exposure duration (years)		60
Years for carcinogen amortization		60

SUMMARY OF PQRA RESULTS Version: March 16, 2009

User Name: **Site:**
Proponent: **File #:**
Date: **Comment:**

		Maximum Hazard/Risk Estimates					
		Benz[a]anthracene	**Benzo(b)fluoranthene**	**Benzo(k)fluoranthene**	**Polychlorinated Biphenyls (total)**	**Acenaphthene**	**Dibenz(a,h)anthracene**
Hazard Quotient - Oral/Dermal		NA	NA	NA	1.80E+02	2.67E-06	NA
Hazard Quotient - Inhalation		NA	NA	NA	3.84E-03	3.55E-06	NA
Hazard Index - Total		NA	NA	NA	1.80E+02	6.22E-06	NA
Target Hazard Index:	0.2				**Target Hazard Index Exceeded**		
Cancer Risk - Oral		1.31E-04	1.15E-08	4.26E-09	NA	NA	1.51E-09
Cancer Risk - Dermal		8.16E-09	1.27E-08	4.74E-09	NA	NA	1.68E-09
Cancer Risk - Oral + Dermal		1.31E-04	2.42E-08	9.00E-09	NA	NA	3.19E-09
Cancer Risk - Inhalation		1.10E-11	2.94E-11	4.14E-13	NA	NA	3.51E-14
Cancer Risk - Total		1.31E-04	2.42E-08	9.00E-09	NA	NA	3.19E-09
Target Cancer Risk:	1.00E-05	**Target Cancer Risk Exceeded**					

	Critical Receptors					
	Benz[a]anthracene	**Benzo(b)fluoranthene**	**Benzo(k)fluoranthene**	**Polychlorinated Biphenyls (total)**	**Acenaphthene**	**Dibenz(a,h)anthracene**
Oral/Dermal - non-cancer effects	NA	NA	NA	Toddler	Toddler	NA
Inhalation - non-cancer effects	NA	NA	NA	Toddler	All Age Groups	NA
Total - non-cancer effects	NA	NA	NA	Toddler	Toddler	NA
Oral - cancer effects	Adult	Adult	Adult	NA	NA	Adult
Dermal - cancer effects	Adult	Adult	Adult	NA	NA	Adult
Oral + Dermal - cancer effects	Adult	Adult	Adult	NA	NA	Adult
Inhalation - cancer effects	Adult	Adult	Adult	NA	NA	Adult
Total - cancer effects	Adult	Adult	Adult	NA	NA	Adult
Source of indoor air vapours	Soil	Soil	Soil	Soil	Soil	Soil
Model used for vapour transport	Health Canada	Health Canada	Health Canada	Health Canada	Health Canada	Health Canada

Key Calculated Model Parameters						
Vapour Intrusion Model Parameters	Note: parameters show as "NA" if relevant exposure pathways are inoperative or if user-input concentration is used instead of modelled value					
Qsoil/Qbuilding	NA	NA	NA	NA	NA	NA
Soil alpha	NA	NA	NA	NA	NA	NA
Groundwater alpha	NA	NA	NA	NA	NA	NA
Groundwater model dilution factors						
DF1 (soil to leachate)	3.08E+03	8.89E+03	1.15E+04	2.24E+02	4.46E+01	6.44E+03
DF2 (leachate at source to water table):	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00
DF3 (leachate at water table to groundwater):	3.36E+00	3.36E+00	3.36E+00	3.36E+00	3.36E+00	3.36E+00
DF4 (source to receptor) - drinking water:	NA	NA	NA	NA	NA	NA
DF4 (source to receptor) - bathing/swimming water:	NA	NA	NA	NA	NA	NA

Notes/Comments

Vapour Intrusion Model

Chemical Interactions
All chemicals of concern present at the site should be evaluated for potential additive effects based on target organs and mechanisms of effect.
All carcinogenic PAH present at the site must be treated additively

Concentration Checks

Precluding Conditions

Other Notes

Error functions in groundwater model could not be calculated; installation of Analysis ToolPak is required

HEALTH CANADA PQRA SPREADSHEET Version: March 16, 2009
OUTPUT SHEET - TODDLER

User Name: **Site:**
Proponent: **File #:**
Date: **Comment:**

Exposure Scenario: **User-Defined**
Native population considered

Chemical Properties	Units	Benz[a]anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Polychlorinated Biphenyls (total)	Acenaphthene	Dibenz(a,h)anthracene
Tolerable daily intake	mg/kg/d	NA	NA	NA	0.00013	0.02	NA
Tolerable concentration	mg/m^3	NA	NA	NA	NA	0.003	NA
Relative dermal absorption factor	unitless	0.13	0.13	0.13	0.14	0.13	0.13

Chemical Concentrations	Units	Benz[a]anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Polychlorinated Biphenyls (total)	Acenaphthene	Dibenz(a,h)anthracene
Soil	mg/kg	1.14E+00	1.78E+00	6.62E-01	1.71E+01	1.00E-01	2.35E-01
Drinking water	mg/L	NA	NA	NA	NA	NA	NA
Bathing/swimming water	mg/L	NA	NA	NA	NA	NA	NA
Indoor air vapours	mg/m^3	NA	NA	NA	NA	NA	NA
Outdoor air vapours	mg/m^3	1.06E-07	2.87E-07	3.54E-09	2.68E-05	3.23E-07	1.64E-10
Outdoor air particulate	mg/m^3	8.66E-10	1.35E-09	5.03E-10	1.30E-08	7.59E-11	1.79E-10
Amortized total air concentration	mg/m^3	3.54E-09	9.50E-09	1.33E-10	8.85E-07	1.07E-08	1.13E-11
Root vegetables	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Other vegetables	mg/kg wet wt	not evaluated	not evaluated	not evaluated	1.00E-01	not evaluated	not evaluated
Fish	mg/kg wet wt	7.45E-01	not evaluated	not evaluated	1.64E+01	not evaluated	not evaluated
Wild game	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated

RESULTS

	Exposure (mg/kg/d)					
	Benz[a]anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Polychlorinated Biphenyls (total)	Acenaphthene	Dibenz(a,h)anthracene
Inadvertent ingestion of contaminated soil	5.47E-07	8.54E-07	3.17E-07	8.20E-06	4.80E-08	1.13E-07
Inhalation of contaminated soil particles	1.61E-11	2.51E-11	9.35E-12	2.41E-10	1.41E-12	3.32E-12
Inhalation of contaminant vapours - indoor	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inhalation of contaminant vapours - outdoor	1.98E-09	5.33E-09	6.58E-11	4.98E-07	6.00E-09	3.06E-12
Ingestion of contaminated drinking water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dermal contact with contaminated soil	6.11E-08	9.54E-08	3.55E-08	9.87E-07	5.36E-09	1.26E-08
Dermal contact with water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ingestion of contaminated food	1.06E-03	0.00E+00	0.00E+00	2.34E-02	0.00E+00	0.00E+00
Total ingestion exposure	1.06E-03	8.54E-07	3.17E-07	2.34E-02	4.80E-08	1.13E-07
Total dermal exposure	6.11E-08	9.54E-08	3.55E-08	9.87E-07	5.36E-09	1.26E-08
Ingestion + dermal exposure	1.06E-03	9.49E-07	3.53E-07	2.34E-02	5.33E-08	1.25E-07
Total inhalation exposure	1.99E-09	5.35E-09	7.52E-11	4.99E-07	6.00E-09	6.37E-12
Total Exposure (all pathways)	1.06E-03	9.54E-07	3.53E-07	2.34E-02	5.93E-08	1.25E-07

	Hazard/Risk Estimates					
	Benz[a]anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Polychlorinated Biphenyls (total)	Acenaphthene	Dibenz(a,h)anthracene
Hazard Quotient - Oral/Dermal	NA	NA	NA	1.80E+02	2.67E-06	NA
Hazard Quotient - Inhalation	NA	NA	NA	3.84E-03	3.55E-06	NA
Hazard Index - Total	NA	NA	NA	1.80E+02	6.22E-06	NA
Target Hazard Index: 0.2				**Target Hazard Index Exceeded**		

HEALTH CANADA PQRA SPREADSHEET Version: March 16, 2009
OUTPUT SHEET - ADULT

User Name: **Site:**
Proponent: **File #:**
Date: **Comment:**

Exposure Scenario: **User-Defined**
Native population considered

Chemical Properties	Units	Benz[a]anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Polychlorinated Biphenyls (total)	Acenaphthene	Dibenz(a,h)anthracene
Tolerable daily intake	mg/kg/d	NA	NA	NA	0.00013	0.02	NA
Tolerable concentration	mg/m^3	NA	NA	NA	NA	0.003	NA
Oral slope factor	$(mg/kg/d)^{-1}$	0.23	0.23	0.23	NA	NA	0.23
Inhalation slope factor	$(mg/kg/d)^{-1}$	0.0137	0.0137	0.0137	NA	NA	0.0137
Inhalation unit risk	$(mg/m^3)^{-1}$	0.0031	0.0031	0.0031	NA	NA	0.0031
Dermal slope factor	$(mg/kg/d)^{-1}$	NA	NA	NA	NA	NA	NA
Critical oral exposure benchmark		slope factor	slope factor	slope factor	TDI	TDI	slope factor
Critical inhalation exposure benchmark		unit risk	unit risk	unit risk	NA	TC	unit risk
Relative dermal absorption factor	unitless	0.13	0.13	0.13	0.14	0.13	0.13

Chemical Concentrations	Units	Benz[a]anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Polychlorinated Biphenyls (total)	Acenaphthene	Dibenz(a,h)anthracene
Soil	mg/kg	1.14E+00	1.78E+00	6.62E-01	1.71E+01	1.00E-01	2.35E-01
Drinking water	mg/L	NA	NA	NA	NA	NA	NA
Bathing/swimming water	mg/L	NA	NA	NA	NA	NA	NA
Indoor air vapours	mg/m^3	NA	NA	NA	NA	NA	NA
Outdoor air vapours	mg/m^3	1.06E-07	2.87E-07	3.54E-09	2.68E-05	3.23E-07	1.64E-10
Outdoor air particulate	mg/m^3	8.66E-10	1.35E-09	5.03E-10	1.30E-08	7.59E-11	1.79E-10
Amortized total air concentration	mg/m^3	3.54E-09	9.50E-09	1.33E-10	8.85E-07	1.07E-08	1.13E-11
Root vegetables	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Other vegetables	mg/kg wet wt	not evaluated	not evaluated	not evaluated	1.00E-01	not evaluated	not evaluated
Fish	mg/kg wet wt	7.45E-01	not evaluated	not evaluated	1.64E+01	not evaluated	not evaluated
Wild game	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated

RESULTS

	Exposure (mg/kg/d)					
	Benz[a]anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Polychlorinated Biphenyls (total)	Acenaphthene	Dibenz(a,h)anthracene
Inadvertent ingestion of contaminated soil	3.19E-08	4.98E-08	1.85E-08	4.78E-07	2.80E-09	6.57E-09
Inhalation of contaminated soil particles	6.38E-12	9.97E-12	3.71E-12	9.57E-11	5.59E-13	1.32E-12
Inhalation of contaminant vapours - indoor	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inhalation of contaminant vapours - outdoor	7.84E-10	2.11E-09	2.61E-11	1.98E-07	2.38E-09	1.21E-12
Ingestion of contaminated drinking water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dermal contact with contaminated soil	3.55E-08	5.54E-08	2.06E-08	5.73E-07	3.11E-09	7.32E-09
Dermal contact with water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ingestion of contaminated food	5.72E-04	0.00E+00	0.00E+00	1.26E-02	0.00E+00	0.00E+00
Total ingestion exposure	5.72E-04	4.98E-08	1.85E-08	1.26E-02	2.80E-09	6.57E-09
Total dermal exposure	3.55E-08	5.54E-08	2.06E-08	5.73E-07	3.11E-09	7.32E-09
Ingestion + dermal exposure	5.72E-04	1.05E-07	3.91E-08	1.26E-02	5.91E-09	1.39E-08
Total inhalation exposure	7.91E-10	2.12E-09	2.98E-11	1.98E-07	2.38E-09	2.53E-12
Total Exposure (all pathways)	5.72E-04	1.07E-07	3.92E-08	1.26E-02	8.29E-09	1.39E-08

		Hazard/Risk Estimates					
		Benz[a]anthracene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Polychlorinated Biphenyls (total)	Acenaphthene	Dibenz(a,h)anthracene
Hazard Quotient - Oral/Dermal		NA	NA	NA	9.72E+01	2.96E-07	NA
Hazard Quotient - Inhalation		NA	NA	NA	1.52E-03	3.55E-06	NA
Hazard Index - Total		NA	NA	NA	9.72E+01	3.85E-06	NA
Target Hazard Index:	0.2				**Target Hazard Index Exceeded**		
Cancer Risk - Oral		1.31E-04	1.15E-08	4.26E-09	NA	NA	1.51E-09
Cancer Risk - Dermal		8.16E-09	1.27E-08	4.74E-09	NA	NA	1.68E-09
Cancer Risk - Oral + Dermal		1.31E-04	2.42E-08	9.00E-09	NA	NA	3.19E-09
Cancer Risk - Inhalation		1.10E-11	2.94E-11	4.14E-13	NA	NA	3.51E-14
Cancer Risk - Total		1.31E-04	2.42E-08	9.00E-09	NA	NA	3.19E-09
Target Cancer Risk:	1.00E-05	**Target Cancer Risk Exceeded**					

HEALTH CANADA PQRA SPREADSHEET
USER INPUT SHEET

User Name:		Site:	
Proponent:		File #:	
Date:		Comment:	

PROBLEM FORMULATION

Potential Land Uses (Yes/No)		Default	***Operative Pathways (Yes/No)***		Default
Agricultural	No	Yes	Inadvertent ingestion of soil		Yes
Residential/urban parkland		Yes	Inhalation of soil particles		Yes
Commercial	No	Yes	Inhalation of indoor contaminant vapours	No	Yes
Industrial	No	Yes	Inhalation of outdoor contaminant vapours		Yes
Occupational - outdoors	No	Yes	Ingestion of drinking water	No	Yes
Recreational	Yes	Yes	Dermal contact with soil		Yes
Other		No	Dermal contact with water	No	Yes
specify:			Ingestion of contaminated food	Yes	No

Exposure Scenario	User-Defined	Residential	***Vapour Transport Modelling***		
			Vapour source for exposure calculations		Most Conservative

Receptor Groups (Yes/No)		Default	***Active Critical Receptors (Yes/No)***		Default
General public or residents	Yes	Yes	Infant	No	Yes
Employees		Yes	Toddler		Yes
Canadian native communities	Yes	No	Child	No	Yes
Other		No	Teen	No	Yes
specify:			Adult	Yes	Yes
			Other		No
			specify:		

Contaminant Concentrations

Blue numbers exceed theoretical saturation/solubility limits; site should be evaluated for potential NAPL

Chemical Name		F1	F2	F3	Benzene		
Soil (mg/kg)	required	180	1100	***15457***	0.04		
Groundwater - source (mg/L)	optional						
Drinking water (mg/L)	optional						
Bathing/swimming water (mg/L)	optional						
Indoor air - vapours (mg/m^3)	optional						
Outdoor air - vapours (mg/m^3)	optional						
Outdoor air - particulate (mg/m^3)	optional						
Root vegetables (mg/kg wet weight)	optional						
Other vegetables (mg/kg wet weight)	optional						
Fish (mg/kg wet weight)	optional						
Wild game (mg/kg wet weight)	optional						
		See also PHC Sheet	See also PHC Sheet	See also PHC Sheet			

Risk Assessment Endpoints		Default
Acceptable hazard index:	0.5	0.2
Acceptable cancer risk:		1.00E-05

Precluding Conditions for Fate and Transport Models

Are non-aqueous phase liquids (NAPL) present?	Yes	The presence of NAPL may invalidate groundwater transport modelling; soil vapour sampling is requried for the vapour intrusion pathway
Is groundwater contamination present in fractured bedrock?	No	
Is groundwater contamination migrating through a confined aquifer?	No	
Is there active pumping or drawdown of groundwater at the site?	No	
Is contamination present within 1 m of building foundation?	No	
Do any buildings within 5 m of contamination have earthen foundations?	No	
Are any buildings constructed on very high permeability media?	No	
Are there preferential vapour flow pathways connecting contamination to a building?	No	

Fate and Transport Model Input

	Value	Default	Models Affected
Soil Type		coarse-grained	PS, V-I, V-O, GW
Significant vehicle traffic on unpaved roads?		No	P-O
Site Characteristics			
Depth to Groundwater (m)		3	GW, V-O
Depth from Surface to Contamination (m)		0	GW, V-O
Distance - Contaminated Soil to Building (m)		1	V-I
Distance - Contaminated GW to Building (m)		1	V-I
Distance to potable water user (m)		0	GW
Distance to Bathing/Swimming Water (m)		0	GW
Particulate Concentration in Air (ug/m^3)		0.76	P-O
Building Type		Residential	V-I

Optional Sections

User-defined Chemicals

Note: user-defined chemicals should be named in this section before being selected in the 'Contaminant Concentrations' table above

Enter all applicable and appropriate toxicity benchmarks; values must be referenced and justified in the PQRA report.

	Chemical 1	Chemical 2	Chemical 3
Name			
CAS Number			
Chemical class (organic/inorganic)			
Tolerable daily intake (mg/kg/d) - infant			
Tolerable daily intake (mg/kg/d) - toddler			
Tolerable daily intake (mg/kg/d) - child			
Tolerable daily intake (mg/kg/d) - teen			
Tolerable daily intake (mg/kg/d) - adult			
Tolerable concentration (mg/m^3)			
Oral slope factor (mg/kg/d)$^{-1}$			
Inhalation slope factor (mg/kg/d)$^{-1}$			
Inhalation unit risk (mg/m^3)$^{-1}$			
Relative dermal absorption factor			
Organic carbon partitioning coefficient (mL/g) - Koc			
Log Kow (unitless)			
Henry's Law constant at 25°C (unitless) - H'			
Henry's Law constant at 25°C (atm-m3/mol) - H			
Water Solubility at 25°C (mg/L)			
Molecular Weight (g/mol)			
Vapour Pressure at 25°C (atm)			

Note: values in grayed cells will not be used; Health Canada default values are applied.

User-defined Receptor

Name		Defaults
Age group		Toddler
Body weight (kg)		16.5
Soil ingestion rate (g/d)		0.08
Inhalation rate (m^3/d)		9.3
Water ingestion rate (L/d)		0.6
Skin surface area (cm^2)		
- hands		430
- arms		890
- legs		1690
- total		6130
Soil loading to exposed skin (g/cm^2/event)		
- hands		0.0001
- surfaces other than hands		0.00001
Food ingestion (g/d)		
- root vegetables		105
- other vegetables		67
- fish		95
- wild game		85
Evaluate Cancer Risks (Yes/No)?		No

User-defined Land-Use / Exposure Scenario

Scenario name	User-Defined	Defaults
Hours per day (indoors)	0	22.5
Hours per day (outdoors)	8	1.5
Days per week	3	7
Weeks per year	12	52
Dermal exposure events/day		1
Water contact events per day		1
Duration of water contact event (h)		1
Days/year contaminated food ingestion	90	365
Exposure duration (years)		60
Years for carcinogen amortization		60

SUMMARY OF PQRA RESULTS Version: March 16, 2009

User Name: **Site:**
Proponent: **File #:**
Date: **Comment:**

		Maximum Hazard/Risk Estimates					
		F1	**F2**	**F3**	**Benzene**		
Hazard Quotient - Oral/Dermal		6.03E-04	8.04E-03	6.14E-02	NA	NA	NA
Hazard Quotient - Inhalation		6.36E-04	3.01E-03	1.54E-06	NA	NA	NA
Hazard Index - Total		1.24E-03	1.10E-02	6.14E-02	NA	NA	NA
Target Hazard Index:	0.5						
Cancer Risk - Oral		NA	NA	NA	2.53E-10	NA	NA
Cancer Risk - Dermal		NA	NA	NA	6.49E-11	NA	NA
Cancer Risk - Oral + Dermal		NA	NA	NA	3.18E-10	NA	NA
Cancer Risk - Inhalation		NA	NA	NA	3.20E-08	NA	NA
Cancer Risk - Total		NA	NA	NA	3.23E-08	NA	NA
Target Cancer Risk:	1.00E-05						

	Critical Receptors					
	F1	**F2**	**F3**	**Benzene**		
Oral/Dermal - non-cancer effects	Toddler	Toddler	Toddler	NA	NA	NA
Inhalation - non-cancer effects	All Age Groups	All Age Groups	Toddler	NA	NA	NA
Total - non-cancer effects	Toddler	Toddler	Toddler	NA	NA	NA
Oral - cancer effects	NA	NA	NA	Adult	NA	NA
Dermal - cancer effects	NA	NA	NA	Adult	NA	NA
Oral + Dermal - cancer effects	NA	NA	NA	Adult	NA	NA
Inhalation - cancer effects	NA	NA	NA	Adult	NA	NA
Total - cancer effects	NA	NA	NA	Adult	NA	NA
Source of indoor air vapours	Soil	Soil	NA	Soil	NA	NA
Model used for vapour transport	Health Canada	Health Canada	NA	Health Canada	NA	NA

Key Calculated Model Parameters						
Vapour Intrusion Model Parameters	Note: parameters show as "NA" if relevant exposure pathways are inoperative or if user-input concentration is used instead of modelled value					
Qsoil/Qbuilding	NA	NA	NA	NA	NA	NA
Soil alpha	NA	NA	NA	NA	NA	NA
Groundwater alpha	NA	NA	NA	NA	NA	NA
Groundwater model dilution factors						
DF1 (soil to leachate)	2.97E+01	8.68E+01	2.35E+04	4.99E-01	NA	NA
DF2 (leachate at source to water table):	1.00E+00	1.00E+00	1.00E+00	1.00E+00	NA	NA
DF3 (leachate at water table to groundwater):	3.36E+00	3.36E+00	3.36E+00	3.36E+00	NA	NA
DF4 (source to receptor) - drinking water:	NA	NA	NA	NA	NA	NA
DF4 (source to receptor) - bathing/swimming water:	NA	NA	NA	NA	NA	NA

Notes/Comments

Vapour Intrusion Model

Chemical Interactions
All chemicals of concern present at the site should be evaluated for potential additive effects based on target organs and mechanisms of effect.

Concentration Checks

Precluding Conditions
NAPL present at site may invalidate groundwater or vapour transport modelling

Other Notes

Food ingestion pathway is operative; concentrations in food must be specified

HEALTH CANADA PQRA SPREADSHEET Version: March 16, 2009
OUTPUT SHEET - TODDLER

User Name: **Site:**
Proponent: **File #:**
Date: **Comment:**

Exposure Scenario: **User-Defined**
Native population considered

Chemical Properties	Units	F1	F2	F3	Benzene		
Tolerable daily intake	mg/kg/d	NA	NA	NA	NA	NA	NA
Tolerable concentration	mg/m^3	NA	NA	NA	NA	NA	NA
Relative dermal absorption factor	unitless	0.2	0.2	0.2	0.03	1	1

Chemical Concentrations	Units	F1	F2	F3	Benzene		
Soil	mg/kg	1.80E+02	1.10E+03	1.55E+04	4.00E-02	0.00E+00	0.00E+00
Drinking water	mg/L	NA	NA	NA	NA	NA	NA
Bathing/swimming water	mg/L	NA	NA	NA	NA	NA	NA
Indoor air vapours	mg/m^3	NA	NA	NA	NA	NA	NA
Outdoor air vapours	mg/m^3	3.08E-02	6.98E-02	0.00E+00	2.94E-04	0.00E+00	0.00E+00
Outdoor air particulate	mg/m^3	1.13E-07	8.30E-07	0.00E+00	2.42E-11	0.00E+00	0.00E+00
Amortized total air concentration	mg/m^3	1.01E-03	2.30E-03	0.00E+00	9.68E-06	0.00E+00	0.00E+00
Root vegetables	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Other vegetables	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Fish	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Wild game	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated

RESULTS

	Exposure (mg/kg/d)					
	F1	F2	F3	Benzene		
Inadvertent ingestion of contaminated soil	8.63E-05	5.27E-04	7.41E-03	1.92E-08	0.00E+00	0.00E+00
Inhalation of contaminated soil particles	2.11E-09	1.54E-08	0.00E+00	4.50E-13	0.00E+00	0.00E+00
Inhalation of contaminant vapours - indoor	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inhalation of contaminant vapours - outdoor	5.72E-04	1.30E-03	0.00E+00	5.46E-06	0.00E+00	0.00E+00
Ingestion of contaminated drinking water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dermal contact with contaminated soil	1.48E-05	9.07E-05	1.27E-03	4.95E-10	0.00E+00	0.00E+00
Dermal contact with water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ingestion of contaminated food	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total ingestion exposure	8.63E-05	5.27E-04	7.41E-03	1.92E-08	0.00E+00	0.00E+00
Total dermal exposure	1.48E-05	9.07E-05	1.27E-03	4.95E-10	0.00E+00	0.00E+00
Ingestion + dermal exposure	1.01E-04	6.18E-04	8.69E-03	1.97E-08	0.00E+00	0.00E+00
Total inhalation exposure	5.72E-04	1.30E-03	0.00E+00	5.46E-06	0.00E+00	0.00E+00
Total Exposure (all pathways)	6.73E-04	1.92E-03	8.69E-03	5.48E-06	0.00E+00	0.00E+00

	Hazard/Risk Estimates					
	F1	F2	F3	Benzene		
Hazard Quotient - Oral/Dermal	6.03E-04	8.04E-03	6.14E-02	NA	NA	NA
Hazard Quotient - Inhalation	6.36E-04	3.01E-03	1.54E-06	NA	NA	NA
Hazard Index - Total	1.24E-03	1.10E-02	6.14E-02	NA	NA	NA
Target Hazard Index: 0.5						

HEALTH CANADA PQRA SPREADSHEET Version: March 16, 2009
OUTPUT SHEET - ADULT

User Name: **Site:**
Proponent: **File #:**
Date: **Comment:**

Exposure Scenario: **User-Defined**
Native population considered

Chemical Properties	Units	F1	F2	F3	Benzene		
Tolerable daily intake	mg/kg/d	NA	NA	NA	NA	NA	NA
Tolerable concentration	mg/m^3	NA	NA	NA	NA	NA	NA
Oral slope factor	$(mg/kg/d)^{-1}$	NA	NA	NA	0.226	NA	NA
Inhalation slope factor	$(mg/kg/d)^{-1}$	NA	NA	NA	0.0146	NA	NA
Inhalation unit risk	$(mg/m^3)^{-1}$	NA	NA	NA	0.0033	NA	NA
Dermal slope factor	$(mg/kg/d)^{-1}$	NA	NA	NA	NA	NA	NA
Critical oral exposure benchmark		NA	NA	NA	slope factor	NA	NA
Critical inhalation exposure benchmark		NA	NA	NA	unit risk	NA	NA
Relative dermal absorption factor	unitless	0.2	0.2	0.2	0.03	1	1

Chemical Concentrations	Units	F1	F2	F3	Benzene		
Soil	mg/kg	1.80E+02	1.10E+03	1.55E+04	4.00E-02	0.00E+00	0.00E+00
Drinking water	mg/L	NA	NA	NA	NA	NA	NA
Bathing/swimming water	mg/L	NA	NA	NA	NA	NA	NA
Indoor air vapours	mg/m^3	NA	NA	NA	NA	NA	NA
Outdoor air vapours	mg/m^3	3.08E-02	6.98E-02	0.00E+00	2.94E-04	0.00E+00	0.00E+00
Outdoor air particulate	mg/m^3	1.13E-07	8.30E-07	0.00E+00	2.42E-11	0.00E+00	0.00E+00
Amortized total air concentration	mg/m^3	1.01E-03	2.30E-03	0.00E+00	9.68E-06	0.00E+00	0.00E+00
Root vegetables	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Other vegetables	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Fish	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Wild game	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated

RESULTS

	Exposure (mg/kg/d)					
	F1	F2	F3	Benzene		
Inadvertent ingestion of contaminated soil	5.04E-06	3.08E-05	4.32E-04	1.12E-09	0.00E+00	0.00E+00
Inhalation of contaminated soil particles	8.36E-10	6.12E-09	0.00E+00	1.78E-13	0.00E+00	0.00E+00
Inhalation of contaminant vapours - indoor	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inhalation of contaminant vapours - outdoor	2.27E-04	5.14E-04	0.00E+00	2.16E-06	0.00E+00	0.00E+00
Ingestion of contaminated drinking water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dermal contact with contaminated soil	8.62E-06	5.27E-05	7.40E-04	2.87E-10	0.00E+00	0.00E+00
Dermal contact with water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ingestion of contaminated food	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total ingestion exposure	5.04E-06	3.08E-05	4.32E-04	1.12E-09	0.00E+00	0.00E+00
Total dermal exposure	8.62E-06	5.27E-05	7.40E-04	2.87E-10	0.00E+00	0.00E+00
Ingestion + dermal exposure	1.37E-05	8.35E-05	1.17E-03	1.41E-09	0.00E+00	0.00E+00
Total inhalation exposure	2.27E-04	5.14E-04	0.00E+00	2.16E-06	0.00E+00	0.00E+00
Total Exposure (all pathways)	2.40E-04	5.98E-04	1.17E-03	2.17E-06	0.00E+00	0.00E+00

		Hazard/Risk Estimates					
		F1	F2	F3	Benzene		
Hazard Quotient - Oral/Dermal		8.14E-05	1.09E-03	8.29E-03	NA	NA	NA
Hazard Quotient - Inhalation		6.36E-04	3.01E-03	6.11E-07	NA	NA	NA
Hazard Index - Total		7.18E-04	4.09E-03	8.29E-03	NA	NA	NA
Target Hazard Index:	0.5						
Cancer Risk - Oral		NA	NA	NA	2.53E-10	NA	NA
Cancer Risk - Dermal		NA	NA	NA	6.49E-11	NA	NA
Cancer Risk - Oral + Dermal		NA	NA	NA	3.18E-10	NA	NA
Cancer Risk - Inhalation		NA	NA	NA	3.20E-08	NA	NA
Cancer Risk - Total		NA	NA	NA	3.23E-08	NA	NA
Target Cancer Risk:	1.00E-05						

HEALTH CANADA PQRA SPREADSHEET
USER INPUT SHEET

User Name:		Site:	
Proponent:		File #:	
Date:		Comment:	

PROBLEM FORMULATION

Potential Land Uses (Yes/No)		Default
Agricultural	No	Yes
Residential/urban parkland		Yes
Commercial	No	Yes
Industrial	No	Yes
Occupational - outdoors	No	Yes
Recreational	Yes	Yes
Other		No
specify:		

Operative Pathways (Yes/No)		Default
Inadvertent ingestion of soil		Yes
Inhalation of soil particles		Yes
Inhalation of indoor contaminant vapours	No	Yes
Inhalation of outdoor contaminant vapours		Yes
Ingestion of drinking water	No	Yes
Dermal contact with soil		Yes
Dermal contact with water	No	Yes
Ingestion of contaminated food	Yes	No

Exposure Scenario	User-Defined	Residential

Vapour Transport Modelling		
Vapour source for exposure calculations		Most Conservative

Receptor Groups (Yes/No)		Default
General public or residents	Yes	Yes
Employees		Yes
Canadian native communities	Yes	No
Other		No
specify:		

Active Critical Receptors (Yes/No)		Default
Infant	No	Yes
Toddler		Yes
Child	No	Yes
Teen	No	Yes
Adult	Yes	Yes
Other		No
specify:		

Contaminant Concentrations

Chemical Name	required	Bromoform	Tetrachloroethane, 1,1,1,2-	Vinyl chloride			
Soil (mg/kg)	required	0.05	0.05	0.1			
Groundwater - source (mg/L)	optional						
Drinking water (mg/L)	optional						
Bathing/swimming water (mg/L)	optional						
Indoor air - vapours (mg/m^3)	optional						
Outdoor air - vapours (mg/m^3)	optional						
Outdoor air - particulate (mg/m^3)	optional						
Root vegetables (mg/kg wet weight)	optional						
Other vegetables (mg/kg wet weight)	optional						
Fish (mg/kg wet weight)	optional						
Wild game (mg/kg wet weight)	optional						

Risk Assessment Endpoints		Default
Acceptable hazard index:		0.2
Acceptable cancer risk:		1.00E-05

Precluding Conditions for Fate and Transport Models

Are non-aqueous phase liquids (NAPL) present?	No
Is groundwater contamination present in fractured bedrock?	No
Is groundwater contamination migrating through a confined aquifer?	No
Is there active pumping or drawdown of groundwater at the site?	No
Is contamination present within 1 m of building foundation?	No
Do any buildings within 5 m of contamination have earthen foundations?	No
Are any buildings constructed on very high permeability media?	No
Are there preferential vapour flow pathways connecting contamination to a building?	No

Fate and Transport Model Input

	Value	Default	Models Affected
Soil Type		coarse-grained	PS, V-I, V-O, GW
Significant vehicle traffic on unpaved roads?		No	P-O
Site Characteristics			
Depth to Groundwater (m)		3	GW, V-O
Depth from Surface to Contamination (m)		0	GW, V-O
Distance - Contaminated Soil to Building (m)		1	V-I
Distance - Contaminated GW to Building (m)		1	V-I
Distance to potable water user (m)		0	GW
Distance to Bathing/Swimming Water (m)		0	GW
Particulate Concentration in Air (ug/m^3)		0.76	P-O
Building Type		Residential	V-I

Optional Sections

User-defined Chemicals

Note: user-defined chemicals should be named in this section before being selected in the 'Contaminant Concentrations' table above

Enter all applicable and appropriate toxicity benchmarks; values must be referenced and justified in the PQRA report.

	Chemical 1		Chemical 2		Chemical 3
Name	Bromoform	*Health Canada values*	Tetrachloroethane, 1,1,1,2-	*Health Canada values*	
CAS Number		75-25-2		630-20-6	
Chemical class (organic/inorganic)		organic		organic	
Tolerable daily intake (mg/kg/d) - infant					
Tolerable daily intake (mg/kg/d) - toddler	2.00E-02		3.00E-02		
Tolerable daily intake (mg/kg/d) - child					
Tolerable daily intake (mg/kg/d) - teen					
Tolerable daily intake (mg/kg/d) - adult	2.00E-02		3.00E-02		
Tolerable concentration (mg/m^3)					
Oral slope factor (mg/kg/d)$^{-1}$					
Inhalation slope factor (mg/kg/d)$^{-1}$					
Inhalation unit risk (mg/m^3)$^{-1}$					
Relative dermal absorption factor		0.03			
Organic carbon partitioning coefficient (mL/g) - Koc		117.4897555		116	
Log Kow (unitless)		2.38		3.03	
Henry's Law constant at 25°C (unitless) - H'		0.023909209		0.099961229	
Henry's Law constant at 25°C (atm-m3/mol) - H		0.000584949		0.002445596	
Water Solubility at 25°C (mg/L)		3100		1070	
Molecular Weight (g/mol)		252.731		167.849	
Vapour Pressure at 25°C (atm)		0.007174932		0.015593388	

Note: values in grayed cells will not be used; Health Canada default values are applied.

User-defined Receptor

Name		Defaults
Age group		Toddler
Body weight (kg)		16.5
Soil ingestion rate (g/d)		0.08
Inhalation rate (m^3/d)		9.3
Water ingestion rate (L/d)		0.6
Skin surface area (cm^2)		
- hands		430
- arms		890
- legs		1690
- total		6130
Soil loading to exposed skin (g/cm^2/event)		
- hands		0.0001
- surfaces other than hands		0.00001
Food ingestion (g/d)		
- root vegetables		105
- other vegetables		67
- fish		95
- wild game		85
Evaluate Cancer Risks (Yes/No)?		No

User-defined Land-Use / Exposure Scenario

Scenario name	User-Defined	Defaults
Hours per day (indoors)	0	22.5
Hours per day (outdoors)	8	1.5
Days per week	3	7
Weeks per year	12	52
Dermal exposure events/day		1
Water contact events per day		1
Duration of water contact event (h)		1
Days/year contaminated food ingestion		365
Exposure duration (years)		60
Years for carcinogen amortization		60

SUMMARY OF PQRA RESULTS Version: March 16, 2009

User Name: **Site:**
Proponent: **File #:**
Date: **Comment:**

		Maximum Hazard/Risk Estimates					
		Bromoform	**Tetrachloroethane, 1,1,1,2-**	**Vinyl chloride**			
Hazard Quotient - Oral/Dermal		1.23E-06	1.49E-06	NA	NA	NA	NA
Hazard Quotient - Inhalation		4.16E-06	5.59E-05	NA	NA	NA	NA
Hazard Index - Total		5.39E-06	5.74E-05	NA	NA	NA	NA
Target Hazard Index:	0.2						
Cancer Risk - Oral		NA	NA	7.27E-10	NA	NA	NA
Cancer Risk - Dermal		NA	NA	1.87E-10	NA	NA	NA
Cancer Risk - Oral + Dermal		NA	NA	9.14E-10	NA	NA	NA
Cancer Risk - Inhalation		NA	NA	1.16E-04	NA	NA	NA
Cancer Risk - Total		NA	NA	1.16E-04	NA	NA	NA
Target Cancer Risk:	1.00E-05			**Target Cancer Risk Exceeded**			

		Critical Receptors					
		Bromoform	**Tetrachloroethane, 1,1,1,2-**	**Vinyl chloride**			
Oral/Dermal - non-cancer effects		Toddler	Toddler	NA	NA	NA	NA
Inhalation - non-cancer effects		Toddler	Toddler	NA	NA	NA	NA
Total - non-cancer effects		Toddler	Toddler	NA	NA	NA	NA
Oral - cancer effects		NA	NA	Adult	NA	NA	NA
Dermal - cancer effects		NA	NA	Adult	NA	NA	NA
Oral + Dermal - cancer effects		NA	NA	Adult	NA	NA	NA
Inhalation - cancer effects		NA	NA	Adult	NA	NA	NA
Total - cancer effects		NA	NA	Adult	NA	NA	NA
Source of indoor air vapours		Soil	Soil	Soil	NA	NA	NA
Model used for vapour transport		Health Canada	Health Canada	Health Canada	NA	NA	NA

Key Calculated Model Parameters							
Vapour Intrusion Model Parameters	Note: parameters show as "NA" if relevant exposure pathways are inoperative or if user-input concentration is used instead of modelled value						
Qsoil/Qbuilding		NA	NA	NA	NA	NA	NA
Soil alpha		NA	NA	NA	NA	NA	NA
Groundwater alpha		NA	NA	NA	NA	NA	NA
Groundwater model dilution factors							
DF1 (soil to leachate)		6.61E-01	6.64E-01	6.10E-01	NA	NA	NA
DF2 (leachate at source to water table):		1.00E+00	1.00E+00	1.00E+00	NA	NA	NA
DF3 (leachate at water table to groundwater):		3.36E+00	3.36E+00	3.36E+00	NA	NA	NA
DF4 (source to receptor) - drinking water:		NA	NA	NA	NA	NA	NA
DF4 (source to receptor) - bathing/swimming water:		NA	NA	NA	NA	NA	NA

Notes/Comments

Vapour Intrusion Model

Chemical Interactions

All chemicals of concern present at the site should be evaluated for potential additive effects based on target organs and mechanisms of effect.

Concentration Checks

Precluding Conditions

Other Notes

Food ingestion pathway is operative; concentrations in food must be specified

HEALTH CANADA PQRA SPREADSHEET Version: March 16, 2009
OUTPUT SHEET - TODDLER

User Name: **Site:**
Proponent: **File #:**
Date: **Comment:**

Exposure Scenario: **User-Defined**
Native population considered

Chemical Properties	Units	Bromoform	Tetrachloroethane, 1,1,1,2-	Vinyl chloride			
Tolerable daily intake	mg/kg/d	0.02	0.03	NA	NA	NA	NA
Tolerable concentration	mg/m^3	NA	NA	NA	NA	NA	NA
Relative dermal absorption factor	unitless	0.03	1	0.03	1	1	1

Chemical Concentrations	Units	Bromoform	Tetrachloroethane, 1,1,1,2-	Vinyl chloride			
Soil	mg/kg	5.00E-02	5.00E-02	1.00E-01	0.00E+00	0.00E+00	0.00E+00
Drinking water	mg/L	NA	NA	NA	NA	NA	NA
Bathing/swimming water	mg/L	NA	NA	NA	NA	NA	NA
Indoor air vapours	mg/m^3	NA	NA	NA	NA	NA	NA
Outdoor air vapours	mg/m^3	4.47E-06	9.02E-05	6.04E-02	0.00E+00	0.00E+00	0.00E+00
Outdoor air particulate	mg/m^3	3.38E-11	3.32E-11	1.04E-11	0.00E+00	0.00E+00	0.00E+00
Amortized total air concentration	mg/m^3	1.47E-07	2.98E-06	1.99E-03	0.00E+00	0.00E+00	0.00E+00
Root vegetables	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Other vegetables	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Fish	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Wild game	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated

RESULTS

	Exposure (mg/kg/d)					
	Bromoform	Tetrachloroethane, 1,1,1,2-	Vinyl chloride			
Inadvertent ingestion of contaminated soil	2.40E-08	2.40E-08	4.80E-08	0.00E+00	0.00E+00	0.00E+00
Inhalation of contaminated soil particles	6.28E-13	6.17E-13	1.94E-13	0.00E+00	0.00E+00	0.00E+00
Inhalation of contaminant vapours - indoor	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inhalation of contaminant vapours - outdoor	8.31E-08	1.68E-06	1.12E-03	0.00E+00	0.00E+00	0.00E+00
Ingestion of contaminated drinking water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dermal contact with contaminated soil	6.19E-10	2.06E-08	1.24E-09	0.00E+00	0.00E+00	0.00E+00
Dermal contact with water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ingestion of contaminated food	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total ingestion exposure	2.40E-08	2.40E-08	4.80E-08	0.00E+00	0.00E+00	0.00E+00
Total dermal exposure	6.19E-10	2.06E-08	1.24E-09	0.00E+00	0.00E+00	0.00E+00
Ingestion + dermal exposure	2.46E-08	4.46E-08	4.92E-08	0.00E+00	0.00E+00	0.00E+00
Total inhalation exposure	8.31E-08	1.68E-06	1.12E-03	0.00E+00	0.00E+00	0.00E+00
Total Exposure (all pathways)	1.08E-07	1.72E-06	1.12E-03	0.00E+00	0.00E+00	0.00E+00

	Hazard/Risk Estimates					
	Bromoform	Tetrachloroethane, 1,1,1,2-	Vinyl chloride			
Hazard Quotient - Oral/Dermal	1.23E-06	1.49E-06	NA	NA	NA	NA
Hazard Quotient - Inhalation	4.16E-06	5.59E-05	NA	NA	NA	NA
Hazard Index - Total	5.39E-06	5.74E-05	NA	NA	NA	NA
Target Hazard Index: 0.2						

HEALTH CANADA PQRA SPREADSHEET Version: March 16, 2009
OUTPUT SHEET - ADULT

User Name: **Site:**
Proponent: **File #:**
Date: **Comment:**

Exposure Scenario: **User-Defined**
Native population considered

Chemical Properties	**Units**	**Bromoform**	**Tetrachloroethane, 1,1,1,2-**	**Vinyl chloride**			
Tolerable daily intake	mg/kg/d	0.02	0.03	NA	NA	NA	NA
Tolerable concentration	mg/m^3	NA	NA	NA	NA	NA	NA
Oral slope factor	$(mg/kg/d)^{-1}$	NA	NA	0.26	NA	NA	NA
Inhalation slope factor	$(mg/kg/d)^{-1}$	NA	NA	0.26	NA	NA	NA
Inhalation unit risk	$(mg/m^3)^{-1}$	NA	NA	NA	NA	NA	NA
Dermal slope factor	$(mg/kg/d)^{-1}$	NA	NA	NA	NA	NA	NA
Critical oral exposure benchmark		TDI	TDI	slope factor	NA	NA	NA
Critical inhalation exposure benchmark		NA	NA	slope factor	NA	NA	NA
Relative dermal absorption factor	unitless	0.03	1	0.03	1	1	1
				oral SF used for inhalation			

Chemical Concentrations	**Units**	**Bromoform**	**Tetrachloroethane, 1,1,1,2-**	**Vinyl chloride**			
Soil	mg/kg	5.00E-02	5.00E-02	1.00E-01	0.00E+00	0.00E+00	0.00E+00
Drinking water	mg/L	NA	NA	NA	NA	NA	NA
Bathing/swimming water	mg/L	NA	NA	NA	NA	NA	NA
Indoor air vapours	mg/m^3	NA	NA	NA	NA	NA	NA
Outdoor air vapours	mg/m^3	4.47E-06	9.02E-05	6.04E-02	0.00E+00	0.00E+00	0.00E+00
Outdoor air particulate	mg/m^3	3.38E-11	3.32E-11	1.04E-11	0.00E+00	0.00E+00	0.00E+00
Amortized total air concentration	mg/m^3	1.47E-07	2.98E-06	1.99E-03	0.00E+00	0.00E+00	0.00E+00
Root vegetables	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Other vegetables	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Fish	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated
Wild game	mg/kg wet wt	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated	not evaluated

RESULTS

	Exposure (mg/kg/d)					
	Bromoform	**Tetrachloroethane, 1,1,1,2-**	**Vinyl chloride**			
Inadvertent ingestion of contaminated soil	1.40E-09	1.40E-09	2.80E-09	0.00E+00	0.00E+00	0.00E+00
Inhalation of contaminated soil particles	2.49E-13	2.45E-13	7.69E-14	0.00E+00	0.00E+00	0.00E+00
Inhalation of contaminant vapours - indoor	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Inhalation of contaminant vapours - outdoor	3.30E-08	6.65E-07	4.45E-04	0.00E+00	0.00E+00	0.00E+00
Ingestion of contaminated drinking water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dermal contact with contaminated soil	3.59E-10	1.20E-08	7.18E-10	0.00E+00	0.00E+00	0.00E+00
Dermal contact with water	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Ingestion of contaminated food	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total ingestion exposure	1.40E-09	1.40E-09	2.80E-09	0.00E+00	0.00E+00	0.00E+00
Total dermal exposure	3.59E-10	1.20E-08	7.18E-10	0.00E+00	0.00E+00	0.00E+00
Ingestion + dermal exposure	1.76E-09	1.34E-08	3.52E-09	0.00E+00	0.00E+00	0.00E+00
Total inhalation exposure	3.30E-08	6.65E-07	4.45E-04	0.00E+00	0.00E+00	0.00E+00
Total Exposure (all pathways)	3.47E-08	6.78E-07	4.45E-04	0.00E+00	0.00E+00	0.00E+00

		Hazard/Risk Estimates					
		Bromoform	**Tetrachloroethane, 1,1,1,2-**	**Vinyl chloride**			
Hazard Quotient - Oral/Dermal		8.79E-08	4.46E-07	NA	NA	NA	NA
Hazard Quotient - Inhalation		1.65E-06	2.22E-05	NA	NA	NA	NA
Hazard Index - Total		1.74E-06	2.26E-05	NA	NA	NA	NA
Target Hazard Index:	0.2						
Cancer Risk - Oral		NA	NA	7.27E-10	NA	NA	NA
Cancer Risk - Dermal		NA	NA	1.87E-10	NA	NA	NA
Cancer Risk - Oral + Dermal		NA	NA	9.14E-10	NA	NA	NA
Cancer Risk - Inhalation		NA	NA	1.16E-04	NA	NA	NA
Cancer Risk - Total		NA	NA	1.16E-04	NA	NA	NA
Target Cancer Risk:	1.00E-05			**Target Cancer Risk Exceeded**			

APPENDIX C

Calculation of 95% Upper Confidence Limits of the Mean (UCLM)
(ProUCL print-outs)

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Z:\Projects\2009\1584-0901 TC Iqaluit Landfill\SSRA\COC tables\95UCL\soil\soil-inorganic.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	8

Raw Statistics

Minimum	2600
Maximum	5100
Mean	4357
Median	4700
SD	676.8
Coefficient of Variation	0.155
Skewness	-1.487

Log-transformed Statistics

Minimum of Log Data	7.863
Maximum of Log Data	8.537
Mean of log Data	8.366
SD of log Data	0.178

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.839
Shapiro Wilk Critical Value	0.874

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.781
Shapiro Wilk Critical Value	0.874

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	4677

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	4578
95% Modified-t UCL	4665

Assuming Lognormal Distribution

95% H-UCL	4776
95% Chebyshev (MVUE) UCL	5274
97.5% Chebyshev (MVUE) UCL	5668
99% Chebyshev (MVUE) UCL	6442

Gamma Distribution Test

k star (bias corrected)	29.43
Theta Star	148.1
nu star	824
Approximate Chi Square Value (.05)	758.4
Adjusted Level of Significance	0.0312
Adjusted Chi Square Value	750
Anderson-Darling Test Statistic	1.061
Anderson-Darling 5% Critical Value	0.733
Kolmogorov-Smirnov Test Statistic	0.271
Kolmogorov-Smirnov 5% Critical Value	0.228

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	4734
95% Adjusted Gamma UCL	4787

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	4655
95% Jackknife UCL	4677
95% Standard Bootstrap UCL	4635
95% Bootstrap-t UCL	4621
95% Hall's Bootstrap UCL	4597
95% Percentile Bootstrap UCL	4621
95% BCA Bootstrap UCL	4600
95% Chebyshev(Mean, Sd) UCL	5146
97.5% Chebyshev(Mean, Sd) UCL	5487
99% Chebyshev(Mean, Sd) UCL	6157

Potential UCL to Use

Use 95% Student's-t UCL 4677

or 95% Modified-t UCL 4665

Antimony

General Statistics

Number of Valid Data	38	Number of Detected Data	28
Number of Distinct Detected Data	5	Number of Non-Detect Data	10
		Percent Non-Detects	26.32%

Raw Statistics

Minimum Detected	0.8
Maximum Detected	10
Mean of Detected	8.743
SD of Detected	3.141
Minimum Non-Detect	0.2
Maximum Non-Detect	0.2

Log-transformed Statistics

Minimum Detected	-0.223
Maximum Detected	2.303
Mean of Detected	1.99
SD of Detected	0.791
Minimum Non-Detect	-1.609
Maximum Non-Detect	-1.609

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.426
5% Shapiro Wilk Critical Value	0.924

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.436
5% Shapiro Wilk Critical Value	0.924

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	6.468
SD	4.699
95% DL/2 (t) UCL	7.754
Maximum Likelihood Estimate(MLE) Method	
Mean	5.634
SD	6.006
95% MLE (t) UCL	7.278
95% MLE (Tiku) UCL	7.41

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	0.86
SD	2.031
95% H-Stat (DL/2) UCL	53.01
Log ROS Method	
Mean in Log Scale	1.718
SD in Log Scale	0.828
Mean in Original Scale	7.147
SD in Original Scale	3.824
95% Percentile Bootstrap UCL	8.13
95% BCA Bootstrap UCL	8.05

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	2.669
Theta Star	3.276
nu star	149.5
A-D Test Statistic	8.325
5% A-D Critical Value	0.754
K-S Test Statistic	0.754
5% K-S Critical Value	0.167

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.8
Maximum	10
Mean	8.062
Median	10
SD	2.993
k star	3.26
Theta star	2.473

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	6.653
SD	4.387
SE of Mean	0.725
95% KM (t) UCL	7.875
95% KM (z) UCL	7.845
95% KM (jackknife) UCL	7.854
95% KM (bootstrap t) UCL	7.84
95% KM (BCA) UCL	7.895
95% KM (Percentile Bootstrap) UCL	7.895
95% KM (Chebyshev) UCL	9.811
97.5% KM (Chebyshev) UCL	11.18
99% KM (Chebyshev) UCL	13.86

Nu star	247.8
AppChi2	212.3
95% Gamma Approximate UCL	9.408
95% Adjusted Gamma UCL	9.468

Potential UCLs to Use

95% KM (BCA) UCL	7.895

Note: DL/2 is not a recommended method.

Arsenic

General Statistics

Number of Valid Data	38	Number of Detected Data	31
Number of Distinct Detected Data	3	Number of Non-Detect Data	7
		Percent Non-Detects	18.42%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	2	Minimum Detected	0.693
Maximum Detected	5.3	Maximum Detected	1.668
Mean of Detected	4.332	Mean of Detected	1.404
SD of Detected	1.282	SD of Detected	0.391
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.536	Shapiro Wilk Test Statistic	0.529
5% Shapiro Wilk Critical Value	0.929	5% Shapiro Wilk Critical Value	0.929
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	3.626	Mean	1.018
SD	1.897	SD	0.896
95% DL/2 (t) UCL	4.145	95% H-Stat (DL/2) UCL	5.648
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	3.535	Mean in Log Scale	1.29
SD	2.06	SD in Log Scale	0.431
95% MLE (t) UCL	4.099	Mean in Original Scale	3.94
95% MLE (Tiku) UCL	4.131	SD in Original Scale	1.429
		95% Percentile Bootstrap UCL	4.319
		95% BCA Bootstrap UCL	4.279

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	7.491	Data do not follow a Discernable Distribution (0.05)
Theta Star	0.578	
nu star	464.5	

A-D Test Statistic	7.638
5% A-D Critical Value	0.746
K-S Test Statistic	0.746
5% K-S Critical Value	0.158

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1.584
Maximum	5.3
Mean	4.025
Median	5
SD	1.352
k star	6.607
Theta star	0.609
Nu star	502.1
AppChi2	451.2
95% Gamma Approximate UCL	4.48
95% Adjusted Gamma UCL	4.5

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	3.903
SD	1.454
SE of Mean	0.24
95% KM (t) UCL	4.307
95% KM (z) UCL	4.297
95% KM (jackknife) UCL	4.306
95% KM (bootstrap t) UCL	4.283
95% KM (BCA) UCL	4.289
95% KM (Percentile Bootstrap) UCL	4.297
95% KM (Chebyshev) UCL	4.948
97.5% KM (Chebyshev) UCL	5.4
99% KM (Chebyshev) UCL	6.288

Potential UCLs to Use

95% KM (Chebyshev) UCL	4.948

Barium

General Statistics

Number of Valid Observations	38	Number of Distinct Observations	34

Raw Statistics

Minimum	17
Maximum	425
Mean	44.56
Median	30.85
SD	66.22
Coefficient of Variation	1.486
Skewness	5.461

Log-transformed Statistics

Minimum of Log Data	2.833
Maximum of Log Data	6.052
Mean of log Data	3.513
SD of log Data	0.571

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.338
Shapiro Wilk Critical Value	0.938

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	62.68

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	72.39
95% Modified-t UCL	64.27

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.756
Shapiro Wilk Critical Value	0.938

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	47.48
95% Chebyshev (MVUE) UCL	56.15
97.5% Chebyshev (MVUE) UCL	63.44
99% Chebyshev (MVUE) UCL	77.75

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.78	Data do not follow a Discernable Distribution (0.05)	
Theta Star	25.03		
nu star	135.3		
Approximate Chi Square Value (.05)	109.4	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0434	95% CLT UCL	62.23
Adjusted Chi Square Value	108.4	95% Jackknife UCL	62.68
		95% Standard Bootstrap UCL	62.58
Anderson-Darling Test Statistic	4.745	95% Bootstrap-t UCL	139.9
Anderson-Darling 5% Critical Value	0.76	95% Hall's Bootstrap UCL	140.9
Kolmogorov-Smirnov Test Statistic	0.275	95% Percentile Bootstrap UCL	64.73
Kolmogorov-Smirnov 5% Critical Value	0.145	95% BCA Bootstrap UCL	77.46
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	91.38
		97.5% Chebyshev(Mean, Sd) UCL	111.6
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	151.4
95% Approximate Gamma UCL	55.09		
95% Adjusted Gamma UCL	55.58		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	91.38

Beryllium

General Statistics

Number of Valid Data	38	Number of Detected Data	26
Number of Distinct Detected Data	4	Number of Non-Detect Data	12
		Percent Non-Detects	31.58%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.3	Minimum Detected	-1.204
Maximum Detected	1.02	Maximum Detected	0.0198
Mean of Detected	0.516	Mean of Detected	-0.687
SD of Detected	0.131	SD of Detected	0.223
Minimum Non-Detect	0.2	Minimum Non-Detect	-1.609
Maximum Non-Detect	0.2	Maximum Non-Detect	-1.609

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.508	Shapiro Wilk Test Statistic	0.562
5% Shapiro Wilk Critical Value	0.92	5% Shapiro Wilk Critical Value	0.92
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.384
SD	0.223
95% DL/2 (t) UCL	0.446
Maximum Likelihood Estimate(MLE) Method	
Mean	0.369
SD	0.251
95% MLE (t) UCL	0.437
95% MLE (Tiku) UCL	0.444

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-1.197
SD	0.783
95% H-Stat (DL/2) UCL	0.527
Log ROS Method	
Mean in Log Scale	-0.808
SD in Log Scale	0.263
Mean in Original Scale	0.462
SD in Original Scale	0.136
95% Percentile Bootstrap UCL	0.499
95% BCA Bootstrap UCL	0.504

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	17.63
Theta Star	0.0293
nu star	916.9
A-D Test Statistic	6.076
5% A-D Critical Value	0.744
K-S Test Statistic	0.744
5% K-S Critical Value	0.171
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	0.3
Maximum	1.02
Mean	0.496
Median	0.5
SD	0.116
k star	21.4
Theta star	0.0232
Nu star	1626
AppChi2	1534
95% Gamma Approximate UCL	0.526
95% Adjusted Gamma UCL	0.527

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.448
SD	0.146
SE of Mean	0.0242
95% KM (t) UCL	0.488
95% KM (z) UCL	0.487
95% KM (jackknife) UCL	0.488
95% KM (bootstrap t) UCL	0.495
95% KM (BCA) UCL	0.529
95% KM (Percentile Bootstrap) UCL	0.521
95% KM (Chebyshev) UCL	0.553
97.5% KM (Chebyshev) UCL	0.598
99% KM (Chebyshev) UCL	0.688
Potential UCLs to Use	
95% KM (BCA) UCL	0.529

Cadmium

General Statistics

Number of Valid Data	38	Number of Detected Data	28
Number of Distinct Detected Data	10	Number of Non-Detect Data	10
		Percent Non-Detects	26.32%

Raw Statistics	
Minimum Detected	0.2
Maximum Detected	22.4
Mean of Detected	1.345
SD of Detected	4.133
Minimum Non-Detect	0.1
Maximum Non-Detect	0.1

Log-transformed Statistics	
Minimum Detected	-1.609
Maximum Detected	3.109
Mean of Detected	-0.494
SD of Detected	0.776
Minimum Non-Detect	-2.303
Maximum Non-Detect	-2.303

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.225
5% Shapiro Wilk Critical Value	0.924
Data not Normal at 5% Significance Level	

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.488
5% Shapiro Wilk Critical Value	0.924
Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	1.004
SD	3.577
95% DL/2 (t) UCL	1.983
Maximum Likelihood Estimate(MLE) Method	
Mean	0.13
SD	4.24
95% MLE (t) UCL	1.29
95% MLE (Tiku) UCL	1.307

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-1.152
SD	1.298
95% H-Stat (DL/2) UCL	1.126
Log ROS Method	
Mean in Log Scale	-0.836
SD in Log Scale	0.895
Mean in Original Scale	1.037
SD in Original Scale	3.569
95% Percentile Bootstrap UCL	2.184
95% BCA Bootstrap UCL	2.835

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.7
Theta Star	1.923
nu star	39.17
A-D Test Statistic	7.918
5% A-D Critical Value	0.784
K-S Test Statistic	0.784
5% K-S Critical Value	0.172

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	22.4
Mean	0.998
Median	0.5
SD	3.579
k star	0.163
Theta star	6.133
Nu star	12.37
AppChi2	5.469
95% Gamma Approximate UCL	2.257
95% Adjusted Gamma UCL	2.338

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	1.044
SD	3.52
SE of Mean	0.581
95% KM (t) UCL	2.025
95% KM (z) UCL	2
95% KM (jackknife) UCL	1.975
95% KM (bootstrap t) UCL	14.8
95% KM (BCA) UCL	2.777
95% KM (Percentile Bootstrap) UCL	2.222
95% KM (Chebyshev) UCL	3.578
97.5% KM (Chebyshev) UCL	4.675
99% KM (Chebyshev) UCL	6.829

Potential UCLs to Use

95% KM (BCA) UCL	2.777

Calcium

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	9

Raw Statistics		Log-transformed Statistics	
Minimum	1900	Minimum of Log Data	7.55
Maximum	7700	Maximum of Log Data	8.949
Mean	2650	Mean of log Data	7.808
Median	2300	SD of log Data	0.339
SD	1465		
Coefficient of Variation	0.553		
Skewness	3.636		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.417	Shapiro Wilk Test Statistic	0.536
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	3344	95% H-UCL	3123
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	3633
95% Adjusted-CLT UCL	3701	97.5% Chebyshev (MVUE) UCL	4082
95% Modified-t UCL	3407	99% Chebyshev (MVUE) UCL	4964

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	5.47	Data do not follow a Discernable Distribution (0.05)	
Theta Star	484.5		
nu star	153.1		
Approximate Chi Square Value (.05)	125.5	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	3294
Adjusted Chi Square Value	122.2	95% Jackknife UCL	3344
		95% Standard Bootstrap UCL	3282
Anderson-Darling Test Statistic	2.957	95% Bootstrap-t UCL	6708
Anderson-Darling 5% Critical Value	0.737	95% Hall's Bootstrap UCL	6636
Kolmogorov-Smirnov Test Statistic	0.398	95% Percentile Bootstrap UCL	3414
Kolmogorov-Smirnov 5% Critical Value	0.229	95% BCA Bootstrap UCL	3821
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	4357
		97.5% Chebyshev(Mean, Sd) UCL	5096
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	6547
95% Approximate Gamma UCL	3233		
95% Adjusted Gamma UCL	3320		

Potential UCL to Use	
Use 95% Student's-t UCL	3344
or 95% Modified-t UCL	3407

Chromium

General Statistics

Number of Valid Observations	38	Number of Distinct Observations	29

Raw Statistics		Log-transformed Statistics	
Minimum	6.4	Minimum of Log Data	1.856
Maximum	25.5	Maximum of Log Data	3.239
Mean	18.65	Mean of log Data	2.887
Median	19	SD of log Data	0.302
SD	4.684		
Coefficient of Variation	0.251		
Skewness	-0.649		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.952	Shapiro Wilk Test Statistic	0.872
Shapiro Wilk Critical Value	0.938	Shapiro Wilk Critical Value	0.938
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	19.93	95% H-UCL	20.51
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	22.83
95% Adjusted-CLT UCL	19.81	97.5% Chebyshev (MVUE) UCL	24.59
95% Modified-t UCL	19.92	99% Chebyshev (MVUE) UCL	28.06

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	12.09	Data appear Normal at 5% Significance Level	
Theta Star	1.543		
nu star	918.8		
Approximate Chi Square Value (.05)	849.5	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0434	95% CLT UCL	19.9
Adjusted Chi Square Value	846.7	95% Jackknife UCL	19.93
		95% Standard Bootstrap UCL	19.92
Anderson-Darling Test Statistic	0.905	95% Bootstrap-t UCL	19.84
Anderson-Darling 5% Critical Value	0.748	95% Hall's Bootstrap UCL	19.82
Kolmogorov-Smirnov Test Statistic	0.146	95% Percentile Bootstrap UCL	19.86
Kolmogorov-Smirnov 5% Critical Value	0.143	95% BCA Bootstrap UCL	19.85
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	21.96
		97.5% Chebyshev(Mean, Sd) UCL	23.39
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	26.21
95% Approximate Gamma UCL	20.17		
95% Adjusted Gamma UCL	20.24		

Potential UCL to Use			
		Use 95% Student's-t UCL	19.93

Chromium (VI)

General Statistics

Number of Valid Data	14	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	13
		Percent Non-Detects	92.86%

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

The data set for variable Chromium (VI) was not processed!

Cobalt

General Statistics

Number of Valid Observations	38	Number of Distinct Observations	23

Raw Statistics

Minimum	2.1
Maximum	5.9
Mean	3.629
Median	3.65
SD	0.963
Coefficient of Variation	0.265
Skewness	0.716

Log-transformed Statistics

Minimum of Log Data	0.742
Maximum of Log Data	1.775
Mean of log Data	1.256
SD of log Data	0.261

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.936
Shapiro Wilk Critical Value	0.938

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.968
Shapiro Wilk Critical Value	0.938

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	3.893

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	3.905
95% Modified-t UCL	3.896

Assuming Lognormal Distribution

95% H-UCL	3.916
95% Chebyshev (MVUE) UCL	4.306
97.5% Chebyshev (MVUE) UCL	4.6
99% Chebyshev (MVUE) UCL	5.176

Gamma Distribution Test

k star (bias corrected)	14.02
Theta Star	0.259
nu star	1066
Approximate Chi Square Value (.05)	991
Adjusted Level of Significance	0.0434
Adjusted Chi Square Value	988
Anderson-Darling Test Statistic	0.406
Anderson-Darling 5% Critical Value	0.747
Kolmogorov-Smirnov Test Statistic	0.106
Kolmogorov-Smirnov 5% Critical Value	0.143

Data appear Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	3.903
95% Adjusted Gamma UCL	3.915

Nonparametric Statistics

95% CLT UCL	3.886
95% Jackknife UCL	3.893
95% Standard Bootstrap UCL	3.87
95% Bootstrap-t UCL	3.929
95% Hall's Bootstrap UCL	3.904
95% Percentile Bootstrap UCL	3.887
95% BCA Bootstrap UCL	3.897
95% Chebyshev(Mean, Sd) UCL	4.31
97.5% Chebyshev(Mean, Sd) UCL	4.605
99% Chebyshev(Mean, Sd) UCL	5.184

Potential UCL to Use

Use 95% Approximate Gamma UCL 3.903

Copper

General Statistics

Number of Valid Observations	38	Number of Distinct Observations	32

Raw Statistics		Log-transformed Statistics	
Minimum	3.9	Minimum of Log Data	1.361
Maximum	103	Maximum of Log Data	4.635
Mean	16.86	Mean of log Data	2.351
Median	7.9	SD of log Data	0.846
SD	23.61		
Coefficient of Variation	1.4		
Skewness	2.893		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.535	Shapiro Wilk Test Statistic	0.849
Shapiro Wilk Critical Value	0.938	Shapiro Wilk Critical Value	0.938
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	23.32	95% H-UCL	20.4
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	24.78
95% Adjusted-CLT UCL	25.08	97.5% Chebyshev (MVUE) UCL	29.08
95% Modified-t UCL	23.62	99% Chebyshev (MVUE) UCL	37.54
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	1.117	Data do not follow a Discernable Distribution (0.05)	
Theta Star	15.1		
nu star	84.88		
Approximate Chi Square Value (.05)	64.65	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0434	95% CLT UCL	23.16
Adjusted Chi Square Value	63.92	95% Jackknife UCL	23.32
		95% Standard Bootstrap UCL	22.94
Anderson-Darling Test Statistic	3.432	95% Bootstrap-t UCL	26.7
Anderson-Darling 5% Critical Value	0.773	95% Hall's Bootstrap UCL	23.29
Kolmogorov-Smirnov Test Statistic	0.216	95% Percentile Bootstrap UCL	23.24
Kolmogorov-Smirnov 5% Critical Value	0.147	95% BCA Bootstrap UCL	24.93
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	33.56
		97.5% Chebyshev(Mean, Sd) UCL	40.78
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	54.97
95% Approximate Gamma UCL	22.14		
95% Adjusted Gamma UCL	22.4		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	33.56

Iron

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	11

Raw Statistics		Log-transformed Statistics	
Minimum	9900	Minimum of Log Data	9.2
Maximum	29000	Maximum of Log Data	10.28
Mean	21350	Mean of log Data	9.939
Median	21000	SD of log Data	0.269
SD	4957		
Coefficient of Variation	0.232		
Skewness	-0.545		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.947	Shapiro Wilk Test Statistic	0.867
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	23696	95% H-UCL	24694
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	28194
95% Adjusted-CLT UCL	23323	97.5% Chebyshev (MVUE) UCL	31124
95% Modified-t UCL	23664	99% Chebyshev (MVUE) UCL	36878

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	13.26	Data appear Normal at 5% Significance Level	
Theta Star	1610		
nu star	371.4		
Approximate Chi Square Value (.05)	327.7	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	23529
Adjusted Chi Square Value	322.3	95% Jackknife UCL	23696
		95% Standard Bootstrap UCL	23452
Anderson-Darling Test Statistic	0.487	95% Bootstrap-t UCL	23465
Anderson-Darling 5% Critical Value	0.734	95% Hall's Bootstrap UCL	23555
Kolmogorov-Smirnov Test Statistic	0.207	95% Percentile Bootstrap UCL	23421
Kolmogorov-Smirnov 5% Critical Value	0.228	95% BCA Bootstrap UCL	23214
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	27125
		97.5% Chebyshev(Mean, Sd) UCL	29624
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	34533
95% Approximate Gamma UCL	24195		
95% Adjusted Gamma UCL	24603		

Potential UCL to Use			
		Use 95% Student's-t UCL	23696

Lead

General Statistics

Number of Valid Data	38	Number of Detected Data	24
Number of Distinct Detected Data	13	Number of Non-Detect Data	14
		Percent Non-Detects	36.84%

Raw Statistics

Minimum Detected	3
Maximum Detected	256
Mean of Detected	52.25
SD of Detected	64.52
Minimum Non-Detect	2
Maximum Non-Detect	30

Log-transformed Statistics

Minimum Detected	1.099
Maximum Detected	5.545
Mean of Detected	3.114
SD of Detected	1.497
Minimum Non-Detect	0.693
Maximum Non-Detect	3.401

Note: Data have multiple DLs - Use of KM Method is recommended
For all methods (except KM, DL/2, and ROS Methods),
Observations < Largest ND are treated as NDs

Number treated as Non-Detect	22
Number treated as Detected	16
Single DL Non-Detect Percentage	57.89%

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.748
5% Shapiro Wilk Critical Value	0.916

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.873
5% Shapiro Wilk Critical Value	0.916

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	37.79
SD	54.45
95% DL/2 (t) UCL	52.69

Maximum Likelihood Estimate(MLE) Method

Mean	3.107
SD	87.33
95% MLE (t) UCL	27.01
95% MLE (Tiku) UCL	36.3

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	2.822
SD	1.372
95% H-Stat (DL/2) UCL	56.85

Log ROS Method

Mean in Log Scale	2.269
SD in Log Scale	1.764
Mean in Original Scale	34.39
SD in Original Scale	56.15
95% Percentile Bootstrap UCL	50.87
95% BCA Bootstrap UCL	53.63

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.654
Theta Star	79.94
nu star	31.37

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

A-D Test Statistic	0.857
5% A-D Critical Value	0.786
K-S Test Statistic	0.786
5% K-S Critical Value	0.185

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	256
Mean	47.1
Median	30
SD	56.6
k star	0.23
Theta star	204.8
Nu star	17.48
AppChi2	9.017
95% Gamma Approximate UCL	91.32
95% Adjusted Gamma UCL	93.95

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	34.2
SD	55.48
SE of Mean	9.194
95% KM (t) UCL	49.71
95% KM (z) UCL	49.32
95% KM (jackknife) UCL	49.59
95% KM (bootstrap t) UCL	58.54
95% KM (BCA) UCL	51.49
95% KM (Percentile Bootstrap) UCL	49.95
95% KM (Chebyshev) UCL	74.27
97.5% KM (Chebyshev) UCL	91.62
99% KM (Chebyshev) UCL	125.7

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	91.62

Magnesium

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	9

Raw Statistics

Minimum	1800
Maximum	3100
Mean	2421
Median	2400
SD	372.5
Coefficient of Variation	0.154
Skewness	0.0433

Log-transformed Statistics

Minimum of Log Data	7.496
Maximum of Log Data	8.039
Mean of log Data	7.781
SD of log Data	0.157

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.98
Shapiro Wilk Critical Value	0.874

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.974
Shapiro Wilk Critical Value	0.874

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	2598	95% H-UCL	2620
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	2865
95% Adjusted-CLT UCL	2586	97.5% Chebyshev (MVUE) UCL	3056
95% Modified-t UCL	2598	99% Chebyshev (MVUE) UCL	3433

Gamma Distribution Test		Data Distribution
k star (bias corrected)	35.19	Data appear Normal at 5% Significance Level
Theta Star	68.81	
nu star	985.3	
Approximate Chi Square Value (.05)	913.4	**Nonparametric Statistics**
Adjusted Level of Significance	0.0312	95% CLT UCL 2585
Adjusted Chi Square Value	904.2	95% Jackknife UCL 2598
		95% Standard Bootstrap UCL 2576
Anderson-Darling Test Statistic	0.194	95% Bootstrap-t UCL 2606
Anderson-Darling 5% Critical Value	0.733	95% Hall's Bootstrap UCL 2589
Kolmogorov-Smirnov Test Statistic	0.131	95% Percentile Bootstrap UCL 2579
Kolmogorov-Smirnov 5% Critical Value	0.228	95% BCA Bootstrap UCL 2571
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 2855
		97.5% Chebyshev(Mean, Sd) UCL 3043
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 3412
95% Approximate Gamma UCL	2612	
95% Adjusted Gamma UCL	2638	

Potential UCL to Use	Use 95% Student's-t UCL 2598

Manganese

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	14

Raw Statistics		Log-transformed Statistics	
Minimum	45	Minimum of Log Data	3.807
Maximum	250	Maximum of Log Data	5.521
Mean	120.9	Mean of log Data	4.626
Median	93.5	SD of log Data	0.606
SD	72.47		
Coefficient of Variation	0.6		
Skewness	0.736		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.874	Shapiro Wilk Test Statistic	0.921
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	155.2	95% H-UCL	178
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	209.5
95% Adjusted-CLT UCL	156.8	97.5% Chebyshev (MVUE) UCL	247.9
95% Modified-t UCL	155.8	99% Chebyshev (MVUE) UCL	323.2

Gamma Distribution Test	
k star (bias corrected)	2.499
Theta Star	48.36
nu star	69.98
Approximate Chi Square Value (.05)	51.72
Adjusted Level of Significance	0.0312
Adjusted Chi Square Value	49.64
Anderson-Darling Test Statistic	0.476
Anderson-Darling 5% Critical Value	0.742
Kolmogorov-Smirnov Test Statistic	0.157
Kolmogorov-Smirnov 5% Critical Value	0.23

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
95% Approximate Gamma UCL	163.5
95% Adjusted Gamma UCL	170.4

Potential UCL to Use

Data Distribution
Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics	
95% CLT UCL	152.7
95% Jackknife UCL	155.2
95% Standard Bootstrap UCL	151.2
95% Bootstrap-t UCL	162.9
95% Hall's Bootstrap UCL	151.5
95% Percentile Bootstrap UCL	152.4
95% BCA Bootstrap UCL	155.4
95% Chebyshev(Mean, Sd) UCL	205.3
97.5% Chebyshev(Mean, Sd) UCL	241.8
99% Chebyshev(Mean, Sd) UCL	313.6

Use 95% Approximate Gamma UCL 163.5

Mercury

General Statistics

Number of Valid Data	38	Number of Detected Data	32
Number of Distinct Detected Data	19	Number of Non-Detect Data	6
		Percent Non-Detects	15.79%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0054	Minimum Detected	-5.221
Maximum Detected	0.285	Maximum Detected	-1.255
Mean of Detected	0.0476	Mean of Detected	-3.492
SD of Detected	0.0511	SD of Detected	1.022
Minimum Non-Detect	0.005	Minimum Non-Detect	-5.298
Maximum Non-Detect	0.005	Maximum Non-Detect	-5.298

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.638	Shapiro Wilk Test Statistic	0.875
5% Shapiro Wilk Critical Value	0.93	5% Shapiro Wilk Critical Value	0.93
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0405	Mean	-3.887
SD	0.0497	SD	1.315
95% DL/2 (t) UCL	0.0541	95% H-Stat (DL/2) UCL	0.0583

Maximum Likelihood Estimate(MLE) Method	
Mean	0.0354
SD	0.0552
95% MLE (t) UCL	0.0505
95% MLE (Tiku) UCL	0.0502

Log ROS Method	
Mean in Log Scale	-3.84
SD in Log Scale	1.25
Mean in Original Scale	0.0407
SD in Original Scale	0.0495
95% Percentile Bootstrap UCL	0.0549
95% BCA Bootstrap UCL	0.0589

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.16
Theta Star	0.041
nu star	74.26
A-D Test Statistic	1.712
5% A-D Critical Value	0.77
K-S Test Statistic	0.77
5% K-S Critical Value	0.159

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.285
Mean	0.0402
Median	0.0487
SD	0.0499
k star	0.3
Theta star	0.134
Nu star	22.79
AppChi2	12.94
95% Gamma Approximate UCL	0.0709
95% Adjusted Gamma UCL	0.0726

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.041
SD	0.0487
SE of Mean	0.00802
95% KM (t) UCL	0.0545
95% KM (z) UCL	0.0541
95% KM (jackknife) UCL	0.0544
95% KM (bootstrap t) UCL	0.0626
95% KM (BCA) UCL	0.0548
95% KM (Percentile Bootstrap) UCL	0.0552
95% KM (Chebyshev) UCL	0.0759
97.5% KM (Chebyshev) UCL	0.0911
99% KM (Chebyshev) UCL	0.121

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.0911

Molybdenum

General Statistics

Number of Valid Data	38	Number of Detected Data	35
Number of Distinct Detected Data	11	Number of Non-Detect Data	3
		Percent Non-Detects	7.89%

Raw Statistics

Minimum Detected	0.6
Maximum Detected	5.6
Mean of Detected	3.303
SD of Detected	1.394
Minimum Non-Detect	0.5
Maximum Non-Detect	0.5

Log-transformed Statistics

Minimum Detected	-0.511
Maximum Detected	1.723
Mean of Detected	1.051
SD of Detected	0.622
Minimum Non-Detect	-0.693
Maximum Non-Detect	-0.693

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.746
5% Shapiro Wilk Critical Value	0.934
Data not Normal at 5% Significance Level	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	3.062
SD	1.576
95% DL/2 (t) UCL	3.493
Maximum Likelihood Estimate(MLE) Method	
Mean	3.026
SD	1.632
95% MLE (t) UCL	3.473
95% MLE (Tiku) UCL	3.479

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	3.337
Theta Star	0.99
nu star	233.6
A-D Test Statistic	5.146
5% A-D Critical Value	0.753
K-S Test Statistic	0.753
5% K-S Critical Value	0.149
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	0.207
Maximum	5.6
Mean	3.091
Median	4
SD	1.527
k star	2.317
Theta star	1.334
Nu star	176.1
AppChi2	146.4
95% Gamma Approximate UCL	3.718
95% Adjusted Gamma UCL	3.746

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.708
5% Shapiro Wilk Critical Value	0.934
Data not Lognormal at 5% Significance Level	

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	0.858
SD	0.894
95% H-Stat (DL/2) UCL	4.9
Log ROS Method	
Mean in Log Scale	0.957
SD in Log Scale	0.68
Mean in Original Scale	3.111
SD in Original Scale	1.492
95% Percentile Bootstrap UCL	3.49
95% BCA Bootstrap UCL	3.469

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	3.089
SD	1.507
SE of Mean	0.248
95% KM (t) UCL	3.508
95% KM (z) UCL	3.497
95% KM (jackknife) UCL	3.503
95% KM (bootstrap t) UCL	3.467
95% KM (BCA) UCL	3.503
95% KM (Percentile Bootstrap) UCL	3.511
95% KM (Chebyshev) UCL	4.17
97.5% KM (Chebyshev) UCL	4.638
99% KM (Chebyshev) UCL	5.557
Potential UCLs to Use	
95% KM (Chebyshev) UCL	4.17

Nickel

General Statistics

Number of Valid Data	38	Number of Detected Data	34
Number of Distinct Detected Data	21	Number of Non-Detect Data	4
		Percent Non-Detects	10.53%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	4.5	Minimum Detected	1.504
Maximum Detected	8.8	Maximum Detected	2.175
Mean of Detected	6.212	Mean of Detected	1.811
SD of Detected	1.128	SD of Detected	0.179
Minimum Non-Detect	5	Minimum Non-Detect	1.609
Maximum Non-Detect	5	Maximum Non-Detect	1.609

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.955	Shapiro Wilk Test Statistic	0.967
5% Shapiro Wilk Critical Value	0.933	5% Shapiro Wilk Critical Value	0.933
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	5.821	Mean	1.717
SD	1.571	SD	0.326
95% DL/2 (t) UCL	6.251	95% H-Stat (DL/2) UCL	6.133
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	5.985	Mean in Log Scale	1.777
SD	1.263	SD in Log Scale	0.198
95% MLE (t) UCL	6.331	Mean in Original Scale	6.025
95% MLE (Tiku) UCL	6.336	SD in Original Scale	1.203
		95% Percentile Bootstrap UCL	6.349
		95% BCA Bootstrap UCL	6.373

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	29.18	Data appear Normal at 5% Significance Level	
Theta Star	0.213		
nu star	1984		
A-D Test Statistic	0.314	Nonparametric Statistics	
5% A-D Critical Value	0.746	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.746	Mean	6.039
5% K-S Critical Value	0.151	SD	1.167
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.192
		95% KM (t) UCL	6.363
Assuming Gamma Distribution		95% KM (z) UCL	6.355
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	6.363
Minimum	3.797	95% KM (bootstrap t) UCL	6.378
Maximum	8.8	95% KM (BCA) UCL	6.35
Mean	6.038	95% KM (Percentile Bootstrap) UCL	6.345
Median	5.95	95% KM (Chebyshev) UCL	6.877
SD	1.195	97.5% KM (Chebyshev) UCL	7.239
k star	24.55	99% KM (Chebyshev) UCL	7.952
Theta star	0.246		
Nu star	1866	Potential UCLs to Use	
AppChi2	1766	95% KM (t) UCL	6.363
95% Gamma Approximate UCL	6.377	95% KM (Percentile Bootstrap) UCL	6.345
95% Adjusted Gamma UCL	6.392		

Note: DL/2 is not a recommended method.

Phosphorus

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	12

Raw Statistics		Log-transformed Statistics	
Minimum	520	Minimum of Log Data	6.254
Maximum	850	Maximum of Log Data	6.745
Mean	691.4	Mean of log Data	6.528
Median	665	SD of log Data	0.152
SD	104.1		
Coefficient of Variation	0.151		
Skewness	0.118		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.95	Shapiro Wilk Test Statistic	0.955
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	740.7	95% H-UCL	746.1
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	814
95% Adjusted-CLT UCL	738.1	97.5% Chebyshev (MVUE) UCL	867
95% Modified-t UCL	740.8	99% Chebyshev (MVUE) UCL	971.2

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	37.18	Data appear Normal at 5% Significance Level	
Theta Star	18.6		
nu star	1041		
Approximate Chi Square Value (.05)	967	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0312	95% CLT UCL	737.2
Adjusted Chi Square Value	957.6	95% Jackknife UCL	740.7
		95% Standard Bootstrap UCL	734.6
Anderson-Darling Test Statistic	0.308	95% Bootstrap-t UCL	743.5
Anderson-Darling 5% Critical Value	0.733	95% Hall's Bootstrap UCL	738.8
Kolmogorov-Smirnov Test Statistic	0.146	95% Percentile Bootstrap UCL	736.4
Kolmogorov-Smirnov 5% Critical Value	0.228	95% BCA Bootstrap UCL	736.4
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	812.7
		97.5% Chebyshev(Mean, Sd) UCL	865.1
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	968.1
95% Approximate Gamma UCL	744.3		
95% Adjusted Gamma UCL	751.6		

Potential UCL to Use		Use 95% Student's-t UCL	740.7

Potassium

General Statistics

Number of Valid Data	30	Number of Detected Data	30
Number of Distinct Detected Data	29	Number of Non-Detect Data	0
Number of Missing Values	8	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	5.03	Minimum Detected	1.615
Maximum Detected	960	Maximum Detected	6.867
Mean of Detected	341.5	Mean of Detected	4.001
SD of Detected	385.2	SD of Detected	2.437
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.758	Shapiro Wilk Test Statistic	0.688
5% Shapiro Wilk Critical Value	0.927	5% Shapiro Wilk Critical Value	0.927
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	341.5	Mean	4.001
SD	385.2	SD	2.437
95% DL/2 (t) UCL	461	95% H-Stat (DL/2) UCL	8225
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.35	Data do not follow a Discernable Distribution (0.05)	
Theta Star	974.7		
nu star	21.02		
A-D Test Statistic	4.001	**Nonparametric Statistics**	
5% A-D Critical Value	0.839	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.839	Mean	341.5
5% K-S Critical Value	0.172	SD	378.8
Data not Gamma Distributed at 5% Significance Level		SE of Mean	70.33
		95% KM (t) UCL	461
Assuming Gamma Distribution		95% KM (z) UCL	457.2
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	461
Minimum	5.03	95% KM (bootstrap t) UCL	473.4
Maximum	960	95% KM (BCA) UCL	451
Mean	341.5	95% KM (Percentile Bootstrap) UCL	456
Median	6.58	95% KM (Chebyshev) UCL	648
SD	385.2	97.5% KM (Chebyshev) UCL	780.7
k star	0.35	99% KM (Chebyshev) UCL	1041
Theta star	974.7		
Nu star	21.02	**Potential UCLs to Use**	
AppChi2	11.61	99% KM (Chebyshev) UCL	1041
95% Gamma Approximate UCL	618.4		
95% Adjusted Gamma UCL	640.7		

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Selenium

General Statistics

Number of Valid Data	38	Number of Detected Data	13
Number of Distinct Detected Data	3	Number of Non-Detect Data	25
		Percent Non-Detects	65.79%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.51	Minimum Detected	-0.673
Maximum Detected	2	Maximum Detected	0.693
Mean of Detected	1.778	Mean of Detected	0.495
SD of Detected	0.543	SD of Detected	0.484
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	0.5	Maximum Non-Detect	-0.693

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.452	Shapiro Wilk Test Statistic	0.457
5% Shapiro Wilk Critical Value	0.866	5% Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.773	Mean	-0.743
SD	0.797	SD	0.946
95% DL/2 (t) UCL	0.991	95% H-Stat (DL/2) UCL	0.942
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-0.0762
		SD in Log Scale	0.572
		Mean in Original Scale	1.086
		SD in Original Scale	0.621
		95% Percentile Bootstrap UCL	1.256
		95% BCA Bootstrap UCL	1.255
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	4.99	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.356		
nu star	129.7		
A-D Test Statistic	3.793	**Nonparametric Statistics**	
5% A-D Critical Value	0.735	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.735	Mean	0.944
5% K-S Critical Value	0.237	SD	0.674
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.114
		95% KM (t) UCL	1.136
Assuming Gamma Distribution		95% KM (z) UCL	1.131
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1.106
Minimum	0.51	95% KM (bootstrap t) UCL	1.125
Maximum	2.827	95% KM (BCA) UCL	2
Mean	2.037	95% KM (Percentile Bootstrap) UCL	2
Median	2	95% KM (Chebyshev) UCL	1.44
SD	0.555	97.5% KM (Chebyshev) UCL	1.655
k star	8.655	99% KM (Chebyshev) UCL	2.077
Theta star	0.235		
Nu star	657.8	**Potential UCLs to Use**	
AppChi2	599.3	95% KM (t) UCL	1.136
95% Gamma Approximate UCL	2.235	95% KM (% Bootstrap) UCL	2
95% Adjusted Gamma UCL	2.244		

Note: DL/2 is not a recommended method.

Silver

General Statistics

Number of Valid Data	38	Number of Detected Data	24
Number of Distinct Detected Data	1	Number of Non-Detect Data	14
		Percent Non-Detects	36.84%

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

The data set for variable Silver was not processed!

Sodium

General Statistics

Number of Valid Data	14	Number of Detected Data	11
Number of Distinct Detected Data	6	Number of Non-Detect Data	3
		Percent Non-Detects	21.43%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	110	Minimum Detected	4.7
Maximum Detected	280	Maximum Detected	5.635
Mean of Detected	142.7	Mean of Detected	4.923
SD of Detected	48.6	SD of Detected	0.267
Minimum Non-Detect	100	Minimum Non-Detect	4.605
Maximum Non-Detect	100	Maximum Non-Detect	4.605

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.642	Shapiro Wilk Test Statistic	0.748
5% Shapiro Wilk Critical Value	0.85	5% Shapiro Wilk Critical Value	0.85
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	122.9	Mean	4.706
SD	58.1	SD	0.49
95% DL/2 (t) UCL	150.4	95% H-Stat (DL/2) UCL	160.3
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	126.2	Mean in Log Scale	4.798
SD	53.41	SD in Log Scale	0.344
95% MLE (t) UCL	151.5	Mean in Original Scale	128.6
95% MLE (Tiku) UCL	151.6	SD in Original Scale	51.09
		95% Percentile Bootstrap UCL	152.2
		95% BCA Bootstrap UCL	158.8

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	9.752	Data do not follow a Discernable Distribution (0.05)	
Theta Star	14.64		
nu star	214.5		
A-D Test Statistic	1.246	Nonparametric Statistics	
5% A-D Critical Value	0.729	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.729	Mean	135.7
5% K-S Critical Value	0.255	SD	43.21
Data not Gamma Distributed at 5% Significance Level		SE of Mean	12.11
		95% KM (t) UCL	157.2
Assuming Gamma Distribution		95% KM (z) UCL	155.6
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	156.9
Minimum	84.24	95% KM (bootstrap t) UCL	199.1
Maximum	280	95% KM (BCA) UCL	157.1
Mean	133.8	95% KM (Percentile Bootstrap) UCL	156.4
Median	120	95% KM (Chebyshev) UCL	188.5
SD	46.58	97.5% KM (Chebyshev) UCL	211.4
k star	9.751	99% KM (Chebyshev) UCL	256.2
Theta star	13.72		

Nu star	273
AppChi2	235.8
95% Gamma Approximate UCL	155
95% Adjusted Gamma UCL	158

Potential UCLs to Use

95% KM (BCA) UCL 157.1

Note: DL/2 is not a recommended method.

Strontium

General Statistics

Number of Valid Observations	14	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	4	Minimum of Log Data	1.386
Maximum	14	Maximum of Log Data	2.639
Mean	7.143	Mean of log Data	1.922
Median	7	SD of log Data	0.299
SD	2.381		
Coefficient of Variation	0.333		
Skewness	1.837		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.825	Shapiro Wilk Test Statistic	0.932
Shapiro Wilk Critical Value	0.874	Shapiro Wilk Critical Value	0.874

Data not Normal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	8.27	95% H-UCL	8.362
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	9.63
95% Adjusted-CLT UCL	8.524	97.5% Chebyshev (MVUE) UCL	10.71
95% Modified-t UCL	8.322	99% Chebyshev (MVUE) UCL	12.84

Gamma Distribution Test		Data Distribution
k star (bias corrected)	9.161	Data appear Gamma Distributed at 5% Significance Level
Theta Star	0.78	
nu star	256.5	
Approximate Chi Square Value (.05)	220.4	**Nonparametric Statistics**
Adjusted Level of Significance	0.0312	95% CLT UCL 8.19
Adjusted Chi Square Value	216	95% Jackknife UCL 8.27
		95% Standard Bootstrap UCL 8.131
Anderson-Darling Test Statistic	0.572	95% Bootstrap-t UCL 8.77
Anderson-Darling 5% Critical Value	0.734	95% Hall's Bootstrap UCL 13.69
Kolmogorov-Smirnov Test Statistic	0.202	95% Percentile Bootstrap UCL 8.286
Kolmogorov-Smirnov 5% Critical Value	0.229	95% BCA Bootstrap UCL 8.429
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 9.917
		97.5% Chebyshev(Mean, Sd) UCL 11.12
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 13.48
95% Approximate Gamma UCL	8.312	
95% Adjusted Gamma UCL	8.483	

Potential UCL to Use

Use 95% Approximate Gamma UCL 8.312

Thallium

General Statistics

Number of Valid Data	38	Number of Detected Data	25
Number of Distinct Detected Data	2	Number of Non-Detect Data	13
		Percent Non-Detects	34.21%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.09	Minimum Detected	-2.408
Maximum Detected	1	Maximum Detected	0
Mean of Detected	0.964	Mean of Detected	-0.0963
SD of Detected	0.182	SD of Detected	0.482
Minimum Non-Detect	0.05	Minimum Non-Detect	-2.996
Maximum Non-Detect	0.05	Maximum Non-Detect	-2.996

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.206	Shapiro Wilk Test Statistic	0.206
5% Shapiro Wilk Critical Value	0.918	5% Shapiro Wilk Critical Value	0.918
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.643	Mean	-1.325
SD	0.474	SD	1.77
95% DL/2 (t) UCL	0.772	95% H-Stat (DL/2) UCL	3.326
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.517	Mean in Log Scale	-0.218
SD	0.663	SD in Log Scale	0.428
95% MLE (t) UCL	0.699	Mean in Original Scale	0.853
95% MLE (Tiku) UCL	0.721	SD in Original Scale	0.217
		95% Percentile Bootstrap UCL	0.908
		95% BCA Bootstrap UCL	0.901
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	7.598	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.127		
nu star	379.9		

A-D Test Statistic	9.269
5% A-D Critical Value	0.745
K-S Test Statistic	0.745
5% K-S Critical Value	0.175

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.09
Maximum	1
Mean	0.94
Median	1
SD	0.156
k star	11.5
Theta star	0.0818
Nu star	873.7
AppChi2	806.1
95% Gamma Approximate UCL	1.019
95% Adjusted Gamma UCL	1.022

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.665
SD	0.439
SE of Mean	0.0727
95% KM (t) UCL	0.787
95% KM (z) UCL	0.784
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	0.982
97.5% KM (Chebyshev) UCL	1.119
99% KM (Chebyshev) UCL	1.388

Potential UCLs to Use

95% KM (BCA) UCL	N/A

Tin (Sn)

General Statistics

Number of Valid Data	24	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	21
Number of Missing Values	14	Percent Non-Detects	87.50%

Raw Statistics

Minimum Detected	8.7
Maximum Detected	9.8
Mean of Detected	9.2
SD of Detected	0.557
Minimum Non-Detect	5
Maximum Non-Detect	5

Log-transformed Statistics

Minimum Detected	2.163
Maximum Detected	2.282
Mean of Detected	2.218
SD of Detected	0.0601
Minimum Non-Detect	1.609
Maximum Non-Detect	1.609

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.976
5% Shapiro Wilk Critical Value	0.767

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.98
5% Shapiro Wilk Critical Value	0.767

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	3.338
SD	2.269
95% DL/2 (t) UCL	4.131
Maximum Likelihood Estimate(MLE) Method	
Mean	5.415
SD	4.013
95% MLE (t) UCL	6.819
95% MLE (Tiku) UCL	8.869

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	1.079
SD	0.44
95% H-Stat (DL/2) UCL	3.421
Log ROS Method	
Mean in Log Scale	1.876
SD in Log Scale	0.204
Mean in Original Scale	6.656
SD in Original Scale	1.373
95% Percentile Bootstrap UCL	7.128
95% BCA Bootstrap UCL	7.11

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	0.275
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	8.763
SD	0.231
SE of Mean	0.0577
95% KM (t) UCL	8.861
95% KM (z) UCL	8.857
95% KM (jackknife) UCL	9.023
95% KM (bootstrap t) UCL	8.829
95% KM (BCA) UCL	9.8
95% KM (Percentile Bootstrap) UCL	9.8
95% KM (Chebyshev) UCL	9.014
97.5% KM (Chebyshev) UCL	9.123
99% KM (Chebyshev) UCL	9.336

Potential UCLs to Use

95% KM (t) UCL	8.861
95% KM (Percentile Bootstrap) UCL	9.8

Vanadium

General Statistics

Number of Valid Observations	38	Number of Distinct Observations	35

Raw Statistics		Log-transformed Statistics	
Minimum	13.9	Minimum of Log Data	2.632
Maximum	68	Maximum of Log Data	4.22
Mean	41.58	Mean of log Data	3.674
Median	40.65	SD of log Data	0.353
SD	12.47		
Coefficient of Variation	0.3		
Skewness	-0.174		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.977	Shapiro Wilk Test Statistic	0.903
Shapiro Wilk Critical Value	0.938	Shapiro Wilk Critical Value	0.938
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	44.99	95% H-UCL	46.6
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	52.6
95% Adjusted-CLT UCL	44.84	97.5% Chebyshev (MVUE) UCL	57.24
95% Modified-t UCL	44.98	99% Chebyshev (MVUE) UCL	66.35

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	8.796	Data appear Normal at 5% Significance Level	
Theta Star	4.727		
nu star	668.5		
Approximate Chi Square Value (.05)	609.5	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0434	95% CLT UCL	44.9
Adjusted Chi Square Value	607.2	95% Jackknife UCL	44.99
		95% Standard Bootstrap UCL	44.89
Anderson-Darling Test Statistic	0.761	95% Bootstrap-t UCL	44.87
Anderson-Darling 5% Critical Value	0.748	95% Hall's Bootstrap UCL	44.92
Kolmogorov-Smirnov Test Statistic	0.145	95% Percentile Bootstrap UCL	44.85
Kolmogorov-Smirnov 5% Critical Value	0.143	95% BCA Bootstrap UCL	44.75
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	50.39
		97.5% Chebyshev(Mean, Sd) UCL	54.21
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	61.7
95% Approximate Gamma UCL	45.6		
95% Adjusted Gamma UCL	45.77		

Potential UCL to Use		Use 95% Student's-t UCL	44.99

Zinc

General Statistics

Number of Valid Observations	38	Number of Distinct Observations	35

Raw Statistics		Log-transformed Statistics	
Minimum	22	Minimum of Log Data	3.091
Maximum	488	Maximum of Log Data	6.19
Mean	63.25	Mean of log Data	3.827
Median	36	SD of log Data	0.656
SD	83.75		
Coefficient of Variation	1.324		
Skewness	4.181		

Relevant UCL Statistics

Normal Distribution Test	
Shapiro Wilk Test Statistic	0.46
Shapiro Wilk Critical Value	0.938
Data not Normal at 5% Significance Level	

Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.795
Shapiro Wilk Critical Value	0.938
Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution	
95% Student's-t UCL	86.17
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL	95.44
95% Modified-t UCL	87.71

Assuming Lognormal Distribution	
95% H-UCL	70.88
95% Chebyshev (MVUE) UCL	84.87
97.5% Chebyshev (MVUE) UCL	97.11
99% Chebyshev (MVUE) UCL	121.2

Gamma Distribution Test	
k star (bias corrected)	1.593
Theta Star	39.7
nu star	121.1
Approximate Chi Square Value (.05)	96.66
Adjusted Level of Significance	0.0434
Adjusted Chi Square Value	95.76
Anderson-Darling Test Statistic	4.194
Anderson-Darling 5% Critical Value	0.763
Kolmogorov-Smirnov Test Statistic	0.255
Kolmogorov-Smirnov 5% Critical Value	0.145
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
95% Approximate Gamma UCL	79.22
95% Adjusted Gamma UCL	79.97

Data Distribution
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
95% CLT UCL	85.6
95% Jackknife UCL	86.17
95% Standard Bootstrap UCL	85.49
95% Bootstrap-t UCL	132.8
95% Hall's Bootstrap UCL	178.1
95% Percentile Bootstrap UCL	87.58
95% BCA Bootstrap UCL	99.52
95% Chebyshev(Mean, Sd) UCL	122.5
97.5% Chebyshev(Mean, Sd) UCL	148.1
99% Chebyshev(Mean, Sd) UCL	198.4

Potential UCL to Use	
Use 95% Chebyshev (Mean, Sd) UCL	122.5

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Z:\Projects\2009\1584-0901 TC Iqaluit Landfill\SSRA\COC tables\95UCL\soil\soil-PAH.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Acenaphthene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	2	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.04	Minimum Detected	-3.219
Maximum Detected	0.1	Maximum Detected	-2.303
Mean of Detected	0.0475	Mean of Detected	-3.104
SD of Detected	0.0212	SD of Detected	0.324
Minimum Non-Detect	0.01	Minimum Non-Detect	-4.605
Maximum Non-Detect	0.01	Maximum Non-Detect	-4.605

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.419	Shapiro Wilk Test Statistic	0.419
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0333	Mean	-3.836
SD	0.0269	SD	1.111
95% DL/2 (t) UCL	0.0473	95% H-Stat (DL/2) UCL	0.0921

Maximum Likelihood Estimate(MLE) Method	
Mean	0.0481
SD	0.0198
95% MLE (t) UCL	0.0584
95% MLE (Tiku) UCL	0.0605

Log ROS Method	
Mean in Log Scale	-3.299
SD in Log Scale	0.394
Mean in Original Scale	0.0401
SD in Original Scale	0.0203
95% Percentile Bootstrap UCL	0.0507
95% BCA Bootstrap UCL	0.055

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	5.638
Theta Star	0.00843
nu star	90.21
A-D Test Statistic	2.513
5% A-D Critical Value	0.716
K-S Test Statistic	0.716
5% K-S Critical Value	0.294

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.0308
Maximum	0.1
Mean	0.0447
Median	0.04
SD	0.0177
k star	8.347
Theta star	0.00536
Nu star	200.3
AppChi2	168.6
95% Gamma Approximate UCL	0.0531
95% Adjusted Gamma UCL	0.0546

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.045
SD	0.0166
SE of Mean	0.00512
95% KM (t) UCL	0.0542
95% KM (z) UCL	0.0534
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	0.0673
97.5% KM (Chebyshev) UCL	0.077
99% KM (Chebyshev) UCL	0.0959

Potential UCLs to Use

95% KM (BCA) UCL	N/A

Acenaphthylene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	1	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

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

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Acenaphthylene was not processed!

Anthracene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	2	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.05	Minimum Detected	-2.996
Maximum Detected	0.1	Maximum Detected	-2.303
Mean of Detected	0.0563	Mean of Detected	-2.909
SD of Detected	0.0177	SD of Detected	0.245
Minimum Non-Detect	0.005	Minimum Non-Detect	-5.298
Maximum Non-Detect	0.005	Maximum Non-Detect	-5.298

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.419	Shapiro Wilk Test Statistic	0.419
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0383	Mean	-3.937
SD	0.03	SD	1.53
95% DL/2 (t) UCL	0.0539	95% H-Stat (DL/2) UCL	0.275
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0313	Mean in Log Scale	-3.056
SD	0.0394	SD in Log Scale	0.298
95% MLE (t) UCL	0.0517	Mean in Original Scale	0.0492
95% MLE (Tiku) UCL	0.054	SD in Original Scale	0.0176
		95% Percentile Bootstrap UCL	0.0583
		95% BCA Bootstrap UCL	0.0615

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	10.22
Theta Star	0.0055
nu star	163.5
A-D Test Statistic	2.509
5% A-D Critical Value	0.716
K-S Test Statistic	0.716
5% K-S Critical Value	0.294

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.0424
Maximum	0.1
Mean	0.054
Median	0.05
SD	0.0148
k star	15.69
Theta star	0.00344
Nu star	376.5
AppChi2	332.6
95% Gamma Approximate UCL	0.0611
95% Adjusted Gamma UCL	0.0623

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0542
SD	0.0138
SE of Mean	0.00426
95% KM (t) UCL	0.0618
95% KM (z) UCL	0.0612
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	0.0728
97.5% KM (Chebyshev) UCL	0.0808
99% KM (Chebyshev) UCL	0.0966

Potential UCLs to Use

95% KM (BCA) UCL	N/A

Benzo(a)anthracene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	4	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.05	Minimum Detected	-2.996
Maximum Detected	1.14	Maximum Detected	0.131
Mean of Detected	0.195	Mean of Detected	-2.48
SD of Detected	0.382	SD of Detected	1.084
Minimum Non-Detect	0.01	Minimum Non-Detect	-4.605
Maximum Non-Detect	0.01	Maximum Non-Detect	-4.605

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.45
5% Shapiro Wilk Critical Value	0.818

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.132
SD	0.319
95% DL/2 (t) UCL	0.297
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0297
SD	0.398
95% MLE (t) UCL	0.236
95% MLE (Tiku) UCL	0.249

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.53
Theta Star	0.368
nu star	8.476
A-D Test Statistic	1.985
5% A-D Critical Value	0.748
K-S Test Statistic	0.748
5% K-S Critical Value	0.305

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1.14
Mean	0.134
Median	0.05
SD	0.318
k star	0.169
Theta star	0.792
Nu star	4.056
AppChi2	0.744
95% Gamma Approximate UCL	0.73
95% Adjusted Gamma UCL	0.972

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.57
5% Shapiro Wilk Critical Value	0.818

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-3.419
SD	1.635
95% H-Stat (DL/2) UCL	0.766
Log ROS Method	
Mean in Log Scale	-3.247
SD in Log Scale	1.456
Mean in Original Scale	0.133
SD in Original Scale	0.318
95% Percentile Bootstrap UCL	0.314
95% BCA Bootstrap UCL	0.411

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.147
SD	0.3
SE of Mean	0.0925
95% KM (t) UCL	0.313
95% KM (z) UCL	0.299
95% KM (jackknife) UCL	0.309
95% KM (bootstrap t) UCL	5.814
95% KM (BCA) UCL	0.326
95% KM (Percentile Bootstrap) UCL	0.326
95% KM (Chebyshev) UCL	0.55
97.5% KM (Chebyshev) UCL	0.724
99% KM (Chebyshev) UCL	1.067

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.724

Benzo(a)pyrene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	3	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.05	Minimum Detected	-2.996
Maximum Detected	1.31	Maximum Detected	0.27
Mean of Detected	0.21	Mean of Detected	-2.542
SD of Detected	0.444	SD of Detected	1.143
Minimum Non-Detect	0.005	Minimum Non-Detect	-5.298
Maximum Non-Detect	0.005	Maximum Non-Detect	-5.298

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.428	Shapiro Wilk Test Statistic	0.478
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.141	Mean	-3.692
SD	0.369	SD	1.928
95% DL/2 (t) UCL	0.332	95% H-Stat (DL/2) UCL	1.841
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0215	Mean in Log Scale	-3.28
SD	0.46	SD in Log Scale	1.45
95% MLE (t) UCL	0.26	Mean in Original Scale	0.143
95% MLE (Tiku) UCL	0.276	SD in Original Scale	0.368
		95% Percentile Bootstrap UCL	0.354
		95% BCA Bootstrap UCL	0.462

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.474	Data do not follow a Discernable Distribution (0.05)
Theta Star	0.444	
nu star	7.585	

A-D Test Statistic	2.345
5% A-D Critical Value	0.754
K-S Test Statistic	0.754
5% K-S Critical Value	0.307

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1.31
Mean	0.143
Median	0.05
SD	0.368
k star	0.166
Theta star	0.859
Nu star	3.991
AppChi2	0.718
95% Gamma Approximate UCL	0.794
95% Adjusted Gamma UCL	1.06

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.157
SD	0.348
SE of Mean	0.107
95% KM (t) UCL	0.35
95% KM (z) UCL	0.333
95% KM (jackknife) UCL	0.345
95% KM (bootstrap t) UCL	1.8E+308
95% KM (BCA) UCL	0.264
95% KM (Percentile Bootstrap) UCL	0.365
95% KM (Chebyshev) UCL	0.625
97.5% KM (Chebyshev) UCL	0.827
99% KM (Chebyshev) UCL	1.225

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.827

Benzo(b+j)fluoranthene

General Statistics

Number of Valid Data	7	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	5
Number of Missing Values	5	Percent Non-Detects	71.43%

Raw Statistics

Minimum Detected	0.13
Maximum Detected	1.78
Mean of Detected	0.955
SD of Detected	1.167
Minimum Non-Detect	0.05
Maximum Non-Detect	0.05

Log-transformed Statistics

Minimum Detected	-2.04
Maximum Detected	0.577
Mean of Detected	-0.732
SD of Detected	1.85
Minimum Non-Detect	-2.996
Maximum Non-Detect	-2.996

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters
(e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results
and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	1
5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.291
SD	0.658
95% DL/2 (t) UCL	0.774
Maximum Likelihood Estimate(MLE) Method	N/A
MLE method failed to converge properly	

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	0.356
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	1
5% Shapiro Wilk Critical Value	N/A
Data not Lognormal at 5% Significance Level	

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-2.844
SD	1.629
95% H-Stat (DL/2) UCL	1.975
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.366
SD	0.577
SE of Mean	0.309
95% KM (t) UCL	0.965
95% KM (z) UCL	0.873
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	1.711
97.5% KM (Chebyshev) UCL	2.293
99% KM (Chebyshev) UCL	3.436
Potential UCLs to Use	
97.5% KM (Chebyshev) UCL	2.293

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Benzo(g,h,i)perylene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	4	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.05	Minimum Detected	-2.996
Maximum Detected	0.728	Maximum Detected	-0.317
Mean of Detected	0.154	Mean of Detected	-2.478
SD of Detected	0.238	SD of Detected	0.997
Minimum Non-Detect	0.02	Minimum Non-Detect	-3.912
Maximum Non-Detect	0.02	Maximum Non-Detect	-3.912

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.531	Shapiro Wilk Test Statistic	0.618
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.106	Mean	-3.187
SD	0.202	SD	1.315
95% DL/2 (t) UCL	0.211	95% H-Stat (DL/2) UCL	0.344
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0449	Mean in Log Scale	-3.221
SD	0.253	SD in Log Scale	1.386
95% MLE (t) UCL	0.176	Mean in Original Scale	0.106
95% MLE (Tiku) UCL	0.185	SD in Original Scale	0.202
		95% Percentile Bootstrap UCL	0.212
		95% BCA Bootstrap UCL	0.278

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.681	Data do not follow a Discernable Distribution (0.05)
Theta Star	0.226	
nu star	10.89	

A-D Test Statistic	1.685
5% A-D Critical Value	0.737
K-S Test Statistic	0.737
5% K-S Critical Value	0.302

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.728
Mean	0.111
Median	0.05
SD	0.201
k star	0.215
Theta star	0.515
Nu star	5.157
AppChi2	1.225
95% Gamma Approximate UCL	0.466
95% Adjusted Gamma UCL	0.594

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.119
SD	0.188
SE of Mean	0.058
95% KM (t) UCL	0.224
95% KM (z) UCL	0.215
95% KM (jackknife) UCL	0.221
95% KM (bootstrap t) UCL	11.74
95% KM (BCA) UCL	0.22
95% KM (Percentile Bootstrap) UCL	0.232
95% KM (Chebyshev) UCL	0.372
97.5% KM (Chebyshev) UCL	0.482
99% KM (Chebyshev) UCL	0.697

Potential UCLs to Use

95% KM (BCA) UCL	0.22

Benzo(k)fluoranthene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	3	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

Raw Statistics

Minimum Detected	0.05
Maximum Detected	0.662
Mean of Detected	0.133
SD of Detected	0.215
Minimum Non-Detect	0.01
Maximum Non-Detect	0.01

Log-transformed Statistics

Minimum Detected	-2.996
Maximum Detected	-0.412
Mean of Detected	-2.586
SD of Detected	0.911
Minimum Non-Detect	-4.605
Maximum Non-Detect	-4.605

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.463
5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level	

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.547
5% Shapiro Wilk Critical Value	0.818
Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.0902
SD	0.182
95% DL/2 (t) UCL	0.185
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0337
SD	0.229
95% MLE (t) UCL	0.152
95% MLE (Tiku) UCL	0.16

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-3.49
SD	1.52
95% H-Stat (DL/2) UCL	0.461
Log ROS Method	
Mean in Log Scale	-3.219
SD in Log Scale	1.21
Mean in Original Scale	0.0926
SD in Original Scale	0.181
95% Percentile Bootstrap UCL	0.194
95% BCA Bootstrap UCL	0.252

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.719
Theta Star	0.185
nu star	11.5
A-D Test Statistic	2.014
5% A-D Critical Value	0.735
K-S Test Statistic	0.735
5% K-S Critical Value	0.301
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.662
Mean	0.0965
Median	0.05
SD	0.18
k star	0.218
Theta star	0.443
Nu star	5.227
AppChi2	1.258
95% Gamma Approximate UCL	0.401
95% Adjusted Gamma UCL	0.51

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.105
SD	0.168
SE of Mean	0.052
95% KM (t) UCL	0.199
95% KM (z) UCL	0.191
95% KM (jackknife) UCL	0.196
95% KM (bootstrap t) UCL	1.8E+308
95% KM (BCA) UCL	0.16
95% KM (Percentile Bootstrap) UCL	0.203
95% KM (Chebyshev) UCL	0.332
97.5% KM (Chebyshev) UCL	0.43
99% KM (Chebyshev) UCL	0.622
Potential UCLs to Use	
95% KM (BCA) UCL	0.16

Chrysene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	4	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.05	Minimum Detected	-2.996
Maximum Detected	1.04	Maximum Detected	0.0392
Mean of Detected	0.185	Mean of Detected	-2.462
SD of Detected	0.346	SD of Detected	1.049
Minimum Non-Detect	0.01	Minimum Non-Detect	-4.605
Maximum Non-Detect	0.01	Maximum Non-Detect	-4.605

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.46	Shapiro Wilk Test Statistic	0.6
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.125	Mean	-3.407
SD	0.29	SD	1.628
95% DL/2 (t) UCL	0.275	95% H-Stat (DL/2) UCL	0.754
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0326	Mean in Log Scale	-3.224
SD	0.362	SD in Log Scale	1.433
95% MLE (t) UCL	0.221	Mean in Original Scale	0.126
95% MLE (Tiku) UCL	0.233	SD in Original Scale	0.289
		95% Percentile Bootstrap UCL	0.291
		95% BCA Bootstrap UCL	0.376

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.566	Data do not follow a Discernable Distribution (0.05)
Theta Star	0.326	
nu star	9.059	

A-D Test Statistic	1.856
5% A-D Critical Value	0.744
K-S Test Statistic	0.744
5% K-S Critical Value	0.304

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1.04
Mean	0.128
Median	0.05
SD	0.289
k star	0.199
Theta star	0.641
Nu star	4.787
AppChi2	1.055
95% Gamma Approximate UCL	0.58
95% Adjusted Gamma UCL	0.75

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.14
SD	0.272
SE of Mean	0.0839
95% KM (t) UCL	0.29
95% KM (z) UCL	0.278
95% KM (jackknife) UCL	0.287
95% KM (bootstrap t) UCL	2.508
95% KM (BCA) UCL	0.232
95% KM (Percentile Bootstrap) UCL	0.302
95% KM (Chebyshev) UCL	0.505
97.5% KM (Chebyshev) UCL	0.664
99% KM (Chebyshev) UCL	0.975

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.664

Dibenz(a,h)anthracene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	3	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

Raw Statistics

Minimum Detected	0.05
Maximum Detected	0.235
Mean of Detected	0.0919
SD of Detected	0.0781
Minimum Non-Detect	0.02
Maximum Non-Detect	0.02

Log-transformed Statistics

Minimum Detected	-2.996
Maximum Detected	-1.448
Mean of Detected	-2.629
SD of Detected	0.68
Minimum Non-Detect	-3.912
Maximum Non-Detect	-3.912

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.595
5% Shapiro Wilk Critical Value	0.818

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.0646
SD	0.0742
95% DL/2 (t) UCL	0.103
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0461
SD	0.0929
95% MLE (t) UCL	0.0943
95% MLE (Tiku) UCL	0.0977

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.472
Theta Star	0.0624
nu star	23.55
A-D Test Statistic	1.844
5% A-D Critical Value	0.723
K-S Test Statistic	0.723
5% K-S Critical Value	0.297

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00988
Maximum	0.235
Mean	0.0759
Median	0.05
SD	0.0682
k star	1.439
Theta star	0.0528
Nu star	34.54
AppChi2	22.1
95% Gamma Approximate UCL	0.119
95% Adjusted Gamma UCL	0.127

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.584
5% Shapiro Wilk Critical Value	0.818

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-3.288
SD	1.114
95% H-Stat (DL/2) UCL	0.173
Log ROS Method	
Mean in Log Scale	-3.127
SD in Log Scale	0.935
Mean in Original Scale	0.0669
SD in Original Scale	0.0725
95% Percentile Bootstrap UCL	0.103
95% BCA Bootstrap UCL	0.115

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0779
SD	0.0628
SE of Mean	0.0194
95% KM (t) UCL	0.113
95% KM (z) UCL	0.11
95% KM (jackknife) UCL	0.112
95% KM (bootstrap t) UCL	1.8E+308
95% KM (BCA) UCL	0.106
95% KM (Percentile Bootstrap) UCL	0.109
95% KM (Chebyshev) UCL	0.162
97.5% KM (Chebyshev) UCL	0.199
99% KM (Chebyshev) UCL	0.271

Potential UCLs to Use

95% KM (BCA) UCL	0.106

Fluoranthene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	4	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.05	Minimum Detected	-2.996
Maximum Detected	1.07	Maximum Detected	0.0677
Mean of Detected	0.19	Mean of Detected	-2.458
SD of Detected	0.357	SD of Detected	1.073
Minimum Non-Detect	0.005	Minimum Non-Detect	-5.298
Maximum Non-Detect	0.005	Maximum Non-Detect	-5.298

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.467	Shapiro Wilk Test Statistic	0.604
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.127	Mean	-3.636
SD	0.299	SD	1.939
95% DL/2 (t) UCL	0.282	95% H-Stat (DL/2) UCL	2.05
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0314	Mean in Log Scale	-3.242
SD	0.375	SD in Log Scale	1.472
95% MLE (t) UCL	0.226	Mean in Original Scale	0.129
95% MLE (Tiku) UCL	0.238	SD in Original Scale	0.298
		95% Percentile Bootstrap UCL	0.297
		95% BCA Bootstrap UCL	0.386

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.554	Data do not follow a Discernable Distribution (0.05)
Theta Star	0.342	
nu star	8.865	

A-D Test Statistic	1.832
5% A-D Critical Value	0.745
K-S Test Statistic	0.745
5% K-S Critical Value	0.304

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1.07
Mean	0.131
Median	0.05
SD	0.298
k star	0.17
Theta star	0.77
Nu star	4.078
AppChi2	0.753
95% Gamma Approximate UCL	0.709
95% Adjusted Gamma UCL	0.943

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.143
SD	0.28
SE of Mean	0.0865
95% KM (t) UCL	0.298
95% KM (z) UCL	0.285
95% KM (jackknife) UCL	0.295
95% KM (bootstrap t) UCL	5.607
95% KM (BCA) UCL	0.305
95% KM (Percentile Bootstrap) UCL	0.312
95% KM (Chebyshev) UCL	0.52
97.5% KM (Chebyshev) UCL	0.683
99% KM (Chebyshev) UCL	1.004

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.683

Fluorene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	1	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

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

The data set for variable Fluorene was not processed!

Indeno(1,2,3-cd)pyrene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	4	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

Raw Statistics

Minimum Detected	0.05
Maximum Detected	0.881
Mean of Detected	0.176
SD of Detected	0.289
Minimum Non-Detect	0.02
Maximum Non-Detect	0.02

Log-transformed Statistics

Minimum Detected	-2.996
Maximum Detected	-0.127
Mean of Detected	-2.405
SD of Detected	1.041
Minimum Non-Detect	-3.912
Maximum Non-Detect	-3.912

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.527
5% Shapiro Wilk Critical Value	0.818

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.121
SD	0.245
95% DL/2 (t) UCL	0.248
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0459
SD	0.306
95% MLE (t) UCL	0.205
95% MLE (Tiku) UCL	0.215

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.631
Theta Star	0.28
nu star	10.09
A-D Test Statistic	1.495
5% A-D Critical Value	0.74
K-S Test Statistic	0.74
5% K-S Critical Value	0.303

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.881
Mean	0.125
Median	0.05
SD	0.244
k star	0.211
Theta star	0.593
Nu star	5.054
AppChi2	1.177
95% Gamma Approximate UCL	0.536
95% Adjusted Gamma UCL	0.686

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.672
5% Shapiro Wilk Critical Value	0.818

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-3.138
SD	1.365
95% H-Stat (DL/2) UCL	0.424
Log ROS Method	
Mean in Log Scale	-3.212
SD in Log Scale	1.486
Mean in Original Scale	0.121
SD in Original Scale	0.245
95% Percentile Bootstrap UCL	0.252
95% BCA Bootstrap UCL	0.319

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.134
SD	0.229
SE of Mean	0.0706
95% KM (t) UCL	0.261
95% KM (z) UCL	0.25
95% KM (jackknife) UCL	0.258
95% KM (bootstrap t) UCL	2.391
95% KM (BCA) UCL	0.258
95% KM (Percentile Bootstrap) UCL	0.26
95% KM (Chebyshev) UCL	0.442
97.5% KM (Chebyshev) UCL	0.575
99% KM (Chebyshev) UCL	0.837

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.575

2-Methylnaphthalene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	1	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

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

The data set for variable 2-Methylnaphthalene was not processed!

Naphthalene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	1	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

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

The data set for variable Naphthalene was not processed!

Phenanthrene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	4	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.05	Minimum Detected	-2.996
Maximum Detected	0.171	Maximum Detected	-1.766
Mean of Detected	0.0753	Mean of Detected	-2.694
SD of Detected	0.0428	SD of Detected	0.461
Minimum Non-Detect	0.005	Minimum Non-Detect	-5.298
Maximum Non-Detect	0.005	Maximum Non-Detect	-5.298

Warning: There are only 4 Distinct Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.677
5% Shapiro Wilk Critical Value	0.818

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.051
SD	0.0495
95% DL/2 (t) UCL	0.0767
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0767
SD	0.04
95% MLE (t) UCL	0.0974
95% MLE (Tiku) UCL	0.102

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	3.111
Theta Star	0.0242
nu star	49.77
A-D Test Statistic	1.147
5% A-D Critical Value	0.719
K-S Test Statistic	0.719
5% K-S Critical Value	0.295

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.0261
Maximum	0.171
Mean	0.0667
Median	0.05
SD	0.0377
k star	3.572
Theta star	0.0187
Nu star	85.73
AppChi2	65.39
95% Gamma Approximate UCL	0.0874
95% Adjusted Gamma UCL	0.0912

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.722
5% Shapiro Wilk Critical Value	0.818

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-3.793
SD	1.665
95% H-Stat (DL/2) UCL	0.534
Log ROS Method	
Mean in Log Scale	-3.063
SD in Log Scale	0.674
Mean in Original Scale	0.0578
SD in Original Scale	0.0429
95% Percentile Bootstrap UCL	0.079
95% BCA Bootstrap UCL	0.0824

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0668
SD	0.0348
SE of Mean	0.0107
95% KM (t) UCL	0.0861
95% KM (z) UCL	0.0845
95% KM (jackknife) UCL	0.0857
95% KM (bootstrap t) UCL	0.109
95% KM (BCA) UCL	0.0837
95% KM (Percentile Bootstrap) UCL	0.087
95% KM (Chebyshev) UCL	0.114
97.5% KM (Chebyshev) UCL	0.134
99% KM (Chebyshev) UCL	0.174

Potential UCLs to Use

95% KM (BCA) UCL	0.0837

Pyrene

General Statistics

Number of Valid Data	12	Number of Detected Data	8
Number of Distinct Detected Data	4	Number of Non-Detect Data	4
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.05	Minimum Detected	-2.996
Maximum Detected	1.04	Maximum Detected	0.0392
Mean of Detected	0.181	Mean of Detected	-2.512
SD of Detected	0.348	SD of Detected	1.062
Minimum Non-Detect	0.005	Minimum Non-Detect	-5.298
Maximum Non-Detect	0.005	Maximum Non-Detect	-5.298

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.451	Shapiro Wilk Test Statistic	0.552
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.122	Mean	-3.672
SD	0.291	SD	1.911
95% DL/2 (t) UCL	0.272	95% H-Stat (DL/2) UCL	1.741
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0284	Mean in Log Scale	-3.253
SD	0.364	SD in Log Scale	1.414
95% MLE (t) UCL	0.217	Mean in Original Scale	0.124
95% MLE (Tiku) UCL	0.23	SD in Original Scale	0.29
		95% Percentile Bootstrap UCL	0.289
		95% BCA Bootstrap UCL	0.378

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.549	Data do not follow a Discernable Distribution (0.05)
Theta Star	0.33	
nu star	8.787	

A-D Test Statistic	2.038
5% A-D Critical Value	0.745
K-S Test Statistic	0.745
5% K-S Critical Value	0.304

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1.04
Mean	0.125
Median	0.05
SD	0.29
k star	0.17
Theta star	0.736
Nu star	4.08
AppChi2	0.754
95% Gamma Approximate UCL	0.678
95% Adjusted Gamma UCL	0.901

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.138
SD	0.273
SE of Mean	0.0841
95% KM (t) UCL	0.289
95% KM (z) UCL	0.276
95% KM (jackknife) UCL	0.285
95% KM (bootstrap t) UCL	17.14
95% KM (BCA) UCL	0.298
95% KM (Percentile Bootstrap) UCL	0.298
95% KM (Chebyshev) UCL	0.504
97.5% KM (Chebyshev) UCL	0.663
99% KM (Chebyshev) UCL	0.974

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.663

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Z:\Projects\2009\1584-0901 TC Iqaluit Landfill\SSRA\COC tables\95UCL\soil\soil-PCB.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor 1016

General Statistics

Number of Valid Data	21	Number of Detected Data	17
Number of Distinct Detected Data	7	Number of Non-Detect Data	4
		Percent Non-Detects	19.05%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.02	Minimum Detected	-3.912
Maximum Detected	1.5	Maximum Detected	0.405
Mean of Detected	0.275	Mean of Detected	-2.313
SD of Detected	0.451	SD of Detected	1.323
Minimum Non-Detect	0.01	Minimum Non-Detect	-4.605
Maximum Non-Detect	0.01	Maximum Non-Detect	-4.605

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.588	Shapiro Wilk Test Statistic	0.707
5% Shapiro Wilk Critical Value	0.892	5% Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.223	Mean	-2.881
SD	0.418	SD	1.686
95% DL/2 (t) UCL	0.381	95% H-Stat (DL/2) UCL	0.819
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.162	Mean in Log Scale	-2.84
SD	0.47	SD in Log Scale	1.639
95% MLE (t) UCL	0.339	Mean in Original Scale	0.224
95% MLE (Tiku) UCL	0.335	SD in Original Scale	0.417
		95% Percentile Bootstrap UCL	0.382
		95% BCA Bootstrap UCL	0.424

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.537	Data do not follow a Discernable Distribution (0.05)
Theta Star	0.511	
nu star	18.27	

A-D Test Statistic	3.017
5% A-D Critical Value	0.789
K-S Test Statistic	0.789
5% K-S Critical Value	0.219

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1.5
Mean	0.222
Median	0.05
SD	0.418
k star	0.181
Theta star	1.228
Nu star	7.604
AppChi2	2.508
95% Gamma Approximate UCL	0.674
95% Adjusted Gamma UCL	0.739

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.226
SD	0.406
SE of Mean	0.0914
95% KM (t) UCL	0.384
95% KM (z) UCL	0.376
95% KM (jackknife) UCL	0.379
95% KM (bootstrap t) UCL	0.481
95% KM (BCA) UCL	0.385
95% KM (Percentile Bootstrap) UCL	0.386
95% KM (Chebyshev) UCL	0.624
97.5% KM (Chebyshev) UCL	0.797
99% KM (Chebyshev) UCL	1.135

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.797

Aroclor 1221

General Statistics

Number of Valid Data	21	Number of Detected Data	17
Number of Distinct Detected Data	7	Number of Non-Detect Data	4
		Percent Non-Detects	19.05%

Raw Statistics

Minimum Detected	0.03
Maximum Detected	1.5
Mean of Detected	0.275
SD of Detected	0.451
Minimum Non-Detect	0.01
Maximum Non-Detect	0.01

Log-transformed Statistics

Minimum Detected	-3.507
Maximum Detected	0.405
Mean of Detected	-2.289
SD of Detected	1.296
Minimum Non-Detect	-4.605
Maximum Non-Detect	-4.605

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.585
5% Shapiro Wilk Critical Value	0.892

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.672
5% Shapiro Wilk Critical Value	0.892

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.224
SD	0.417
95% DL/2 (t) UCL	0.381
Maximum Likelihood Estimate(MLE) Method	
Mean	0.163
SD	0.47
95% MLE (t) UCL	0.34
95% MLE (Tiku) UCL	0.336

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-2.862
SD	1.676
95% H-Stat (DL/2) UCL	0.809
Log ROS Method	
Mean in Log Scale	-2.799
SD in Log Scale	1.596
Mean in Original Scale	0.224
SD in Original Scale	0.417
95% Percentile Bootstrap UCL	0.367
95% BCA Bootstrap UCL	0.426

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.547
Theta Star	0.504
nu star	18.59
A-D Test Statistic	3.169
5% A-D Critical Value	0.788
K-S Test Statistic	0.788
5% K-S Critical Value	0.219
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1.5
Mean	0.223
Median	0.05
SD	0.418
k star	0.182
Theta star	1.227
Nu star	7.625
AppChi2	2.52
95% Gamma Approximate UCL	0.674
95% Adjusted Gamma UCL	0.739

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.229
SD	0.405
SE of Mean	0.0911
95% KM (t) UCL	0.386
95% KM (z) UCL	0.378
95% KM (jackknife) UCL	0.382
95% KM (bootstrap t) UCL	0.504
95% KM (BCA) UCL	0.41
95% KM (Percentile Bootstrap) UCL	0.389
95% KM (Chebyshev) UCL	0.626
97.5% KM (Chebyshev) UCL	0.797
99% KM (Chebyshev) UCL	1.135
Potential UCLs to Use	
97.5% KM (Chebyshev) UCL	0.797

Aroclor 1242

General Statistics			
Number of Valid Data	21	Number of Detected Data	17
Number of Distinct Detected Data	7	Number of Non-Detect Data	4
		Percent Non-Detects	19.05%

Raw Statistics	
Minimum Detected	0.02
Maximum Detected	1.5
Mean of Detected	0.275
SD of Detected	0.451
Minimum Non-Detect	0.01
Maximum Non-Detect	0.01

Log-transformed Statistics	
Minimum Detected	-3.912
Maximum Detected	0.405
Mean of Detected	-2.313
SD of Detected	1.323
Minimum Non-Detect	-4.605
Maximum Non-Detect	-4.605

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.588
5% Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level	

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.707
5% Shapiro Wilk Critical Value	0.892
Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.223
SD	0.418
95% DL/2 (t) UCL	0.381
Maximum Likelihood Estimate(MLE) Method	
Mean	0.162
SD	0.47
95% MLE (t) UCL	0.339
95% MLE (Tiku) UCL	0.335

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-2.881
SD	1.686
95% H-Stat (DL/2) UCL	0.819
Log ROS Method	
Mean in Log Scale	-2.84
SD in Log Scale	1.639
Mean in Original Scale	0.224
SD in Original Scale	0.417
95% Percentile Bootstrap UCL	0.366
95% BCA Bootstrap UCL	0.428

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.537
Theta Star	0.511
nu star	18.27
A-D Test Statistic	3.017
5% A-D Critical Value	0.789
K-S Test Statistic	0.789
5% K-S Critical Value	0.219
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1.5
Mean	0.222
Median	0.05
SD	0.418
k star	0.181
Theta star	1.228

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.226
SD	0.406
SE of Mean	0.0914
95% KM (t) UCL	0.384
95% KM (z) UCL	0.376
95% KM (jackknife) UCL	0.379
95% KM (bootstrap t) UCL	0.495
95% KM (BCA) UCL	0.406
95% KM (Percentile Bootstrap) UCL	0.389
95% KM (Chebyshev) UCL	0.624
97.5% KM (Chebyshev) UCL	0.797
99% KM (Chebyshev) UCL	1.135

Nu star	7.604
AppChi2	2.508
95% Gamma Approximate UCL	0.674
95% Adjusted Gamma UCL	0.739

Note: DL/2 is not a recommended method.

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.797

Aroclor 1248

General Statistics

Number of Valid Data	21	Number of Detected Data	17
Number of Distinct Detected Data	8	Number of Non-Detect Data	4
		Percent Non-Detects	19.05%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.02	Minimum Detected	-3.912
Maximum Detected	1.5	Maximum Detected	0.405
Mean of Detected	0.284	Mean of Detected	-2.228
SD of Detected	0.448	SD of Detected	1.323
Minimum Non-Detect	0.01	Minimum Non-Detect	-4.605
Maximum Non-Detect	0.01	Maximum Non-Detect	-4.605

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.616	Shapiro Wilk Test Statistic	0.767
5% Shapiro Wilk Critical Value	0.892	5% Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.231	Mean	-2.813
SD	0.416	SD	1.71
95% DL/2 (t) UCL	0.387	95% H-Stat (DL/2) UCL	0.945
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.171	Mean in Log Scale	-2.778
SD	0.469	SD in Log Scale	1.671
95% MLE (t) UCL	0.347	Mean in Original Scale	0.231
95% MLE (Tiku) UCL	0.343	SD in Original Scale	0.416
		95% Percentile Bootstrap UCL	0.393
		95% BCA Bootstrap UCL	0.447

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.56	Data do not follow a Discernable Distribution (0.05)
Theta Star	0.507	
nu star	19.04	

A-D Test Statistic	2.442
5% A-D Critical Value	0.787
K-S Test Statistic	0.787
5% K-S Critical Value	0.219

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1.5
Mean	0.23
Median	0.05
SD	0.416
k star	0.182
Theta star	1.263
Nu star	7.648
AppChi2	2.533
95% Gamma Approximate UCL	0.695
95% Adjusted Gamma UCL	0.761

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.234
SD	0.404
SE of Mean	0.0909
95% KM (t) UCL	0.391
95% KM (z) UCL	0.383
95% KM (jackknife) UCL	0.385
95% KM (bootstrap t) UCL	0.503
95% KM (BCA) UCL	0.392
95% KM (Percentile Bootstrap) UCL	0.394
95% KM (Chebyshev) UCL	0.63
97.5% KM (Chebyshev) UCL	0.802
99% KM (Chebyshev) UCL	1.139

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.802

Aroclor 1254

General Statistics

Number of Valid Data	21	Number of Detected Data	17
Number of Distinct Detected Data	8	Number of Non-Detect Data	4
		Percent Non-Detects	19.05%

Raw Statistics

Minimum Detected	0.02
Maximum Detected	1.5
Mean of Detected	0.278
SD of Detected	0.449
Minimum Non-Detect	0.01
Maximum Non-Detect	0.01

Log-transformed Statistics

Minimum Detected	-3.912
Maximum Detected	0.405
Mean of Detected	-2.269
SD of Detected	1.311
Minimum Non-Detect	-4.605
Maximum Non-Detect	-4.605

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.597
5% Shapiro Wilk Critical Value	0.892

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.226
SD	0.417
95% DL/2 (t) UCL	0.383

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.745
5% Shapiro Wilk Critical Value	0.892

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-2.846
SD	1.691
95% H-Stat (DL/2) UCL	0.861

Maximum Likelihood Estimate(MLE) Method	
Mean	0.165
SD	0.469
95% MLE (t) UCL	0.342
95% MLE (Tiku) UCL	0.338

Log ROS Method	
Mean in Log Scale	-2.806
SD in Log Scale	1.645
Mean in Original Scale	0.226
SD in Original Scale	0.417
95% Percentile Bootstrap UCL	0.385
95% BCA Bootstrap UCL	0.44

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.551
Theta Star	0.504
nu star	18.74
A-D Test Statistic	2.708
5% A-D Critical Value	0.787
K-S Test Statistic	0.787
5% K-S Critical Value	0.219

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1.5
Mean	0.225
Median	0.05
SD	0.417
k star	0.182
Theta star	1.238
Nu star	7.633
AppChi2	2.524
95% Gamma Approximate UCL	0.68
95% Adjusted Gamma UCL	0.745

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.229
SD	0.405
SE of Mean	0.0911
95% KM (t) UCL	0.386
95% KM (z) UCL	0.379
95% KM (jackknife) UCL	0.381
95% KM (bootstrap t) UCL	0.502
95% KM (BCA) UCL	0.394
95% KM (Percentile Bootstrap) UCL	0.394
95% KM (Chebyshev) UCL	0.626
97.5% KM (Chebyshev) UCL	0.798
99% KM (Chebyshev) UCL	1.136

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.798

Aroclor 1260

General Statistics

Number of Valid Data	21
Number of Distinct Detected Data	9
Number of Detected Data	17
Number of Non-Detect Data	4
Percent Non-Detects	19.05%

Raw Statistics

Minimum Detected	0.02
Maximum Detected	17.1
Mean of Detected	2.567
SD of Detected	5.173
Minimum Non-Detect	0.01
Maximum Non-Detect	0.01

Log-transformed Statistics

Minimum Detected	-3.912
Maximum Detected	2.839
Mean of Detected	-1.692
SD of Detected	2.311
Minimum Non-Detect	-4.605
Maximum Non-Detect	-4.605

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.57
5% Shapiro Wilk Critical Value	0.892

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	2.079
SD	4.74
95% DL/2 (t) UCL	3.863
Maximum Likelihood Estimate(MLE) Method	
Mean	1.359
SD	5.317
95% MLE (t) UCL	3.36
95% MLE (Tiku) UCL	3.302

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.259
Theta Star	9.916
nu star	8.802
A-D Test Statistic	3.104
5% A-D Critical Value	0.855
K-S Test Statistic	0.855
5% K-S Critical Value	0.228

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	17.1
Mean	2.078
Median	0.05
SD	4.74
k star	0.143
Theta star	14.54
Nu star	6.003
AppChi2	1.641
95% Gamma Approximate UCL	7.6
95% Adjusted Gamma UCL	8.467

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.68
5% Shapiro Wilk Critical Value	0.892

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-2.379
SD	2.525
95% H-Stat (DL/2) UCL	35.25
Log ROS Method	
Mean in Log Scale	-2.609
SD in Log Scale	2.856
Mean in Original Scale	2.079
SD in Original Scale	4.74
95% Percentile Bootstrap UCL	3.901
95% BCA Bootstrap UCL	4.51

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	2.082
SD	4.624
SE of Mean	1.04
95% KM (t) UCL	3.876
95% KM (z) UCL	3.793
95% KM (jackknife) UCL	3.861
95% KM (bootstrap t) UCL	5.958
95% KM (BCA) UCL	3.858
95% KM (Percentile Bootstrap) UCL	3.802
95% KM (Chebyshev) UCL	6.616
97.5% KM (Chebyshev) UCL	8.578
99% KM (Chebyshev) UCL	12.43

Potential UCLs to Use

99% KM (Chebyshev) UCL	12.43

Aroclor 1262

General Statistics

Number of Valid Data	21	Number of Detected Data	17
Number of Distinct Detected Data	7	Number of Non-Detect Data	4
		Percent Non-Detects	19.05%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.02	Minimum Detected	-3.912
Maximum Detected	1.5	Maximum Detected	0.405
Mean of Detected	0.275	Mean of Detected	-2.313
SD of Detected	0.451	SD of Detected	1.323
Minimum Non-Detect	0.01	Minimum Non-Detect	-4.605
Maximum Non-Detect	0.01	Maximum Non-Detect	-4.605

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.588	Shapiro Wilk Test Statistic	0.707
5% Shapiro Wilk Critical Value	0.892	5% Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.223	Mean	-2.881
SD	0.418	SD	1.686
95% DL/2 (t) UCL	0.381	95% H-Stat (DL/2) UCL	0.819
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.162	Mean in Log Scale	-2.84
SD	0.47	SD in Log Scale	1.639
95% MLE (t) UCL	0.339	Mean in Original Scale	0.224
95% MLE (Tiku) UCL	0.335	SD in Original Scale	0.417
		95% Percentile Bootstrap UCL	0.383
		95% BCA Bootstrap UCL	0.428

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.537	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.511		
nu star	18.27		
A-D Test Statistic	3.017	Nonparametric Statistics	
5% A-D Critical Value	0.789	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.789	Mean	0.226
5% K-S Critical Value	0.219	SD	0.406
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.0914
		95% KM (t) UCL	0.384

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1.5
Mean	0.222
Median	0.05
SD	0.418
k star	0.181
Theta star	1.228
Nu star	7.604
AppChi2	2.508
95% Gamma Approximate UCL	0.674
95% Adjusted Gamma UCL	0.739

Note: DL/2 is not a recommended method.

95% KM (z) UCL	0.376
95% KM (jackknife) UCL	0.379
95% KM (bootstrap t) UCL	0.499
95% KM (BCA) UCL	0.411
95% KM (Percentile Bootstrap) UCL	0.388
95% KM (Chebyshev) UCL	0.624
97.5% KM (Chebyshev) UCL	0.797
99% KM (Chebyshev) UCL	1.135
Potential UCLs to Use	
97.5% KM (Chebyshev) UCL	0.797

Aroclor 1268

General Statistics

Number of Valid Data	21	Number of Detected Data	17
Number of Distinct Detected Data	7	Number of Non-Detect Data	4
		Percent Non-Detects	19.05%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.02	Minimum Detected	-3.912
Maximum Detected	1.5	Maximum Detected	0.405
Mean of Detected	0.275	Mean of Detected	-2.313
SD of Detected	0.451	SD of Detected	1.323
Minimum Non-Detect	0.01	Minimum Non-Detect	-4.605
Maximum Non-Detect	0.01	Maximum Non-Detect	-4.605

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.588	Shapiro Wilk Test Statistic	0.707
5% Shapiro Wilk Critical Value	0.892	5% Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.223	Mean	-2.881
SD	0.418	SD	1.686
95% DL/2 (t) UCL	0.381	95% H-Stat (DL/2) UCL	0.819
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.162	Mean in Log Scale	-2.84
SD	0.47	SD in Log Scale	1.639
95% MLE (t) UCL	0.339	Mean in Original Scale	0.224
95% MLE (Tiku) UCL	0.335	SD in Original Scale	0.417
		95% Percentile Bootstrap UCL	0.382
		95% BCA Bootstrap UCL	0.428

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.537
Theta Star	0.511
nu star	18.27
A-D Test Statistic	3.017
5% A-D Critical Value	0.789
K-S Test Statistic	0.789
5% K-S Critical Value	0.219
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1.5
Mean	0.222
Median	0.05
SD	0.418
k star	0.181
Theta star	1.228
Nu star	7.604
AppChi2	2.508
95% Gamma Approximate UCL	0.674
95% Adjusted Gamma UCL	0.739

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.226
SD	0.406
SE of Mean	0.0914
95% KM (t) UCL	0.384
95% KM (z) UCL	0.376
95% KM (jackknife) UCL	0.379
95% KM (bootstrap t) UCL	0.499
95% KM (BCA) UCL	0.413
95% KM (Percentile Bootstrap) UCL	0.374
95% KM (Chebyshev) UCL	0.624
97.5% KM (Chebyshev) UCL	0.797
99% KM (Chebyshev) UCL	1.135
Potential UCLs to Use	
97.5% KM (Chebyshev) UCL	0.797

Polychlorinated biphenyls

General Statistics

Number of Valid Data	21	Number of Detected Data	17
Number of Distinct Detected Data	9	Number of Non-Detect Data	4
		Percent Non-Detects	19.05%

Raw Statistics	
Minimum Detected	0.03
Maximum Detected	17.1
Mean of Detected	2.585
SD of Detected	5.164
Minimum Non-Detect	0.01
Maximum Non-Detect	0.01

Log-transformed Statistics	
Minimum Detected	-3.507
Maximum Detected	2.839
Mean of Detected	-1.599
SD of Detected	2.291
Minimum Non-Detect	-4.605
Maximum Non-Detect	-4.605

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.575
5% Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level	

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.683
5% Shapiro Wilk Critical Value	0.892
Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	2.093
SD	4.734
95% DL/2 (t) UCL	3.875
Maximum Likelihood Estimate(MLE) Method	
Mean	1.375
SD	5.312
95% MLE (t) UCL	3.374
95% MLE (Tiku) UCL	3.317

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-2.303
SD	2.533
95% H-Stat (DL/2) UCL	39.32
Log ROS Method	
Mean in Log Scale	-2.517
SD in Log Scale	2.844
Mean in Original Scale	2.093
SD in Original Scale	4.735
95% Percentile Bootstrap UCL	3.909
95% BCA Bootstrap UCL	4.287

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.265
Theta Star	9.743
nu star	9.02
A-D Test Statistic	2.948
5% A-D Critical Value	0.852
K-S Test Statistic	0.852
5% K-S Critical Value	0.228

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	17.1
Mean	2.092
Median	0.05
SD	4.735
k star	0.144
Theta star	14.53
Nu star	6.05
AppChi2	1.666
95% Gamma Approximate UCL	7.601
95% Adjusted Gamma UCL	8.463

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	2.098
SD	4.618
SE of Mean	1.039
95% KM (t) UCL	3.89
95% KM (z) UCL	3.807
95% KM (jackknife) UCL	3.876
95% KM (bootstrap t) UCL	5.915
95% KM (BCA) UCL	3.988
95% KM (Percentile Bootstrap) UCL	3.943
95% KM (Chebyshev) UCL	6.626
97.5% KM (Chebyshev) UCL	8.585
99% KM (Chebyshev) UCL	12.43

Potential UCLs to Use

99% KM (Chebyshev) UCL	12.43

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Z:\Projects\2009\1584-0901 TC Iqaluit Landfill\SSRA\COC tables\95UCL\soil\soil-PHC.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzene

General Statistics

Number of Valid Data	32	Number of Detected Data	20
Number of Distinct Detected Data	2	Number of Non-Detect Data	12
		Percent Non-Detects	37.50%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.03	Minimum Detected	-3.507
Maximum Detected	0.04	Maximum Detected	-3.219
Mean of Detected	0.035	Mean of Detected	-3.363
SD of Detected	0.00513	SD of Detected	0.148
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.641	Shapiro Wilk Test Statistic	0.641
5% Shapiro Wilk Critical Value	0.905	5% Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0223	Mean	-4.692
SD	0.0172	SD	1.748
95% DL/2 (t) UCL	0.0274	95% H-Stat (DL/2) UCL	0.123

Maximum Likelihood Estimate(MLE) Method	
Mean	0.0169
SD	0.025
95% MLE (t) UCL	0.0243
95% MLE (Tiku) UCL	0.0254

Log ROS Method	
Mean in Log Scale	-3.481
SD in Log Scale	0.202
Mean in Original Scale	0.0314
SD in Original Scale	0.00637
95% Percentile Bootstrap UCL	0.0332
95% BCA Bootstrap UCL	0.0333

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	41.4
Theta Star	0.0008455
nu star	1656
A-D Test Statistic	3.593
5% A-D Critical Value	0.739
K-S Test Statistic	0.739
5% K-S Critical Value	0.193

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.0252
Maximum	0.04
Mean	0.0341
Median	0.0333
SD	0.00469
k star	49.44
Theta star	0.0006891
Nu star	3164
AppChi2	3035
95% Gamma Approximate UCL	0.0355
95% Adjusted Gamma UCL	0.0356

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0331
SD	0.00464
SE of Mean	0.0008407
95% KM (t) UCL	0.0346
95% KM (z) UCL	0.0345
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	0.0368
97.5% KM (Chebyshev) UCL	0.0384
99% KM (Chebyshev) UCL	0.0415

Potential UCLs to Use

95% KM (BCA) UCL	N/A

Ethylbenzene

General Statistics

Number of Valid Data	32	Number of Detected Data	20
Number of Distinct Detected Data	1	Number of Non-Detect Data	12
		Percent Non-Detects	37.50%

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

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Ethylbenzene was not processed!

Toluene

General Statistics

Number of Valid Data	32	Number of Detected Data	20
Number of Distinct Detected Data	1	Number of Non-Detect Data	12
		Percent Non-Detects	37.50%

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

The data set for variable Toluene was not processed!

m+p-Xylene

General Statistics

Number of Valid Data	32	Number of Detected Data	20
Number of Distinct Detected Data	1	Number of Non-Detect Data	12
		Percent Non-Detects	37.50%

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

The data set for variable m+p-Xylene was not processed!

o-Xylene

General Statistics

Number of Valid Data	32	Number of Detected Data	20
Number of Distinct Detected Data	1	Number of Non-Detect Data	12
		Percent Non-Detects	37.50%

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

The data set for variable o-Xylene was not processed!

Xylenes (total)

General Statistics

Number of Valid Data	32	Number of Detected Data	20
Number of Distinct Detected Data	1	Number of Non-Detect Data	12
		Percent Non-Detects	37.50%

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

The data set for variable Xylenes (total) was not processed!

F1 (C6-C10)

General Statistics

Number of Valid Data	32	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	31
		Percent Non-Detects	96.88%

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

The data set for variable F1 (C6-C10) was not processed!

F1 (C6-C10) minus BTEX

General Statistics

Number of Valid Data	32	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	31
		Percent Non-Detects	96.88%

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

The data set for variable F1 (C6-C10) minus BTEX was not processed!

F2 (C10-C16)

General Statistics

Number of Valid Data	32	Number of Detected Data	21
Number of Distinct Detected Data	6	Number of Non-Detect Data	11
		Percent Non-Detects	34.38%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	30	Minimum Detected	3.401
Maximum Detected	1100	Maximum Detected	7.003
Mean of Detected	102.7	Mean of Detected	3.748
SD of Detected	246.1	SD of Detected	0.953
Minimum Non-Detect	10	Minimum Non-Detect	2.303
Maximum Non-Detect	10	Maximum Non-Detect	2.303

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.337
5% Shapiro Wilk Critical Value	0.908

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	69.09
SD	203.2
95% DL/2 (t) UCL	130
Maximum Likelihood Estimate(MLE) Method	N/A

MLE yields a negative mean

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.419
5% Shapiro Wilk Critical Value	0.908

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	3.013
SD	1.285
95% H-Stat (DL/2) UCL	84.62
Log ROS Method	
Mean in Log Scale	3.158
SD in Log Scale	1.162
Mean in Original Scale	70.26
SD in Original Scale	202.8
95% Percentile Bootstrap UCL	135.9
95% BCA Bootstrap UCL	177.8

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.62
Theta Star	165.7
nu star	26.03
A-D Test Statistic	6.321
5% A-D Critical Value	0.789
K-S Test Statistic	0.789
5% K-S Critical Value	0.198

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1100
Mean	72.36
Median	30
SD	202.6
k star	0.141
Theta star	514.2
Nu star	9.007
AppChi2	3.331
95% Gamma Approximate UCL	195.6
95% Adjusted Gamma UCL	207

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	77.69
SD	197.6
SE of Mean	35.79
95% KM (t) UCL	138.4
95% KM (z) UCL	136.6
95% KM (jackknife) UCL	137.9
95% KM (bootstrap t) UCL	2624
95% KM (BCA) UCL	143.4
95% KM (Percentile Bootstrap) UCL	144.1
95% KM (Chebyshev) UCL	233.7
97.5% KM (Chebyshev) UCL	301.2
99% KM (Chebyshev) UCL	433.8

Potential UCLs to Use

95% KM (BCA) UCL	143.4

F3 (C16-C34)

General Statistics

Number of Valid Data	32	Number of Detected Data	24
Number of Distinct Detected Data	10	Number of Non-Detect Data	8
		Percent Non-Detects	25.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	50	Minimum Detected	3.912
Maximum Detected	44400	Maximum Detected	10.7
Mean of Detected	2104	Mean of Detected	4.773
SD of Detected	9043	SD of Detected	1.628
Minimum Non-Detect	10	Minimum Non-Detect	2.303
Maximum Non-Detect	10	Maximum Non-Detect	2.303

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.242	Shapiro Wilk Test Statistic	0.599
5% Shapiro Wilk Critical Value	0.916	5% Shapiro Wilk Critical Value	0.916
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1580	Mean	3.982
SD	7843	SD	1.976
95% DL/2 (t) UCL	3930	95% H-Stat (DL/2) UCL	1203
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	3.962
		SD in Log Scale	2.035
		Mean in Original Scale	1580
		SD in Original Scale	7843
		95% Percentile Bootstrap UCL	4333
		95% BCA Bootstrap UCL	5866

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.244	Data do not follow a Discernable Distribution (0.05)
Theta Star	8621	
nu star	11.72	

A-D Test Statistic	6.252
5% A-D Critical Value	0.874
K-S Test Statistic	0.874
5% K-S Critical Value	0.195

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	1E-09
Maximum	44400
Mean	1578
Median	50
SD	7844
k star	0.104
Theta star	15201
Nu star	6.645
AppChi2	1.978
95% Gamma Approximate UCL	5302
95% Adjusted Gamma UCL	5685

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	1591
SD	7718
SE of Mean	1394
95% KM (t) UCL	3954
95% KM (z) UCL	3883
95% KM (jackknife) UCL	3941
95% KM (bootstrap t) UCL	163519
95% KM (BCA) UCL	4377
95% KM (Percentile Bootstrap) UCL	4350
95% KM (Chebyshev) UCL	7666
97.5% KM (Chebyshev) UCL	10294
99% KM (Chebyshev) UCL	15457

Potential UCLs to Use

99% KM (Chebyshev) UCL	15457

F4 (C34-C50)

General Statistics

Number of Valid Data	32	Number of Detected Data	24
Number of Distinct Detected Data	10	Number of Non-Detect Data	8
		Percent Non-Detects	25.00%

Raw Statistics

Minimum Detected	50
Maximum Detected	6960
Mean of Detected	412.1
SD of Detected	1409
Minimum Non-Detect	10
Maximum Non-Detect	10

Log-transformed Statistics

Minimum Detected	3.912
Maximum Detected	8.848
Mean of Detected	4.514
SD of Detected	1.226
Minimum Non-Detect	2.303
Maximum Non-Detect	2.303

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.28
5% Shapiro Wilk Critical Value	0.916

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	310.3
SD	1227
95% DL/2 (t) UCL	678

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.578
5% Shapiro Wilk Critical Value	0.916

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	3.788
SD	1.658
95% H-Stat (DL/2) UCL	390.1

Maximum Likelihood Estimate(MLE) Method	
Mean	27.03
SD	1434
95% MLE (t) UCL	456.9
95% MLE (Tiku) UCL	459.2

Log ROS Method	
Mean in Log Scale	3.91
SD in Log Scale	1.524
Mean in Original Scale	311.4
SD in Original Scale	1226
95% Percentile Bootstrap UCL	735.9
95% BCA Bootstrap UCL	1137

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.405
Theta Star	1017
nu star	19.45
A-D Test Statistic	5.695
5% A-D Critical Value	0.822
K-S Test Statistic	0.822
5% K-S Critical Value	0.19

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	6960
Mean	309.1
Median	50
SD	1227
k star	0.118
Theta star	2625
Nu star	7.537
AppChi2	2.47
95% Gamma Approximate UCL	943.2
95% Adjusted Gamma UCL	1005

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	321.6
SD	1205
SE of Mean	217.5
95% KM (t) UCL	690.4
95% KM (z) UCL	679.4
95% KM (jackknife) UCL	688.4
95% KM (bootstrap t) UCL	5992
95% KM (BCA) UCL	771.8
95% KM (Percentile Bootstrap) UCL	750.9
95% KM (Chebyshev) UCL	1270
97.5% KM (Chebyshev) UCL	1680
99% KM (Chebyshev) UCL	2486

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	1680

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Z:\Projects\2009\1584-0901 TC Iqaluit Landfill\SSRA\COC tables\95UCL\soil\soil-VOC.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Bromodichloromethane

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable Bromodichloromethane was not processed!

Bromoform

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable Bromoform was not processed!

Carbon tetrachloride

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable Carbon tetrachloride was not processed!

Chlorobenzene

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable Chlorobenzene was not processed!

Chlorodibromomethane

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable Chlorodibromomethane was not processed!

Chloroform

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable Chloroform was not processed!

1,2-Dichlorobenzene

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable 1,2-Dichlorobenzene was not processed!

1,3-Dichlorobenzene

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable 1,3-Dichlorobenzene was not processed!

1,4-Dichlorobenzene

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

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

1,1-Dichloroethane

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

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

1,2-Dichloroethane

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable 1,2-Dichloroethane was not processed!

1,1-Dichloroethene

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

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

cis-1,2-Dichloroethene

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable cis-1,2-Dichloroethene was not processed!

trans-1,2-Dichloroethene

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable trans-1,2-Dichloroethene was not processed!

Dichloromethane

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	3	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.3	Minimum Detected	-1.204
Maximum Detected	0.8	Maximum Detected	-0.223
Mean of Detected	0.483	Mean of Detected	-0.809
SD of Detected	0.214	SD of Detected	0.445
Minimum Non-Detect	0.003	Minimum Non-Detect	-5.809
Maximum Non-Detect	0.003	Maximum Non-Detect	-5.809

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.817	Shapiro Wilk Test Statistic	0.794
5% Shapiro Wilk Critical Value	0.788	5% Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.224	Mean	-3.875
SD	0.286	SD	2.968
95% DL/2 (t) UCL	0.365	95% H-Stat (DL/2) UCL	614.3
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.00128	Mean in Log Scale	-1.531
SD	0.519	SD in Log Scale	0.817
95% MLE (t) UCL	0.258	Mean in Original Scale	0.291
95% MLE (Tiku) UCL	0.33	SD in Original Scale	0.234
		95% Percentile Bootstrap UCL	0.398
		95% BCA Bootstrap UCL	0.412

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	3.226	Data appear Normal at 5% Significance Level
Theta Star	0.15	
nu star	38.71	

A-D Test Statistic	0.708
5% A-D Critical Value	0.698
K-S Test Statistic	0.698
5% K-S Critical Value	0.333

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.197
Maximum	0.8
Mean	0.505
Median	0.554
SD	0.2
k star	4.757
Theta star	0.106
Nu star	123.7
AppChi2	99.01
95% Gamma Approximate UCL	0.631
95% Adjusted Gamma UCL	0.652

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.385
SD	0.161
SE of Mean	0.0489
95% KM (t) UCL	0.472
95% KM (z) UCL	0.465
95% KM (jackknife) UCL	0.467
95% KM (bootstrap t) UCL	0.506
95% KM (BCA) UCL	0.469
95% KM (Percentile Bootstrap) UCL	0.492
95% KM (Chebyshev) UCL	0.598
97.5% KM (Chebyshev) UCL	0.69
99% KM (Chebyshev) UCL	0.871

Potential UCLs to Use

95% KM (t) UCL	0.472
95% KM (Percentile Bootstrap) UCL	0.492

1,2-Dichloropropane

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable 1,2-Dichloropropane was not processed!

trans-1,3-Dichloropropene

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable trans-1,3-Dichloropropene was not processed!

Methyl-tert-butylether

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable Methyl-tert-butylether was not processed!

Styrene

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable Styrene was not processed!

1,1,1,2-Tetrachloroethane

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable 1,1,1,2-Tetrachloroethane was not processed!

1,1,2,2-Tetrachloroethane

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable 1,1,2,2-Tetrachloroethane was not processed!

Tetrachloroethene

General Statistics

Number of Valid Data	13	Number of Detected Data	8
Number of Distinct Detected Data	3	Number of Non-Detect Data	5
Number of Missing Values	6	Percent Non-Detects	38.46%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.033	Minimum Detected	-3.411
Maximum Detected	0.057	Maximum Detected	-2.865
Mean of Detected	0.0488	Mean of Detected	-3.031
SD of Detected	0.00682	SD of Detected	0.16
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.648	Shapiro Wilk Test Statistic	0.609
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.0304
SD	0.0247
95% DL/2 (t) UCL	0.0426
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0222
SD	0.0358
95% MLE (t) UCL	0.0399
95% MLE (Tiku) UCL	0.0424

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-4.522
SD	1.967
95% H-Stat (DL/2) UCL	0.744
Log ROS Method	
Mean in Log Scale	-3.145
SD in Log Scale	0.199
Mean in Original Scale	0.0438
SD in Original Scale	0.00846
95% Percentile Bootstrap UCL	0.0474
95% BCA Bootstrap UCL	0.0475

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	30.7
Theta Star	0.00159
nu star	491.1
A-D Test Statistic	1.669
5% A-D Critical Value	0.715
K-S Test Statistic	0.715
5% K-S Critical Value	0.293

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.033
Maximum	0.057
Mean	0.0476
Median	0.05
SD	0.00594
k star	47.6
Theta star	0.0009991
Nu star	1238
AppChi2	1157
95% Gamma Approximate UCL	0.0509
95% Adjusted Gamma UCL	0.0514

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0427
SD	0.00915
SE of Mean	0.00271
95% KM (t) UCL	0.0475
95% KM (z) UCL	0.0472
95% KM (jackknife) UCL	0.05
95% KM (bootstrap t) UCL	0.0467
95% KM (BCA) UCL	0.0511
95% KM (Percentile Bootstrap) UCL	0.0511
95% KM (Chebyshev) UCL	0.0545
97.5% KM (Chebyshev) UCL	0.0596
99% KM (Chebyshev) UCL	0.0697

Potential UCLs to Use

95% KM (BCA) UCL	0.0511

1,1,1-Trichloroethane

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

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

1,1,2-Trichloroethane

General Statistics

Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

The data set for variable 1,1,2-Trichloroethane was not processed!

Trichloroethene

General Statistics

Number of Valid Data	12	Number of Detected Data	6
Number of Distinct Detected Data	3	Number of Non-Detect Data	6
Number of Missing Values	7	Percent Non-Detects	50.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.005	Minimum Detected	-5.298
Maximum Detected	0.015	Maximum Detected	-4.2
Mean of Detected	0.0108	Mean of Detected	-4.586
SD of Detected	0.00376	SD of Detected	0.402
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.866	Shapiro Wilk Test Statistic	0.834
5% Shapiro Wilk Critical Value	0.788	5% Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.00592
SD	0.00573
95% DL/2 (t) UCL	0.00889
Maximum Likelihood Estimate(MLE) Method	
Mean	0.003
SD	0.009
95% MLE (t) UCL	0.00767
95% MLE (Tiku) UCL	0.00874

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-5.747
SD	1.243
95% H-Stat (DL/2) UCL	0.0245
Log ROS Method	
Mean in Log Scale	-5.124
SD in Log Scale	0.666
Mean in Original Scale	0.00724
SD in Original Scale	0.0046
95% Percentile Bootstrap UCL	0.00939
95% BCA Bootstrap UCL	0.0096

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	4.331
Theta Star	0.0025
nu star	51.97
A-D Test Statistic	0.551
5% A-D Critical Value	0.698
K-S Test Statistic	0.698
5% K-S Critical Value	0.333

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	0.005
Maximum	0.015
Mean	0.0108
Median	0.0102
SD	0.00346
k star	6.833
Theta star	0.00159
Nu star	164
AppChi2	135.4
95% Gamma Approximate UCL	0.0131
95% Adjusted Gamma UCL	0.0135

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data appear Normal at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.00792
SD	0.0038
SE of Mean	0.0012
95% KM (t) UCL	0.0101
95% KM (z) UCL	0.00989
95% KM (jackknife) UCL	0.0108
95% KM (bootstrap t) UCL	0.00989
95% KM (BCA) UCL	0.0117
95% KM (Percentile Bootstrap) UCL	0.0117
95% KM (Chebyshev) UCL	0.0131
97.5% KM (Chebyshev) UCL	0.0154
99% KM (Chebyshev) UCL	0.0199
Potential UCLs to Use	
95% KM (t) UCL	0.0101
95% KM (Percentile Bootstrap) UCL	0.0117

Vinyl chloride

General Statistics			
Number of Valid Data	13	Number of Detected Data	6
Number of Distinct Detected Data	1	Number of Non-Detect Data	7
Number of Missing Values	6	Percent Non-Detects	53.85%

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

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Vinyl chloride was not processed!

Sediment Results for 95% UCLs

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Z:\Projects\2009\1584-0901 TC Iqaluit Landfill\SSRA\COC tables\95UCL\sediment\sediment-inorganic-brackish.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Number of Valid Data	11	Number of Detected Data	11
Number of Distinct Detected Data	10	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	2600	Minimum Detected	7.863
Maximum Detected	4600	Maximum Detected	8.434
Mean of Detected	3682	Mean of Detected	8.197
SD of Detected	612.9	SD of Detected	0.178
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.939	Shapiro Wilk Test Statistic	0.903
5% Shapiro Wilk Critical Value	0.85	5% Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	3682	Mean	8.197
SD	612.9	SD	0.178
95% DL/2 (t) UCL	4017	95% H-Stat (DL/2) UCL	4092
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	26.67	Data appear Normal at 5% Significance Level
Theta Star	138	
nu star	586.8	

A-D Test Statistic	0.45
5% A-D Critical Value	0.729
K-S Test Statistic	0.729
5% K-S Critical Value	0.255

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	2600
Maximum	4600
Mean	3682
Median	3700
SD	612.9
k star	26.67
Theta star	138
Nu star	586.8
AppChi2	531.6
95% Gamma Approximate UCL	4064
95% Adjusted Gamma UCL	4131

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	3682
SD	584.4
SE of Mean	184.8
95% KM (t) UCL	4017
95% KM (z) UCL	3986
95% KM (jackknife) UCL	4017
95% KM (bootstrap t) UCL	3972
95% KM (BCA) UCL	3955
95% KM (Percentile Bootstrap) UCL	3955
95% KM (Chebyshev) UCL	4487
97.5% KM (Chebyshev) UCL	4836
99% KM (Chebyshev) UCL	5520

Potential UCLs to Use

95% KM (t) UCL	4017
95% KM (Percentile Bootstrap) UCL	3955

Antimony (Sb)

General Statistics

Number of Valid Data	18	Number of Detected Data	8
Number of Distinct Detected Data	2	Number of Non-Detect Data	10
		Percent Non-Detects	55.56%

Raw Statistics

Minimum Detected	0.7
Maximum Detected	10
Mean of Detected	8.838
SD of Detected	3.288
Minimum Non-Detect	0.2
Maximum Non-Detect	0.2

Log-transformed Statistics

Minimum Detected	-0.357
Maximum Detected	2.303
Mean of Detected	1.97
SD of Detected	0.94
Minimum Non-Detect	-1.609
Maximum Non-Detect	-1.609

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters
(e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.419
5% Shapiro Wilk Critical Value	0.818

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	3.983
SD	4.941
95% DL/2 (t) UCL	6.009
Maximum Likelihood Estimate(MLE) Method	N/A

MLE yields a negative mean

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.419
5% Shapiro Wilk Critical Value	0.818

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-0.404
SD	2.266
95% H-Stat (DL/2) UCL	12.34
Log ROS Method	
Mean in Log Scale	1.142
SD in Log Scale	1.044
Mean in Original Scale	4.933
SD in Original Scale	4.212
95% Percentile Bootstrap UCL	6.475
95% BCA Bootstrap UCL	6.678

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.676
Theta Star	5.272
nu star	26.82
A-D Test Statistic	2.566
5% A-D Critical Value	0.723
K-S Test Statistic	0.723
5% K-S Critical Value	0.297

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.7
Maximum	12.89
Mean	9.252
Median	10
SD	2.786
k star	3.899
Theta star	2.373
Nu star	140.4
AppChi2	114
95% Gamma Approximate UCL	11.39
95% Adjusted Gamma UCL	11.63

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	4.317
SD	4.534
SE of Mean	1.142
95% KM (t) UCL	6.304
95% KM (z) UCL	6.196
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	9.296
97.5% KM (Chebyshev) UCL	11.45
99% KM (Chebyshev) UCL	15.68

Potential UCLs to Use

95% KM (t) UCL	6.304
95% KM (% Bootstrap) UCL	N/A

Arsenic (As)

General Statistics

Number of Valid Data	18	Number of Detected Data	13
Number of Distinct Detected Data	4	Number of Non-Detect Data	5
		Percent Non-Detects	27.78%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1	Minimum Detected	0
Maximum Detected	7	Maximum Detected	1.946
Mean of Detected	3.846	Mean of Detected	1.176
SD of Detected	1.951	SD of Detected	0.669
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.817	Shapiro Wilk Test Statistic	0.787
5% Shapiro Wilk Critical Value	0.866	5% Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.917	Mean	0.657
SD	2.251	SD	1.029
95% DL/2 (t) UCL	3.84	95% H-Stat (DL/2) UCL	3.455
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	2.602	Mean in Log Scale	0.78
SD	2.656	SD in Log Scale	0.88
95% MLE (t) UCL	3.691	Mean in Original Scale	3.004
95% MLE (Tiku) UCL	3.755	SD in Original Scale	2.158
		95% Percentile Bootstrap UCL	3.795
		95% BCA Bootstrap UCL	3.823

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	2.423	Data do not follow a Discernable Distribution (0.05)
Theta Star	1.587	
nu star	63.01	

A-D Test Statistic	1.412
5% A-D Critical Value	0.739
K-S Test Statistic	0.739
5% K-S Critical Value	0.238

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	0.513
Maximum	7
Mean	3.299
Median	2.758
SD	1.933
k star	2.118
Theta star	1.558
Nu star	76.24
AppChi2	57.13
95% Gamma Approximate UCL	4.403
95% Adjusted Gamma UCL	4.529

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	3.056
SD	2.04
SE of Mean	0.501
95% KM (t) UCL	3.926
95% KM (z) UCL	3.879
95% KM (jackknife) UCL	3.916
95% KM (bootstrap t) UCL	3.967
95% KM (BCA) UCL	4
95% KM (Percentile Bootstrap) UCL	3.944
95% KM (Chebyshev) UCL	5.238
97.5% KM (Chebyshev) UCL	6.182
99% KM (Chebyshev) UCL	8.036

Potential UCLs to Use

95% KM (BCA) UCL	4

Barium (Ba)

General Statistics

Number of Valid Observations	18	Number of Distinct Observations	14

Raw Statistics

Minimum	11
Maximum	25.9
Mean	18.47
Median	18.7
SD	4.247
Coefficient of Variation	0.23
Skewness	-0.119

Log-transformed Statistics

Minimum of Log Data	2.398
Maximum of Log Data	3.254
Mean of log Data	2.889
SD of log Data	0.246

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.963
Shapiro Wilk Critical Value	0.897

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.934
Shapiro Wilk Critical Value	0.897

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	20.21

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	20.09
95% Modified-t UCL	20.21

Assuming Lognormal Distribution

95% H-UCL	20.65
95% Chebyshev (MVUE) UCL	23.21
97.5% Chebyshev (MVUE) UCL	25.25
99% Chebyshev (MVUE) UCL	29.26

Gamma Distribution Test	
k star (bias corrected)	15.53
Theta Star	1.19
nu star	559
Approximate Chi Square Value (.05)	505.2
Adjusted Level of Significance	0.0357
Adjusted Chi Square Value	500.2
Anderson-Darling Test Statistic	0.365
Anderson-Darling 5% Critical Value	0.739
Kolmogorov-Smirnov Test Statistic	0.114
Kolmogorov-Smirnov 5% Critical Value	0.203

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
95% Approximate Gamma UCL	20.44
95% Adjusted Gamma UCL	20.64

Potential UCL to Use

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics	
95% CLT UCL	20.12
95% Jackknife UCL	20.21
95% Standard Bootstrap UCL	20.05
95% Bootstrap-t UCL	20.18
95% Hall's Bootstrap UCL	20.13
95% Percentile Bootstrap UCL	20.04
95% BCA Bootstrap UCL	19.98
95% Chebyshev(Mean, Sd) UCL	22.84
97.5% Chebyshev(Mean, Sd) UCL	24.72
99% Chebyshev(Mean, Sd) UCL	28.43

Use 95% Student's-t UCL 20.21

Cadmium (Cd)

General Statistics

Number of Valid Data	18	Number of Detected Data	13
Number of Distinct Detected Data	4	Number of Non-Detect Data	5
		Percent Non-Detects	27.78%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.1	Minimum Detected	-2.303
Maximum Detected	0.5	Maximum Detected	-0.693
Mean of Detected	0.354	Mean of Detected	-1.191
SD of Detected	0.171	SD of Detected	0.628
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.752	Shapiro Wilk Test Statistic	0.766
5% Shapiro Wilk Critical Value	0.866	5% Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.269
SD	0.201
95% DL/2 (t) UCL	0.352
Maximum Likelihood Estimate(MLE) Method	
Mean	0.243
SD	0.235
95% MLE (t) UCL	0.34
95% MLE (Tiku) UCL	0.345

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-1.693
SD	0.985
95% H-Stat (DL/2) UCL	0.309
Log ROS Method	
Mean in Log Scale	-1.56
SD in Log Scale	0.822
Mean in Original Scale	0.279
SD in Original Scale	0.191
95% Percentile Bootstrap UCL	0.352
95% BCA Bootstrap UCL	0.355

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	2.693
Theta Star	0.131
nu star	70.02
A-D Test Statistic	1.416
5% A-D Critical Value	0.738
K-S Test Statistic	0.738
5% K-S Critical Value	0.238

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.0556
Maximum	0.5
Mean	0.306
Median	0.26
SD	0.17
k star	2.368
Theta star	0.129
Nu star	85.25
AppChi2	64.97
95% Gamma Approximate UCL	0.401
95% Adjusted Gamma UCL	0.412

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.283
SD	0.18
SE of Mean	0.0442
95% KM (t) UCL	0.36
95% KM (z) UCL	0.356
95% KM (jackknife) UCL	0.359
95% KM (bootstrap t) UCL	0.363
95% KM (BCA) UCL	0.367
95% KM (Percentile Bootstrap) UCL	0.361
95% KM (Chebyshev) UCL	0.476
97.5% KM (Chebyshev) UCL	0.56
99% KM (Chebyshev) UCL	0.723

Potential UCLs to Use

95% KM (BCA) UCL	0.367

Calcium

General Statistics

Number of Valid Data	11	Number of Detected Data	11
Number of Distinct Detected Data	9	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Sediment Results for 95% UCLs

Raw Statistics	
Minimum Detected	1500
Maximum Detected	3500
Mean of Detected	2336
SD of Detected	510.4
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

Log-transformed Statistics	
Minimum Detected	7.313
Maximum Detected	8.161
Mean of Detected	7.735
SD of Detected	0.217
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.92
5% Shapiro Wilk Critical Value	0.85

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.944
5% Shapiro Wilk Critical Value	0.85

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	2336
SD	510.4
95% DL/2 (t) UCL	2615
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	7.735
SD	0.217
95% H-Stat (DL/2) UCL	2664
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	17.2
Theta Star	135.8
nu star	378.5
A-D Test Statistic	0.402
5% A-D Critical Value	0.729
K-S Test Statistic	0.729
5% K-S Critical Value	0.255

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1500
Maximum	3500
Mean	2336
Median	2400
SD	510.4
k star	17.2
Theta star	135.8
Nu star	378.5
AppChi2	334.4
95% Gamma Approximate UCL	2644
95% Adjusted Gamma UCL	2699

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data appear Normal at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	2336
SD	486.7
SE of Mean	153.9
95% KM (t) UCL	2615
95% KM (z) UCL	2590
95% KM (jackknife) UCL	2615
95% KM (bootstrap t) UCL	2659
95% KM (BCA) UCL	2582
95% KM (Percentile Bootstrap) UCL	2582
95% KM (Chebyshev) UCL	3007
97.5% KM (Chebyshev) UCL	3297
99% KM (Chebyshev) UCL	3868

Potential UCLs to Use	
95% KM (t) UCL	2615
95% KM (Percentile Bootstrap) UCL	2582

Chromium (Cr)

General Statistics

Number of Valid Observations	18	Number of Distinct Observations	13

Raw Statistics

Minimum	9.3
Maximum	30
Mean	15.72
Median	15.25
SD	4.821
Coefficient of Variation	0.307
Skewness	1.407

Log-transformed Statistics

Minimum of Log Data	2.23
Maximum of Log Data	3.401
Mean of log Data	2.715
SD of log Data	0.286

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.891
Shapiro Wilk Critical Value	0.897

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.965
Shapiro Wilk Critical Value	0.897

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	17.7

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	17.99
95% Modified-t UCL	17.76

Assuming Lognormal Distribution

95% H-UCL	17.89
95% Chebyshev (MVUE) UCL	20.38
97.5% Chebyshev (MVUE) UCL	22.4
99% Chebyshev (MVUE) UCL	26.38

Gamma Distribution Test

k star (bias corrected)	10.6
Theta Star	1.483
nu star	381.6
Approximate Chi Square Value (.05)	337.3
Adjusted Level of Significance	0.0357
Adjusted Chi Square Value	333.3
Anderson-Darling Test Statistic	0.289
Anderson-Darling 5% Critical Value	0.739
Kolmogorov-Smirnov Test Statistic	0.112
Kolmogorov-Smirnov 5% Critical Value	0.203

Data appear Gamma Distributed at 5% Significance Level

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	17.59
95% Jackknife UCL	17.7
95% Standard Bootstrap UCL	17.52
95% Bootstrap-t UCL	18.18
95% Hall's Bootstrap UCL	19.43
95% Percentile Bootstrap UCL	17.68
95% BCA Bootstrap UCL	18.01
95% Chebyshev(Mean, Sd) UCL	20.68
97.5% Chebyshev(Mean, Sd) UCL	22.82
99% Chebyshev(Mean, Sd) UCL	27.03

Assuming Gamma Distribution

95% Approximate Gamma UCL	17.79
95% Adjusted Gamma UCL	18

Potential UCL to Use

Use 95% Approximate Gamma UCL 17.79

Chromium (VI)

General Statistics

Number of Valid Data	11	Number of Detected Data	4
Number of Distinct Detected Data	3	Number of Non-Detect Data	7
Number of Missing Values	7	Percent Non-Detects	63.64%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.4	Minimum Detected	-0.916
Maximum Detected	0.8	Maximum Detected	-0.223
Mean of Detected	0.575	Mean of Detected	-0.603
SD of Detected	0.206	SD of Detected	0.366
Minimum Non-Detect	0.2	Minimum Non-Detect	-1.609
Maximum Non-Detect	0.2	Maximum Non-Detect	-1.609

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.829	Shapiro Wilk Test Statistic	0.81
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.273	Mean	-1.685
SD	0.265	SD	0.881
95% DL/2 (t) UCL	0.417	95% H-Stat (DL/2) UCL	0.283
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.584	Mean in Log Scale	-1.434
SD	0.179	SD in Log Scale	0.78
95% MLE (t) UCL	0.682	Mean in Original Scale	0.312
95% MLE (Tiku) UCL	0.745	SD in Original Scale	0.243
		95% Percentile Bootstrap UCL	0.437
		95% BCA Bootstrap UCL	0.454

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	2.722	Data appear Normal at 5% Significance Level
Theta Star	0.211	
nu star	21.78	

A-D Test Statistic	0.542
5% A-D Critical Value	0.657
K-S Test Statistic	0.657
5% K-S Critical Value	0.395

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.339
Maximum	1.055
Mean	0.682
Median	0.7
SD	0.242
k star	5.836
Theta star	0.117
Nu star	128.4
AppChi2	103.2
95% Gamma Approximate UCL	0.848
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.464
SD	0.137
SE of Mean	0.0476
95% KM (t) UCL	0.55
95% KM (z) UCL	0.542
95% KM (jackknife) UCL	0.542
95% KM (bootstrap t) UCL	0.523
95% KM (BCA) UCL	0.709
95% KM (Percentile Bootstrap) UCL	0.709
95% KM (Chebyshev) UCL	0.671
97.5% KM (Chebyshev) UCL	0.761
99% KM (Chebyshev) UCL	0.937

Potential UCLs to Use

95% KM (t) UCL	0.55
95% KM (Percentile Bootstrap) UCL	0.709

Cobalt (Co)

General Statistics

Number of Valid Observations	18	Number of Distinct Observations	11

Raw Statistics

Minimum	2.3
Maximum	5.7
Mean	3.333
Median	3.2
SD	0.779
Coefficient of Variation	0.234
Skewness	2.036

Log-transformed Statistics

Minimum of Log Data	0.833
Maximum of Log Data	1.74
Mean of log Data	1.183
SD of log Data	0.204

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.768
Shapiro Wilk Critical Value	0.897

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	3.653

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	3.73
95% Modified-t UCL	3.667

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.861
Shapiro Wilk Critical Value	0.897

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	3.641
95% Chebyshev (MVUE) UCL	4.03
97.5% Chebyshev (MVUE) UCL	4.335
99% Chebyshev (MVUE) UCL	4.932

Gamma Distribution Test

k star (bias corrected)	19.64
Theta Star	0.17
nu star	707
Approximate Chi Square Value (.05)	646.3
Adjusted Level of Significance	0.0357
Adjusted Chi Square Value	640.7
Anderson-Darling Test Statistic	1.24
Anderson-Darling 5% Critical Value	0.739
Kolmogorov-Smirnov Test Statistic	0.268
Kolmogorov-Smirnov 5% Critical Value	0.203

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	3.646
95% Adjusted Gamma UCL	3.678

Potential UCL to Use

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	3.635
95% Jackknife UCL	3.653
95% Standard Bootstrap UCL	3.629
95% Bootstrap-t UCL	3.967
95% Hall's Bootstrap UCL	5.639
95% Percentile Bootstrap UCL	3.65
95% BCA Bootstrap UCL	3.739
95% Chebyshev(Mean, Sd) UCL	4.134
97.5% Chebyshev(Mean, Sd) UCL	4.48
99% Chebyshev(Mean, Sd) UCL	5.161

Use 95% Student's-t UCL 3.653
or 95% Modified-t UCL 3.667

Copper (Cu)

General Statistics

Number of Valid Observations	18	Number of Distinct Observations	15

Raw Statistics

Minimum	4.6
Maximum	18
Mean	6.889
Median	6.3
SD	3.015
Coefficient of Variation	0.438
Skewness	3.196

Log-transformed Statistics

Minimum of Log Data	1.526
Maximum of Log Data	2.89
Mean of log Data	1.872
SD of log Data	0.318

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.619
Shapiro Wilk Critical Value	0.897

Data not Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	8.125

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	8.63
95% Modified-t UCL	8.214

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.814
Shapiro Wilk Critical Value	0.897

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	7.899
95% Chebyshev (MVUE) UCL	9.082
97.5% Chebyshev (MVUE) UCL	10.06
99% Chebyshev (MVUE) UCL	11.99

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	7.353	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.937		
nu star	264.7		
Approximate Chi Square Value (.05)	228	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0357	95% CLT UCL	8.058
Adjusted Chi Square Value	224.8	95% Jackknife UCL	8.125
		95% Standard Bootstrap UCL	8.071
Anderson-Darling Test Statistic	1.179	95% Bootstrap-t UCL	9.29
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	12.85
Kolmogorov-Smirnov Test Statistic	0.23	95% Percentile Bootstrap UCL	8.228
Kolmogorov-Smirnov 5% Critical Value	0.204	95% BCA Bootstrap UCL	8.733
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	9.986
		97.5% Chebyshev(Mean, Sd) UCL	11.33
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	13.96
95% Approximate Gamma UCL	7.997		
95% Adjusted Gamma UCL	8.113		
Potential UCL to Use		Use 95% Student's-t UCL	8.125
		or 95% Modified-t UCL	8.214

Iron

General Statistics

Number of Valid Data	11	Number of Detected Data	11
Number of Distinct Detected Data	9	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	12000	Minimum Detected	9.393
Maximum Detected	46000	Maximum Detected	10.74
Mean of Detected	24091	Mean of Detected	10.01
SD of Detected	10406	SD of Detected	0.4
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.865	Shapiro Wilk Test Statistic	0.95
5% Shapiro Wilk Critical Value	0.85	5% Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	24091	Mean	10.01
SD	10406	SD	0.4
95% DL/2 (t) UCL	29778	95% H-Stat (DL/2) UCL	31357

Maximum Likelihood Estimate(MLE) Method	N/A
MLE method failed to converge properly	

Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	4.987
Theta Star	4831
nu star	109.7
A-D Test Statistic	0.432
5% A-D Critical Value	0.731
K-S Test Statistic	0.731
5% K-S Critical Value	0.256

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	12000
Maximum	46000
Mean	24091
Median	22000
SD	10406
k star	4.987
Theta star	4831
Nu star	109.7
AppChi2	86.54
95% Gamma Approximate UCL	30543
95% Adjusted Gamma UCL	31773

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	24091
SD	9922
SE of Mean	3138
95% KM (t) UCL	29778
95% KM (z) UCL	29252
95% KM (jackknife) UCL	29778
95% KM (bootstrap t) UCL	34277
95% KM (BCA) UCL	29636
95% KM (Percentile Bootstrap) UCL	29182
95% KM (Chebyshev) UCL	37767
97.5% KM (Chebyshev) UCL	43685
99% KM (Chebyshev) UCL	55310

Potential UCLs to Use

95% KM (t) UCL	29778
95% KM (Percentile Bootstrap) UCL	29182

Lead (Pb)

General Statistics

Number of Valid Data	18	Number of Detected Data	16
Number of Distinct Detected Data	9	Number of Non-Detect Data	2
		Percent Non-Detects	11.11%

Raw Statistics

Minimum Detected	3
Maximum Detected	63
Mean of Detected	21.63
SD of Detected	16.52
Minimum Non-Detect	2
Maximum Non-Detect	2

Log-transformed Statistics

Minimum Detected	1.099
Maximum Detected	4.143
Mean of Detected	2.718
SD of Detected	0.957
Minimum Non-Detect	0.693
Maximum Non-Detect	0.693

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.869
5% Shapiro Wilk Critical Value	0.887

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.898
5% Shapiro Wilk Critical Value	0.887

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	19.33
SD	16.89
95% DL/2 (t) UCL	26.26

Maximum Likelihood Estimate(MLE) Method

Mean	18.37
SD	17.88
95% MLE (t) UCL	25.7
95% MLE (Tiku) UCL	25.59

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	2.416
SD	1.257
95% H-Stat (DL/2) UCL	39.37

Log ROS Method

Mean in Log Scale	2.477
SD in Log Scale	1.143
Mean in Original Scale	19.42
SD in Original Scale	16.79
95% Percentile Bootstrap UCL	26
95% BCA Bootstrap UCL	26.81

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.303
Theta Star	16.6
nu star	41.7
A-D Test Statistic	0.718
5% A-D Critical Value	0.754
K-S Test Statistic	0.754
5% K-S Critical Value	0.219

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	1E-09
Maximum	63
Mean	19.22
Median	14.5
SD	17.02
k star	0.245
Theta star	78.36
Nu star	8.831
AppChi2	3.225
95% Gamma Approximate UCL	52.63
95% Adjusted Gamma UCL	58.38

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	19.56
SD	16.18
SE of Mean	3.938
95% KM (t) UCL	26.41
95% KM (z) UCL	26.03
95% KM (jackknife) UCL	26.38
95% KM (bootstrap t) UCL	27.51
95% KM (BCA) UCL	25.83
95% KM (Percentile Bootstrap) UCL	26.22
95% KM (Chebyshev) UCL	36.72
97.5% KM (Chebyshev) UCL	44.15
99% KM (Chebyshev) UCL	58.74

Potential UCLs to Use

95% KM (BCA) UCL	25.83

Magnesium

General Statistics

Number of Valid Data	11	Number of Detected Data	11
Number of Distinct Detected Data	10	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1900	Minimum Detected	7.55
Maximum Detected	4800	Maximum Detected	8.476
Mean of Detected	2909	Mean of Detected	7.944
SD of Detected	794.3	SD of Detected	0.259
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.898	Shapiro Wilk Test Statistic	0.954
5% Shapiro Wilk Critical Value	0.85	5% Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2909	Mean	7.944
SD	794.3	SD	0.259
95% DL/2 (t) UCL	3343	95% H-Stat (DL/2) UCL	3409
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	11.81	Data appear Normal at 5% Significance Level
Theta Star	246.3	
nu star	259.8	

A-D Test Statistic	0.323
5% A-D Critical Value	0.729
K-S Test Statistic	0.729
5% K-S Critical Value	0.255

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	1900
Maximum	4800
Mean	2909
Median	3000
SD	794.3
k star	11.81
Theta star	246.3
Nu star	259.8
AppChi2	223.5
95% Gamma Approximate UCL	3382
95% Adjusted Gamma UCL	3467

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	2909
SD	757.3
SE of Mean	239.5
95% KM (t) UCL	3343
95% KM (z) UCL	3303
95% KM (jackknife) UCL	3343
95% KM (bootstrap t) UCL	3454
95% KM (BCA) UCL	3309
95% KM (Percentile Bootstrap) UCL	3309
95% KM (Chebyshev) UCL	3953
97.5% KM (Chebyshev) UCL	4405
99% KM (Chebyshev) UCL	5292

Potential UCLs to Use

95% KM (t) UCL	3343
95% KM (Percentile Bootstrap) UCL	3309

Manganese

General Statistics

Number of Valid Data	11	Number of Detected Data	11
Number of Distinct Detected Data	10	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics

Minimum Detected	54
Maximum Detected	230
Mean of Detected	91.55
SD of Detected	55.97
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

Log-transformed Statistics

Minimum Detected	3.989
Maximum Detected	5.438
Mean of Detected	4.392
SD of Detected	0.486
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.706
5% Shapiro Wilk Critical Value	0.85

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.785
5% Shapiro Wilk Critical Value	0.85

Data not Lognormal at 5% Significance Level

Sediment Results for 95% UCLs

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	91.55
SD	55.97
95% DL/2 (t) UCL	122.1
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	4.392
SD	0.486
95% H-Stat (DL/2) UCL	126.6
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	3.079
Theta Star	29.73
nu star	67.74
A-D Test Statistic	1.249
5% A-D Critical Value	0.732
K-S Test Statistic	0.732
5% K-S Critical Value	0.256

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	54
Maximum	230
Mean	91.55
Median	67
SD	55.97
k star	3.079
Theta star	29.73
Nu star	67.74
AppChi2	49.8
95% Gamma Approximate UCL	124.5
95% Adjusted Gamma UCL	131.1

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	91.55
SD	53.36
SE of Mean	16.88
95% KM (t) UCL	122.1
95% KM (z) UCL	119.3
95% KM (jackknife) UCL	122.1
95% KM (bootstrap t) UCL	153.4
95% KM (BCA) UCL	121.1
95% KM (Percentile Bootstrap) UCL	121.4
95% KM (Chebyshev) UCL	165.1
97.5% KM (Chebyshev) UCL	196.9
99% KM (Chebyshev) UCL	259.5

Potential UCLs to Use

95% KM (Chebyshev) UCL	165.1

Mercury (Hg)

General Statistics

Number of Valid Data	18	Number of Detected Data	13
Number of Distinct Detected Data	3	Number of Non-Detect Data	5
		Percent Non-Detects	27.78%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0064	Minimum Detected	-5.051
Maximum Detected	0.05	Maximum Detected	-2.996
Mean of Detected	0.0435	Mean of Detected	-3.285
SD of Detected	0.0159	SD of Detected	0.71
Minimum Non-Detect	0.005	Minimum Non-Detect	-5.298
Maximum Non-Detect	0.005	Maximum Non-Detect	-5.298

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.452	Shapiro Wilk Test Statistic	0.461
5% Shapiro Wilk Critical Value	0.866	5% Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0321	Mean	-4.037
SD	0.0231	SD	1.383
95% DL/2 (t) UCL	0.0416	95% H-Stat (DL/2) UCL	0.127
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0283	Mean in Log Scale	-3.566
SD	0.0286	SD in Log Scale	0.766
95% MLE (t) UCL	0.04	Mean in Original Scale	0.0353
95% MLE (Tiku) UCL	0.041	SD in Original Scale	0.0191
		95% Percentile Bootstrap UCL	0.0421
		95% BCA Bootstrap UCL	0.042

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	2.738	Data do not follow a Discernable Distribution (0.05)
Theta Star	0.0159	
nu star	71.19	

A-D Test Statistic	3.799
5% A-D Critical Value	0.738
K-S Test Statistic	0.738
5% K-S Critical Value	0.238

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	0.0064
Maximum	0.05
Mean	0.0401
Median	0.05
SD	0.0148
k star	3.543
Theta star	0.0113
Nu star	127.6
AppChi2	102.5
95% Gamma Approximate UCL	0.0499
95% Adjusted Gamma UCL	0.051

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.0332
SD	0.0211
SE of Mean	0.00517
95% KM (t) UCL	0.0422
95% KM (z) UCL	0.0417
95% KM (jackknife) UCL	0.0418
95% KM (bootstrap t) UCL	0.0404
95% KM (BCA) UCL	0.05
95% KM (Percentile Bootstrap) UCL	0.05
95% KM (Chebyshev) UCL	0.0557
97.5% KM (Chebyshev) UCL	0.0655
99% KM (Chebyshev) UCL	0.0846

Potential UCLs to Use

95% KM (BCA) UCL	0.05

Molybdenum (Mo)

General Statistics

Number of Valid Data	18	Number of Detected Data	17
Number of Distinct Detected Data	10	Number of Non-Detect Data	1
		Percent Non-Detects	5.56%

Raw Statistics

Minimum Detected	1.3
Maximum Detected	11
Mean of Detected	3.894
SD of Detected	2.478
Minimum Non-Detect	0.8
Maximum Non-Detect	0.8

Log-transformed Statistics

Minimum Detected	0.262
Maximum Detected	2.398
Mean of Detected	1.196
SD of Detected	0.585
Minimum Non-Detect	-0.223
Maximum Non-Detect	-0.223

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.764
5% Shapiro Wilk Critical Value	0.892

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	3.7
SD	2.541
95% DL/2 (t) UCL	4.742

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.889
5% Shapiro Wilk Critical Value	0.892

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	1.079
SD	0.755
95% H-Stat (DL/2) UCL	5.2

Maximum Likelihood Estimate(MLE) Method	
Mean	3.651
SD	2.556
95% MLE (t) UCL	4.699
95% MLE (Tiku) UCL	4.671

Log ROS Method	
Mean in Log Scale	1.12
SD in Log Scale	0.653
Mean in Original Scale	3.724
SD in Original Scale	2.509
95% Percentile Bootstrap UCL	4.758
95% BCA Bootstrap UCL	4.944

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	2.689
Theta Star	1.448
nu star	91.41
A-D Test Statistic	1.079
5% A-D Critical Value	0.745
K-S Test Statistic	0.745
5% K-S Critical Value	0.211

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	11
Mean	3.678
Median	4
SD	2.573
k star	0.439
Theta star	8.376
Nu star	15.81
AppChi2	7.826
95% Gamma Approximate UCL	7.428
95% Adjusted Gamma UCL	7.973

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	3.75
SD	2.41
SE of Mean	0.586
95% KM (t) UCL	4.769
95% KM (z) UCL	4.713
95% KM (jackknife) UCL	4.764
95% KM (bootstrap t) UCL	5.406
95% KM (BCA) UCL	4.783
95% KM (Percentile Bootstrap) UCL	4.761
95% KM (Chebyshev) UCL	6.303
97.5% KM (Chebyshev) UCL	7.407
99% KM (Chebyshev) UCL	9.577

Potential UCLs to Use

95% KM (Chebyshev) UCL	6.303

Nickel (Ni)

General Statistics

Number of Valid Data	18	Number of Detected Data	17
Number of Distinct Detected Data	11	Number of Non-Detect Data	1
		Percent Non-Detects	5.56%

Raw Statistics

Minimum Detected	5
Maximum Detected	10
Mean of Detected	5.824
SD of Detected	1.215
Minimum Non-Detect	4.6
Maximum Non-Detect	4.6

Log-transformed Statistics

Minimum Detected	1.609
Maximum Detected	2.303
Mean of Detected	1.746
SD of Detected	0.175
Minimum Non-Detect	1.526
Maximum Non-Detect	1.526

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.661
5% Shapiro Wilk Critical Value	0.892

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.746
5% Shapiro Wilk Critical Value	0.892

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	5.628
SD	1.442
95% DL/2 (t) UCL	6.219

Maximum Likelihood Estimate(MLE) Method

Mean	5.718
SD	1.232
95% MLE (t) UCL	6.223
95% MLE (Tiku) UCL	6.201

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	1.695
SD	0.274
95% H-Stat (DL/2) UCL	6.285

Log ROS Method

Mean in Log Scale	1.725
SD in Log Scale	0.192
Mean in Original Scale	5.718
SD in Original Scale	1.261
95% Percentile Bootstrap UCL	6.222
95% BCA Bootstrap UCL	6.44

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	25.72
Theta Star	0.226
nu star	874.3
A-D Test Statistic	1.405
5% A-D Critical Value	0.737
K-S Test Statistic	0.737
5% K-S Critical Value	0.209

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	3.865
Maximum	10
Mean	5.715
Median	5.5
SD	1.266
k star	21.94
Theta star	0.26
Nu star	790
AppChi2	725.8
95% Gamma Approximate UCL	6.22
95% Adjusted Gamma UCL	6.271

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	5.778
SD	1.161
SE of Mean	0.282
95% KM (t) UCL	6.268
95% KM (z) UCL	6.242
95% KM (jackknife) UCL	6.268
95% KM (bootstrap t) UCL	6.637
95% KM (BCA) UCL	6.294
95% KM (Percentile Bootstrap) UCL	6.278
95% KM (Chebyshev) UCL	7.007
97.5% KM (Chebyshev) UCL	7.539
99% KM (Chebyshev) UCL	8.584

Potential UCLs to Use

95% KM (Chebyshev) UCL	7.007

Phosphorus

General Statistics

Number of Valid Data	11	Number of Detected Data	11
Number of Distinct Detected Data	10	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	530	Minimum Detected	6.273
Maximum Detected	1300	Maximum Detected	7.17
Mean of Detected	819.1	Mean of Detected	6.683
SD of Detected	199.5	SD of Detected	0.234
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.89	Shapiro Wilk Test Statistic	0.94
5% Shapiro Wilk Critical Value	0.85	5% Shapiro Wilk Critical Value	0.85
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	819.1	Mean	6.683
SD	199.5	SD	0.234
95% DL/2 (t) UCL	928.1	95% H-Stat (DL/2) UCL	943.9
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	14.55	Data appear Normal at 5% Significance Level
Theta Star	56.31	
nu star	320	

A-D Test Statistic	0.428
5% A-D Critical Value	0.729
K-S Test Statistic	0.729
5% K-S Critical Value	0.255

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	530
Maximum	1300
Mean	819.1
Median	820
SD	199.5
k star	14.55
Theta star	56.31
Nu star	320
AppChi2	279.6
95% Gamma Approximate UCL	937.6
95% Adjusted Gamma UCL	958.7

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	819.1
SD	190.2
SE of Mean	60.16
95% KM (t) UCL	928.1
95% KM (z) UCL	918
95% KM (jackknife) UCL	928.1
95% KM (bootstrap t) UCL	953.2
95% KM (BCA) UCL	920
95% KM (Percentile Bootstrap) UCL	913.6
95% KM (Chebyshev) UCL	1081
97.5% KM (Chebyshev) UCL	1195
99% KM (Chebyshev) UCL	1418

Potential UCLs to Use

95% KM (t) UCL	928.1
95% KM (Percentile Bootstrap) UCL	913.6

Potassium

General Statistics

Number of Valid Data	11	Number of Detected Data	11
Number of Distinct Detected Data	11	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics

Minimum Detected	520
Maximum Detected	1800
Mean of Detected	1016
SD of Detected	367.5
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

Log-transformed Statistics

Minimum Detected	6.254
Maximum Detected	7.496
Mean of Detected	6.865
SD of Detected	0.365
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.944
5% Shapiro Wilk Critical Value	0.85

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.967
5% Shapiro Wilk Critical Value	0.85

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	1016
SD	367.5
95% DL/2 (t) UCL	1217
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	6.865
SD	0.365
95% H-Stat (DL/2) UCL	1292
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	6.297
Theta Star	161.4
nu star	138.5
A-D Test Statistic	0.244
5% A-D Critical Value	0.73
K-S Test Statistic	0.73
5% K-S Critical Value	0.256

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	520
Maximum	1800
Mean	1016
Median	990
SD	367.5
k star	6.297
Theta star	161.4
Nu star	138.5
AppChi2	112.3
95% Gamma Approximate UCL	1253
95% Adjusted Gamma UCL	1298

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	1016
SD	350.4
SE of Mean	110.8
95% KM (t) UCL	1217
95% KM (z) UCL	1199
95% KM (jackknife) UCL	1217
95% KM (bootstrap t) UCL	1257
95% KM (BCA) UCL	1173
95% KM (Percentile Bootstrap) UCL	1192
95% KM (Chebyshev) UCL	1499
97.5% KM (Chebyshev) UCL	1708
99% KM (Chebyshev) UCL	2119

Potential UCLs to Use

95% KM (t) UCL	1217
95% KM (Percentile Bootstrap) UCL	1192

Selenium (Se)

General Statistics

Number of Valid Data	18	Number of Detected Data	7
Number of Distinct Detected Data	1	Number of Non-Detect Data	11
		Percent Non-Detects	61.11%

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

The data set for variable Selenium (Se) was not processed!

Silver (Ag)

General Statistics

Number of Valid Data	18	Number of Detected Data	7
Number of Distinct Detected Data	1	Number of Non-Detect Data	11
		Percent Non-Detects	61.11%

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

The data set for variable Silver (Ag) was not processed!

Sodium

General Statistics

Number of Valid Data	11	Number of Detected Data	11
Number of Distinct Detected Data	10	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	260	Minimum Detected	5.561
Maximum Detected	8800	Maximum Detected	9.083
Mean of Detected	2456	Mean of Detected	7.398
SD of Detected	2491	SD of Detected	0.974
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.771	Shapiro Wilk Test Statistic	0.98
5% Shapiro Wilk Critical Value	0.85	5% Shapiro Wilk Critical Value	0.85
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2456	Mean	7.398
SD	2491	SD	0.974
95% DL/2 (t) UCL	3817	95% H-Stat (DL/2) UCL	6499
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.054
Theta Star	2330
nu star	23.19
A-D Test Statistic	0.308
5% A-D Critical Value	0.745
K-S Test Statistic	0.745
5% K-S Critical Value	0.26

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	260
Maximum	8800
Mean	2456
Median	1400
SD	2491
k star	1.054
Theta star	2330
Nu star	23.19
AppChi2	13.23
95% Gamma Approximate UCL	4304
95% Adjusted Gamma UCL	4737

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	2456
SD	2375
SE of Mean	750.9
95% KM (t) UCL	3817
95% KM (z) UCL	3692
95% KM (jackknife) UCL	3817
95% KM (bootstrap t) UCL	5497
95% KM (BCA) UCL	3747
95% KM (Percentile Bootstrap) UCL	3738
95% KM (Chebyshev) UCL	5730
97.5% KM (Chebyshev) UCL	7146
99% KM (Chebyshev) UCL	9928

Potential UCLs to Use

95% KM (Chebyshev) UCL	5730

Strontium

General Statistics

Number of Valid Data	11	Number of Detected Data	11
Number of Distinct Detected Data	7	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics

Minimum Detected	7
Maximum Detected	37
Mean of Detected	12.45
SD of Detected	8.501
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

Log-transformed Statistics

Minimum Detected	1.946
Maximum Detected	3.611
Mean of Detected	2.393
SD of Detected	0.477
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.608
5% Shapiro Wilk Critical Value	0.85

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.807
5% Shapiro Wilk Critical Value	0.85

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	12.45
SD	8.501
95% DL/2 (t) UCL	17.1
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	2.393
SD	0.477
95% H-Stat (DL/2) UCL	16.95
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	2.992
Theta Star	4.163
nu star	65.83
A-D Test Statistic	1.044
5% A-D Critical Value	0.733
K-S Test Statistic	0.733
5% K-S Critical Value	0.256

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	7
Maximum	37
Mean	12.45
Median	11
SD	8.501
k star	2.992
Theta star	4.163
Nu star	65.83
AppChi2	48.16
95% Gamma Approximate UCL	17.02
95% Adjusted Gamma UCL	17.94

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	12.45
SD	8.106
SE of Mean	2.563
95% KM (t) UCL	17.1
95% KM (z) UCL	16.67
95% KM (jackknife) UCL	17.1
95% KM (bootstrap t) UCL	24.38
95% KM (BCA) UCL	17.27
95% KM (Percentile Bootstrap) UCL	16.82
95% KM (Chebyshev) UCL	23.63
97.5% KM (Chebyshev) UCL	28.46
99% KM (Chebyshev) UCL	37.96

Potential UCLs to Use

95% KM (Chebyshev) UCL	23.63

Tin (Sn)

General Statistics

Number of Valid Data	7	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	7
		Percent Non-Detects	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters
(e.g., EPC, BTV).

The data set for variable Tin (Sn) was not processed!

Vanadium (V)

General Statistics

Number of Valid Observations	18	Number of Distinct Observations	17

Raw Statistics		Log-transformed Statistics	
Minimum	23.2	Minimum of Log Data	3.144
Maximum	91	Maximum of Log Data	4.511
Mean	40.64	Mean of log Data	3.648
Median	39.3	SD of log Data	0.336
SD	15.63		
Coefficient of Variation	0.385		
Skewness	1.978		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.82	Shapiro Wilk Test Statistic	0.947
Shapiro Wilk Critical Value	0.897	Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	47.05	95% H-UCL	47.34
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	54.68
95% Adjusted-CLT UCL	48.54	97.5% Chebyshev (MVUE) UCL	60.83
95% Modified-t UCL	47.34	99% Chebyshev (MVUE) UCL	72.9

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	7.466	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	5.443		
nu star	268.8		
Approximate Chi Square Value (.05)	231.8	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0357	95% CLT UCL	46.7
Adjusted Chi Square Value	228.5	95% Jackknife UCL	47.05
		95% Standard Bootstrap UCL	46.49
Anderson-Darling Test Statistic	0.388	95% Bootstrap-t UCL	49.56
Anderson-Darling 5% Critical Value	0.74	95% Hall's Bootstrap UCL	76.29
Kolmogorov-Smirnov Test Statistic	0.135	95% Percentile Bootstrap UCL	46.97
Kolmogorov-Smirnov 5% Critical Value	0.204	95% BCA Bootstrap UCL	48.44
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	56.7
		97.5% Chebyshev(Mean, Sd) UCL	63.65
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	77.3
95% Approximate Gamma UCL	47.12		
95% Adjusted Gamma UCL	47.8		

Potential UCL to Use	
Use 95% Approximate Gamma UCL	47.12

Zinc (Zn)

General Statistics

Number of Valid Observations	18	Number of Distinct Observations	18

Raw Statistics		Log-transformed Statistics	
Minimum	21.8	Minimum of Log Data	3.082
Maximum	130	Maximum of Log Data	4.868
Mean	43.29	Mean of log Data	3.662
Median	36.55	SD of log Data	0.44
SD	24.93		
Coefficient of Variation	0.576		
Skewness	2.68		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.716	Shapiro Wilk Test Statistic	0.927
Shapiro Wilk Critical Value	0.897	Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	53.52	95% H-UCL	52.92
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	62.47
95% Adjusted-CLT UCL	56.93	97.5% Chebyshev (MVUE) UCL	71.05
95% Modified-t UCL	54.14	99% Chebyshev (MVUE) UCL	87.89

Gamma Distribution Test		Data Distribution
k star (bias corrected)	4.097	Data appear Gamma Distributed at 5% Significance Level
Theta Star	10.57	
nu star	147.5	
Approximate Chi Square Value (.05)	120.4	**Nonparametric Statistics**
Adjusted Level of Significance	0.0357	95% CLT UCL 52.96
Adjusted Chi Square Value	118.1	95% Jackknife UCL 53.52
		95% Standard Bootstrap UCL 52.73
Anderson-Darling Test Statistic	0.601	95% Bootstrap-t UCL 61.98
Anderson-Darling 5% Critical Value	0.743	95% Hall's Bootstrap UCL 94.92
Kolmogorov-Smirnov Test Statistic	0.134	95% Percentile Bootstrap UCL 53.52
Kolmogorov-Smirnov 5% Critical Value	0.204	95% BCA Bootstrap UCL 58.35
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL 68.91
		97.5% Chebyshev(Mean, Sd) UCL 79.99
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL 101.8
95% Approximate Gamma UCL	53.03	
95% Adjusted Gamma UCL	54.08	

Potential UCL to Use	
Use 95% Approximate Gamma UCL	53.03

Sediment Results for 95% UCL (Inorganic Fresh Water)

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Z:\Projects\2009\1584-0901 TC Iqaluit Landfill\SSRA\COC tables\95UCL\sediment-inorganic-fresh.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Number of Valid Data	14	Number of Detected Data	14
Number of Distinct Detected Data	11	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	3200	Minimum Detected	8.071
Maximum Detected	10000	Maximum Detected	9.21
Mean of Detected	5043	Mean of Detected	8.481
SD of Detected	1741	SD of Detected	0.299
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.822	Shapiro Wilk Test Statistic	0.93
5% Shapiro Wilk Critical Value	0.874	5% Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	5043	Mean	8.481
SD	1741	SD	0.299
95% DL/2 (t) UCL	5867	95% H-Stat (DL/2) UCL	5896
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	8.888	Data appear Gamma Distributed at 5% Significance Level
Theta Star	567.4	
nu star	248.9	
A-D Test Statistic	0.478	Nonparametric Statistics
5% A-D Critical Value	0.734	Kaplan-Meier (KM) Method
K-S Test Statistic	0.734	Mean 5043
5% K-S Critical Value	0.229	SD 1677
Data appear Gamma Distributed at 5% Significance Level		SE of Mean 465.2
		95% KM (t) UCL 5867
Assuming Gamma Distribution		95% KM (z) UCL 5808
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL 5867
Minimum	3200	95% KM (bootstrap t) UCL 6417
Maximum	10000	95% KM (BCA) UCL 5843
Mean	5043	95% KM (Percentile Bootstrap) UCL 5821
Median	4700	95% KM (Chebyshev) UCL 7071

SD	1741	97.5% KM (Chebyshev) UCL	7948
k star	8.888	99% KM (Chebyshev) UCL	9672
Theta star	567.4		
Nu star	248.9	**Potential UCLs to Use**	
AppChi2	213.3	95% KM (BCA) UCL	5843
95% Gamma Approximate UCL	5883		
95% Adjusted Gamma UCL	6005		

Note: DL/2 is not a recommended method.

Antimony (Sb)

General Statistics

Number of Valid Data	21	Number of Detected Data	16
Number of Distinct Detected Data	5	Number of Non-Detect Data	5
		Percent Non-Detects	23.81%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.8	Minimum Detected	-0.223
Maximum Detected	10	Maximum Detected	2.303
Mean of Detected	5.3	Mean of Detected	1.235
SD of Detected	4.314	SD of Detected	1.029
Minimum Non-Detect	0.2	Minimum Non-Detect	-1.609
Maximum Non-Detect	0.2	Maximum Non-Detect	-1.609

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.71	Shapiro Wilk Test Statistic	0.798
5% Shapiro Wilk Critical Value	0.887	5% Shapiro Wilk Critical Value	0.887
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	4.062	Mean	0.393
SD	4.372	SD	1.783
95% DL/2 (t) UCL	5.707	95% H-Stat (DL/2) UCL	13.89
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	3.315	Mean in Log Scale	0.695
SD	5.251	SD in Log Scale	1.351
95% MLE (t) UCL	5.291	Mean in Original Scale	4.131
95% MLE (Tiku) UCL	5.349	SD in Original Scale	4.308
		95% Percentile Bootstrap UCL	5.726
		95% BCA Bootstrap UCL	5.8

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.096	Data do not follow a Discernable Distribution (0.05)	
Theta Star	4.835		
nu star	35.08		
A-D Test Statistic	1.672	**Nonparametric Statistics**	
5% A-D Critical Value	0.758	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.758	Mean	4.229
5% K-S Critical Value	0.22	SD	4.119
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.928
		95% KM (t) UCL	5.83
Assuming Gamma Distribution		95% KM (z) UCL	5.756
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	5.787
Minimum	1E-09	95% KM (bootstrap t) UCL	5.868
Maximum	10	95% KM (BCA) UCL	5.867

Sediment Results for 95% UCL (Inorganic Fresh Water)

Mean	4.239	95% KM (Percentile Bootstrap) UCL	5.857
Median	2	95% KM (Chebyshev) UCL	8.275
SD	4.233	97.5% KM (Chebyshev) UCL	10.03
k star	0.276	99% KM (Chebyshev) UCL	13.47
Theta star	15.37		
Nu star	11.58	**Potential UCLs to Use**	
AppChi2	4.953	97.5% KM (Chebyshev) UCL	10.03
95% Gamma Approximate UCL	9.911		
95% Adjusted Gamma UCL	10.62		

Warning: Recommended UCL exceeds the maximum observation

Note: DL/2 is not a recommended method.

Arsenic (As)

General Statistics

Number of Valid Data	21	Number of Detected Data	12
Number of Distinct Detected Data	3	Number of Non-Detect Data	9
		Percent Non-Detects	42.86%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	2	Minimum Detected	0.693
Maximum Detected	6.3	Maximum Detected	1.841
Mean of Detected	4.108	Mean of Detected	1.323
SD of Detected	1.6	SD of Detected	0.47
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	5	Maximum Non-Detect	1.609

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	13
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	8
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	61.90%

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.73	Shapiro Wilk Test Statistic	0.689
5% Shapiro Wilk Critical Value	0.859	5% Shapiro Wilk Critical Value	0.859
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	3.038	Mean	0.842
SD	1.859	SD	0.856
95% DL/2 (t) UCL	3.738	95% H-Stat (DL/2) UCL	3.642
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	4.748	Mean in Log Scale	0.945
SD	0.502	SD in Log Scale	0.603
95% MLE (t) UCL	4.937	Mean in Original Scale	3.045
95% MLE (Tiku) UCL	5.037	SD in Original Scale	1.762
		95% Percentile Bootstrap UCL	3.66
		95% BCA Bootstrap UCL	3.72

Gamma Distribution Test with Detected Values Only | **Data Distribution Test with Detected Values Only**

k star (bias corrected)	4.355
Theta Star	0.943
nu star	104.5

Data do not follow a Discernable Distribution (0.05)

A-D Test Statistic	1.966
5% A-D Critical Value	0.732
K-S Test Statistic	0.732
5% K-S Critical Value	0.246

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	2
Maximum	6.3
Mean	3.977
Median	4.387
SD	1.347
k star	6.732
Theta star	0.591
Nu star	282.7
AppChi2	244.8
95% Gamma Approximate UCL	4.593
95% Adjusted Gamma UCL	4.644

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	3.205
SD	1.559
SE of Mean	0.355
95% KM (t) UCL	3.817
95% KM (z) UCL	3.789
95% KM (jackknife) UCL	3.806
95% KM (bootstrap t) UCL	3.865
95% KM (BCA) UCL	3.757
95% KM (Percentile Bootstrap) UCL	3.819
95% KM (Chebyshev) UCL	4.753
97.5% KM (Chebyshev) UCL	5.423
99% KM (Chebyshev) UCL	6.739

Potential UCLs to Use

95% KM (t) UCL	3.817
95% KM (% Bootstrap) UCL	3.819

Barium (Ba)

General Statistics

Number of Valid Observations	21	Number of Distinct Observations	20

Raw Statistics

Minimum	19
Maximum	155
Mean	63.57
Median	61
SD	36.15
Coefficient of Variation	0.569
Skewness	0.799

Log-transformed Statistics

Minimum of Log Data	2.944
Maximum of Log Data	5.043
Mean of log Data	3.986
SD of log Data	0.611

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.934
Shapiro Wilk Critical Value	0.908

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.959
Shapiro Wilk Critical Value	0.908

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	77.17

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	78.01
95% Modified-t UCL	77.4

Assuming Lognormal Distribution

95% H-UCL	86.44
95% Chebyshev (MVUE) UCL	103.6
97.5% Chebyshev (MVUE) UCL	120.7
99% Chebyshev (MVUE) UCL	154.1

Gamma Distribution Test

k star (bias corrected)	2.751
Theta Star	23.1
nu star	115.6
Approximate Chi Square Value (.05)	91.74
Adjusted Level of Significance	0.0383
Adjusted Chi Square Value	90.11

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	76.54
95% Jackknife UCL	77.17
95% Standard Bootstrap UCL	75.98

Anderson-Darling Test Statistic	0.272	95% Bootstrap-t UCL	78.4
Anderson-Darling 5% Critical Value	0.749	95% Hall's Bootstrap UCL	78.04
Kolmogorov-Smirnov Test Statistic	0.11	95% Percentile Bootstrap UCL	76.65
Kolmogorov-Smirnov 5% Critical Value	0.191	95% BCA Bootstrap UCL	77.58
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	97.95
		97.5% Chebyshev(Mean, Sd) UCL	112.8
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	142.1
95% Approximate Gamma UCL	80.07		
95% Adjusted Gamma UCL	81.52		
Potential UCL to Use		Use 95% Student's-t UCL	77.17

Beryllium (Be)

General Statistics

Number of Valid Data	21	Number of Detected Data	15
Number of Distinct Detected Data	3	Number of Non-Detect Data	6
		Percent Non-Detects	28.57%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.3	Minimum Detected	-1.204
Maximum Detected	1	Maximum Detected	0
Mean of Detected	0.673	Mean of Detected	-0.484
SD of Detected	0.284	SD of Detected	0.443
Minimum Non-Detect	0.2	Minimum Non-Detect	-1.609
Maximum Non-Detect	0.2	Maximum Non-Detect	-1.609

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.753	Shapiro Wilk Test Statistic	0.793
5% Shapiro Wilk Critical Value	0.881	5% Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.51	Mean	-1.004
SD	0.356	SD	0.92
95% DL/2 (t) UCL	0.644	95% H-Stat (DL/2) UCL	0.578
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.466	Mean in Log Scale	-0.764
SD	0.416	SD in Log Scale	0.599
95% MLE (t) UCL	0.623	Mean in Original Scale	0.549
95% MLE (Tiku) UCL	0.634	SD in Original Scale	0.313
		95% Percentile Bootstrap UCL	0.656
		95% BCA Bootstrap UCL	0.673

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**
k star (bias corrected)	4.694	Data do not follow a Discernable Distribution (0.05)
Theta Star	0.143	
nu star	140.8	

A-D Test Statistic	1.633
5% A-D Critical Value	0.738
K-S Test Statistic	0.738
5% K-S Critical Value	0.222

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.176
Maximum	1
Mean	0.601
Median	0.5
SD	0.276
k star	4.226
Theta star	0.142
Nu star	177.5
AppChi2	147.7
95% Gamma Approximate UCL	0.722
95% Adjusted Gamma UCL	0.732

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.567
SD	0.287
SE of Mean	0.0648
95% KM (t) UCL	0.678
95% KM (z) UCL	0.673
95% KM (jackknife) UCL	0.677
95% KM (bootstrap t) UCL	0.688
95% KM (BCA) UCL	0.695
95% KM (Percentile Bootstrap) UCL	0.69
95% KM (Chebyshev) UCL	0.849
97.5% KM (Chebyshev) UCL	0.971
99% KM (Chebyshev) UCL	1.211

Potential UCLs to Use

95% KM (BCA) UCL	0.695

Cadmium (Cd)

General Statistics

Number of Valid Data	21	Number of Detected Data	17
Number of Distinct Detected Data	12	Number of Non-Detect Data	4
		Percent Non-Detects	19.05%

Raw Statistics

Minimum Detected	0.2
Maximum Detected	6.7
Mean of Detected	2.573
SD of Detected	2.398
Minimum Non-Detect	0.1
Maximum Non-Detect	0.1

Log-transformed Statistics

Minimum Detected	-1.609
Maximum Detected	1.902
Mean of Detected	0.411
SD of Detected	1.151
Minimum Non-Detect	-2.303
Maximum Non-Detect	-2.303

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.825
5% Shapiro Wilk Critical Value	0.892

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	2.092
SD	2.373
95% DL/2 (t) UCL	2.985
Maximum Likelihood Estimate(MLE) Method	
Mean	1.787
SD	2.712
95% MLE (t) UCL	2.808
95% MLE (Tiku) UCL	2.81

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.922
Theta Star	2.79

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.894
5% Shapiro Wilk Critical Value	0.892

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-0.238
SD	1.715
95% H-Stat (DL/2) UCL	6.624
Log ROS Method	
Mean in Log Scale	-0.091
SD in Log Scale	1.491
Mean in Original Scale	2.105
SD in Original Scale	2.361
95% Percentile Bootstrap UCL	2.975
95% BCA Bootstrap UCL	3.013

Data Distribution Test with Detected Values Only

Data appear Lognormal at 5% Significance Level

nu star	31.35
A-D Test Statistic	0.776
5% A-D Critical Value	0.764
K-S Test Statistic	0.764
5% K-S Critical Value	0.215

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	1E-09
Maximum	6.7
Mean	2.089
Median	0.6
SD	2.376
k star	0.212
Theta star	9.834
Nu star	8.921
AppChi2	3.279
95% Gamma Approximate UCL	5.682
95% Adjusted Gamma UCL	6.168

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	2.121
SD	2.291
SE of Mean	0.515
95% KM (t) UCL	3.01
95% KM (z) UCL	2.969
95% KM (jackknife) UCL	2.971
95% KM (bootstrap t) UCL	3.14
95% KM (BCA) UCL	3.066
95% KM (Percentile Bootstrap) UCL	2.985
95% KM (Chebyshev) UCL	4.367
97.5% KM (Chebyshev) UCL	5.339
99% KM (Chebyshev) UCL	7.248

Potential UCLs to Use

97.5% KM (Chebyshev) UCL 5.339

Calcium

General Statistics

Number of Valid Data	14	Number of Detected Data	14
Number of Distinct Detected Data	12	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics

Minimum Detected	1700
Maximum Detected	7600
Mean of Detected	4107
SD of Detected	1921
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

Log-transformed Statistics

Minimum Detected	7.438
Maximum Detected	8.936
Mean of Detected	8.218
SD of Detected	0.473
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.917
5% Shapiro Wilk Critical Value	0.874

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.959
5% Shapiro Wilk Critical Value	0.874

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	4107
SD	1921
95% DL/2 (t) UCL	5016

Maximum Likelihood Estimate(MLE) Method N/A

MLE method failed to converge properly

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	8.218
SD	0.473
95% H-Stat (DL/2) UCL	5397

Log ROS Method

Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only

Data Distribution Test with Detected Values Only

k star (bias corrected)	4.011
Theta Star	1024
nu star	112.3
A-D Test Statistic	0.281
5% A-D Critical Value	0.738
K-S Test Statistic	0.738
5% K-S Critical Value	0.229

Data appear Normal at 5% Significance Level

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	1700
Maximum	7600
Mean	4107
Median	3650
SD	1921
k star	4.011
Theta star	1024
Nu star	112.3
AppChi2	88.85
95% Gamma Approximate UCL	5192
95% Adjusted Gamma UCL	5359

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	4107
SD	1851
SE of Mean	513.3
95% KM (t) UCL	5016
95% KM (z) UCL	4951
95% KM (jackknife) UCL	5016
95% KM (bootstrap t) UCL	5112
95% KM (BCA) UCL	4893
95% KM (Percentile Bootstrap) UCL	4957
95% KM (Chebyshev) UCL	6344
97.5% KM (Chebyshev) UCL	7313
99% KM (Chebyshev) UCL	9214

Potential UCLs to Use

95% KM (t) UCL	5016
95% KM (Percentile Bootstrap) UCL	4957

Chromium (Cr)

General Statistics

Number of Valid Observations	21	Number of Distinct Observations	19

Raw Statistics

Minimum	13
Maximum	55.4
Mean	26.58
Median	22
SD	11.95
Coefficient of Variation	0.45
Skewness	1.208

Log-transformed Statistics

Minimum of Log Data	2.565
Maximum of Log Data	4.015
Mean of log Data	3.197
SD of log Data	0.407

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.861
Shapiro Wilk Critical Value	0.908

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.946
Shapiro Wilk Critical Value	0.908

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	31.08

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	31.61
95% Modified-t UCL	31.19

Assuming Lognormal Distribution

95% H-UCL	31.59
95% Chebyshev (MVUE) UCL	36.93
97.5% Chebyshev (MVUE) UCL	41.47
99% Chebyshev (MVUE) UCL	50.38

Gamma Distribution Test

k star (bias corrected)	5.296
Theta Star	5.019
nu star	222.4
Approximate Chi Square Value (.05)	188.9
Adjusted Level of Significance	0.0383
Adjusted Chi Square Value	186.5

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	30.87
95% Jackknife UCL	31.08
95% Standard Bootstrap UCL	30.74

Anderson-Darling Test Statistic	0.684	95% Bootstrap-t UCL	32.24
Anderson-Darling 5% Critical Value	0.745	95% Hall's Bootstrap UCL	31.36
Kolmogorov-Smirnov Test Statistic	0.16	95% Percentile Bootstrap UCL	31.1
Kolmogorov-Smirnov 5% Critical Value	0.19	95% BCA Bootstrap UCL	31.54
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	37.95
		97.5% Chebyshev(Mean, Sd) UCL	42.87
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	52.54
95% Approximate Gamma UCL	31.3		
95% Adjusted Gamma UCL	31.69		
Potential UCL to Use		Use 95% Approximate Gamma UCL	31.3

Chromium (VI)

General Statistics

Number of Valid Data	13	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	8
Number of Missing Values	8	Percent Non-Detects	61.54%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.4	Minimum Detected	-0.916
Maximum Detected	2.6	Maximum Detected	0.956
Mean of Detected	1.34	Mean of Detected	0.0808
SD of Detected	0.921	SD of Detected	0.752
Minimum Non-Detect	0.2	Minimum Non-Detect	-1.609
Maximum Non-Detect	0.2	Maximum Non-Detect	-1.609

Warning: There are only 5 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.905	Shapiro Wilk Test Statistic	0.949
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.577	Mean	-1.386
SD	0.823	SD	1.283
95% DL/2 (t) UCL	0.984	95% H-Stat (DL/2) UCL	0.7
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-1.535
		SD in Log Scale	1.576
		Mean in Original Scale	0.583
		SD in Original Scale	0.822
		95% Percentile Bootstrap UCL	0.955
		95% BCA Bootstrap UCL	1.067

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.139	Data appear Normal at 5% Significance Level	
Theta Star	1.177		
nu star	11.39		
A-D Test Statistic	0.297	**Nonparametric Statistics**	

5% A-D Critical Value	0.684
K-S Test Statistic	0.684
5% K-S Critical Value	0.36

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	0.203
Maximum	3.983
Mean	1.832
Median	1.904
SD	1.208
k star	1.506
Theta star	1.217
Nu star	39.15
AppChi2	25.82
95% Gamma Approximate UCL	2.778
95% Adjusted Gamma UCL	2.953

Note: DL/2 is not a recommended method.

Kaplan-Meier (KM) Method	
Mean	0.762
SD	0.686
SE of Mean	0.213
95% KM (t) UCL	1.14
95% KM (z) UCL	1.111
95% KM (jackknife) UCL	1.119
95% KM (bootstrap t) UCL	1.445
95% KM (BCA) UCL	2.092
95% KM (Percentile Bootstrap) UCL	1.315
95% KM (Chebyshev) UCL	1.688
97.5% KM (Chebyshev) UCL	2.089
99% KM (Chebyshev) UCL	2.877

Potential UCLs to Use

95% KM (t) UCL	1.14
95% KM (Percentile Bootstrap) UCL	1.315

Cobalt (Co)

General Statistics

Number of Valid Observations	21	Number of Distinct Observations	19

Raw Statistics

Minimum	3.2
Maximum	28
Mean	12.24
Median	13.3
SD	7.394
Coefficient of Variation	0.604
Skewness	0.316

Log-transformed Statistics

Minimum of Log Data	1.163
Maximum of Log Data	3.332
Mean of log Data	2.291
SD of log Data	0.708

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.902
Shapiro Wilk Critical Value	0.908

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.889
Shapiro Wilk Critical Value	0.908

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	15.02

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	15.01
95% Modified-t UCL	15.04

Assuming Lognormal Distribution

95% H-UCL	17.99
95% Chebyshev (MVUE) UCL	21.54
97.5% Chebyshev (MVUE) UCL	25.44
99% Chebyshev (MVUE) UCL	33.11

Gamma Distribution Test

k star (bias corrected)	2.167
Theta Star	5.649
nu star	90.99
Approximate Chi Square Value (.05)	70
Adjusted Level of Significance	0.0383
Adjusted Chi Square Value	68.58
Anderson-Darling Test Statistic	1
Anderson-Darling 5% Critical Value	0.752
Kolmogorov-Smirnov Test Statistic	0.192
Kolmogorov-Smirnov 5% Critical Value	0.191

Data not Gamma Distributed at 5% Significance Level

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	14.89
95% Jackknife UCL	15.02
95% Standard Bootstrap UCL	14.78
95% Bootstrap-t UCL	15.08
95% Hall's Bootstrap UCL	14.99
95% Percentile Bootstrap UCL	14.86
95% BCA Bootstrap UCL	15.02
95% Chebyshev(Mean, Sd) UCL	19.27

		97.5% Chebyshev(Mean, Sd) UCL	22.31
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	28.29
95% Approximate Gamma UCL	15.91		
95% Adjusted Gamma UCL	16.24		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	19.27

Copper (Cu)

General Statistics

Number of Valid Observations	21	Number of Distinct Observations	20

Raw Statistics		**Log-transformed Statistics**	
Minimum	4.9	Minimum of Log Data	1.589
Maximum	292	Maximum of Log Data	5.677
Mean	38.04	Mean of log Data	3.078
Median	20	SD of log Data	0.981
SD	61.17		
Coefficient of Variation	1.608		
Skewness	3.914		

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.488	Shapiro Wilk Test Statistic	0.956
Shapiro Wilk Critical Value	0.908	Shapiro Wilk Critical Value	0.908
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	61.07	95% H-UCL	61.29
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	69.55
95% Adjusted-CLT UCL	72.18	97.5% Chebyshev (MVUE) UCL	84.92
95% Modified-t UCL	62.97	99% Chebyshev (MVUE) UCL	115.1
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	0.911	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	41.75		
nu star	38.27		
Approximate Chi Square Value (.05)	25.1	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0383	95% CLT UCL	60
Adjusted Chi Square Value	24.28	95% Jackknife UCL	61.07
		95% Standard Bootstrap UCL	60.19
Anderson-Darling Test Statistic	0.939	95% Bootstrap-t UCL	101.1
Anderson-Darling 5% Critical Value	0.769	95% Hall's Bootstrap UCL	138.7
Kolmogorov-Smirnov Test Statistic	0.156	95% Percentile Bootstrap UCL	63.4
Kolmogorov-Smirnov 5% Critical Value	0.195	95% BCA Bootstrap UCL	75.95
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	96.23
		97.5% Chebyshev(Mean, Sd) UCL	121.4
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	170.9
95% Approximate Gamma UCL	58		
95% Adjusted Gamma UCL	59.95		
Potential UCL to Use		Use 95% Approximate Gamma UCL	58

Iron

General Statistics

Number of Valid Data	14	Number of Detected Data	14
Number of Distinct Detected Data	13	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Sediment Results for 95% UCL (Inorganic Fresh Water)

Raw Statistics	
Minimum Detected	19000
Maximum Detected	220000
Mean of Detected	72571
SD of Detected	54431
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

Log-transformed Statistics	
Minimum Detected	9.852
Maximum Detected	12.3
Mean of Detected	10.93
SD of Detected	0.77
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.829
5% Shapiro Wilk Critical Value	0.874

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.901
5% Shapiro Wilk Critical Value	0.874

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	72571
SD	54431
95% DL/2 (t) UCL	98334
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	10.93
SD	0.77
95% H-Stat (DL/2) UCL	126487
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	1.672
Theta Star	43410
nu star	46.81
A-D Test Statistic	0.627
5% A-D Critical Value	0.746
K-S Test Statistic	0.746
5% K-S Critical Value	0.232

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	19000
Maximum	220000
Mean	72571
Median	71000
SD	54431
k star	1.672
Theta star	43410
Nu star	46.81
AppChi2	32.11
95% Gamma Approximate UCL	105794
95% Adjusted Gamma UCL	111378

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	72571
SD	52451
SE of Mean	14547
95% KM (t) UCL	98334
95% KM (z) UCL	96500
95% KM (jackknife) UCL	98334
95% KM (bootstrap t) UCL	106045
95% KM (BCA) UCL	98500
95% KM (Percentile Bootstrap) UCL	97214
95% KM (Chebyshev) UCL	135982
97.5% KM (Chebyshev) UCL	163419
99% KM (Chebyshev) UCL	217315

Potential UCLs to Use

95% KM (Chebyshev) UCL 135982

Lead (Pb)

General Statistics

Number of Valid Data	21	Number of Detected Data	20
Number of Distinct Detected Data	15	Number of Non-Detect Data	1

Percent Non-Detects	4.76%

Raw Statistics

Minimum Detected	5
Maximum Detected	201
Mean of Detected	71.75
SD of Detected	62.61
Minimum Non-Detect	3
Maximum Non-Detect	3

Log-transformed Statistics

Minimum Detected	1.609
Maximum Detected	5.303
Mean of Detected	3.778
SD of Detected	1.146
Minimum Non-Detect	1.099
Maximum Non-Detect	1.099

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.867
5% Shapiro Wilk Critical Value	0.905

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.922
5% Shapiro Wilk Critical Value	0.905

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	68.4
SD	62.93
95% DL/2 (t) UCL	92.09
Maximum Likelihood Estimate(MLE) Method	
Mean	66.88
SD	63.71
95% MLE (t) UCL	90.86
95% MLE (Tiku) UCL	89.89

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	3.618
SD	1.338
95% H-Stat (DL/2) UCL	175.4
Log ROS Method	
Mean in Log Scale	3.646
SD in Log Scale	1.271
Mean in Original Scale	68.46
SD in Original Scale	62.86
95% Percentile Bootstrap UCL	91.32
95% BCA Bootstrap UCL	93.57

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.009
Theta Star	71.08
nu star	40.38
A-D Test Statistic	0.469
5% A-D Critical Value	0.765
K-S Test Statistic	0.765
5% K-S Critical Value	0.199

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	201
Mean	68.33
Median	51
SD	63.01
k star	0.381
Theta star	179.6
Nu star	15.98
AppChi2	7.949
95% Gamma Approximate UCL	137.4
95% Adjusted Gamma UCL	145.3

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	68.57
SD	61.23
SE of Mean	13.71
95% KM (t) UCL	92.22
95% KM (z) UCL	91.12
95% KM (jackknife) UCL	92.13
95% KM (bootstrap t) UCL	95.38
95% KM (BCA) UCL	90.33
95% KM (Percentile Bootstrap) UCL	91.19
95% KM (Chebyshev) UCL	128.3
97.5% KM (Chebyshev) UCL	154.2
99% KM (Chebyshev) UCL	205

Potential UCLs to Use

95% KM (Chebyshev) UCL	128.3

Magnesium

General Statistics

Sediment Results for 95% UCL (Inorganic Fresh Water)

Number of Valid Data	14	Number of Detected Data	14
Number of Distinct Detected Data	14	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics

Minimum Detected	1500
Maximum Detected	6200
Mean of Detected	2943
SD of Detected	1242
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

Log-transformed Statistics

Minimum Detected	7.313
Maximum Detected	8.732
Mean of Detected	7.911
SD of Detected	0.4
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.895
5% Shapiro Wilk Critical Value	0.874

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.964
5% Shapiro Wilk Critical Value	0.874

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	2943
SD	1242
95% DL/2 (t) UCL	3531
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	7.911
SD	0.4
95% H-Stat (DL/2) UCL	3684
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	5.366
Theta Star	548.5
nu star	150.2
A-D Test Statistic	0.244
5% A-D Critical Value	0.737
K-S Test Statistic	0.737
5% K-S Critical Value	0.229

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1500
Maximum	6200
Mean	2943
Median	2850
SD	1242
k star	5.366
Theta star	548.5
Nu star	150.2
AppChi2	122.9
95% Gamma Approximate UCL	3597
95% Adjusted Gamma UCL	3696

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	2943
SD	1197
SE of Mean	331.9
95% KM (t) UCL	3531
95% KM (z) UCL	3489
95% KM (jackknife) UCL	3531
95% KM (bootstrap t) UCL	3713
95% KM (BCA) UCL	3514
95% KM (Percentile Bootstrap) UCL	3500
95% KM (Chebyshev) UCL	4390
97.5% KM (Chebyshev) UCL	5016
99% KM (Chebyshev) UCL	6246

Potential UCLs to Use

95% KM (t) UCL	3531
95% KM (Percentile Bootstrap) UCL	3500

Manganese

General Statistics

Number of Valid Data	14	Number of Detected Data	14
Number of Distinct Detected Data	14	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	58	Minimum Detected	4.06
Maximum Detected	8100	Maximum Detected	9
Mean of Detected	1626	Mean of Detected	6.353
SD of Detected	2227	SD of Detected	1.669
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.724	Shapiro Wilk Test Statistic	0.905
5% Shapiro Wilk Critical Value	0.874	5% Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1626	Mean	6.353
SD	2227	SD	1.669
95% DL/2 (t) UCL	2680	95% H-Stat (DL/2) UCL	14840
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.515	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	3158		
nu star	14.42		
A-D Test Statistic	0.568	Nonparametric Statistics	
5% A-D Critical Value	0.785	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.785	Mean	1626
5% K-S Critical Value	0.24	SD	2146
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	595.2
		95% KM (t) UCL	2680
Assuming Gamma Distribution		95% KM (z) UCL	2605
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2680
Minimum	58	95% KM (bootstrap t) UCL	3484
Maximum	8100	95% KM (BCA) UCL	2730
Mean	1626	95% KM (Percentile Bootstrap) UCL	2675
Median	955	95% KM (Chebyshev) UCL	4220
SD	2227	97.5% KM (Chebyshev) UCL	5343
k star	0.515	99% KM (Chebyshev) UCL	7548
Theta star	3158		
Nu star	14.42	Potential UCLs to Use	
AppChi2	6.857	95% KM (Chebyshev) UCL	4220
95% Gamma Approximate UCL	3418		
95% Adjusted Gamma UCL	3794		

Note: DL/2 is not a recommended method.

Mercury (Hg)

General Statistics

Number of Valid Data	21	Number of Detected Data	20
Number of Distinct Detected Data	8	Number of Non-Detect Data	1
		Percent Non-Detects	4.76%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.0155	Minimum Detected	-4.167
Maximum Detected	0.25	Maximum Detected	-1.386
Mean of Detected	0.117	Mean of Detected	-2.51
SD of Detected	0.1	SD of Detected	0.886
Minimum Non-Detect	0.0067	Minimum Non-Detect	-5.006
Maximum Non-Detect	0.0067	Maximum Non-Detect	-5.006

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.666	Shapiro Wilk Test Statistic	0.771
5% Shapiro Wilk Critical Value	0.905	5% Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.112	Mean	-2.662
SD	0.101	SD	1.109
95% DL/2 (t) UCL	0.15	95% H-Stat (DL/2) UCL	0.222
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.11	Mean in Log Scale	-2.604
SD	0.102	SD in Log Scale	0.965
95% MLE (t) UCL	0.148	Mean in Original Scale	0.112
95% MLE (Tiku) UCL	0.146	SD in Original Scale	0.1
		95% Percentile Bootstrap UCL	0.149
		95% BCA Bootstrap UCL	0.15

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.31	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.0897		
nu star	52.39		
A-D Test Statistic	2.772	Nonparametric Statistics	
5% A-D Critical Value	0.758	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.758	Mean	0.113
5% K-S Critical Value	0.197	SD	0.0977
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.0219
		95% KM (t) UCL	0.15
Assuming Gamma Distribution		95% KM (z) UCL	0.149
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.15
Minimum	1E-09	95% KM (bootstrap t) UCL	0.151
Maximum	0.25	95% KM (BCA) UCL	0.153
Mean	0.112	95% KM (Percentile Bootstrap) UCL	0.146
Median	0.05	95% KM (Chebyshev) UCL	0.208
SD	0.101	97.5% KM (Chebyshev) UCL	0.249
k star	0.486	99% KM (Chebyshev) UCL	0.33
Theta star	0.23		
Nu star	20.42	Potential UCLs to Use	
AppChi2	11.16	95% KM (Chebyshev) UCL	0.208

95% Gamma Approximate UCL	0.205
95% Adjusted Gamma UCL	0.215

Note: DL/2 is not a recommended method.

Molybdenum (Mo)

General Statistics

Number of Valid Data	21	Number of Detected Data	20
Number of Distinct Detected Data	11	Number of Non-Detect Data	1
		Percent Non-Detects	4.76%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.9	Minimum Detected	-0.105
Maximum Detected	5	Maximum Detected	1.609
Mean of Detected	3.21	Mean of Detected	1.08
SD of Detected	1.176	SD of Detected	0.47
Minimum Non-Detect	0.8	Minimum Non-Detect	-0.223
Maximum Non-Detect	0.8	Maximum Non-Detect	-0.223

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.94
5% Shapiro Wilk Critical Value	0.905

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.846
5% Shapiro Wilk Critical Value	0.905

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	3.076
SD	1.3
95% DL/2 (t) UCL	3.565
Maximum Likelihood Estimate(MLE) Method	
Mean	3.071
SD	1.284
95% MLE (t) UCL	3.554
95% MLE (Tiku) UCL	3.558

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	0.985
SD	0.632
95% H-Stat (DL/2) UCL	4.073
Log ROS Method	
Mean in Log Scale	1.029
SD in Log Scale	0.513
Mean in Original Scale	3.106
SD in Original Scale	1.242
95% Percentile Bootstrap UCL	3.533
95% BCA Bootstrap UCL	3.525

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	5.074
Theta Star	0.633
nu star	203
A-D Test Statistic	0.788
5% A-D Critical Value	0.745
K-S Test Statistic	0.745
5% K-S Critical Value	0.194

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.349
Maximum	5
Mean	3.074
Median	3
SD	1.305
k star	3.127
Theta star	0.983

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	3.1
SD	1.222
SE of Mean	0.274
95% KM (t) UCL	3.572
95% KM (z) UCL	3.55
95% KM (jackknife) UCL	3.57
95% KM (bootstrap t) UCL	3.558
95% KM (BCA) UCL	3.562
95% KM (Percentile Bootstrap) UCL	3.557
95% KM (Chebyshev) UCL	4.292
97.5% KM (Chebyshev) UCL	4.808
99% KM (Chebyshev) UCL	5.821

Nu star	131.3	**Potential UCLs to Use**	
AppChi2	105.9	95% KM (t) UCL	3.572
95% Gamma Approximate UCL	3.813	95% KM (Percentile Bootstrap) UCL	3.557
95% Adjusted Gamma UCL	3.878		

Note: DL/2 is not a recommended method.

Phosphorus

General Statistics

Number of Valid Data	14	Number of Detected Data	14
Number of Distinct Detected Data	11	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	720	Minimum Detected	6.579
Maximum Detected	2100	Maximum Detected	7.65
Mean of Detected	1058	Mean of Detected	6.91
SD of Detected	399.1	SD of Detected	0.325
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.783	Shapiro Wilk Test Statistic	0.849
5% Shapiro Wilk Critical Value	0.874	5% Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1058	Mean	6.91
SD	399.1	SD	0.325
95% DL/2 (t) UCL	1247	95% H-Stat (DL/2) UCL	1256
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	7.442	Data do not follow a Discernable Distribution (0.05)	
Theta Star	142.1		
nu star	208.4		
A-D Test Statistic	1.025	**Nonparametric Statistics**	
5% A-D Critical Value	0.735	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.735	Mean	1058
5% K-S Critical Value	0.229	SD	384.6
Data not Gamma Distributed at 5% Significance Level		SE of Mean	106.7
		95% KM (t) UCL	1247
Assuming Gamma Distribution		95% KM (z) UCL	1233
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1247
Minimum	720	95% KM (bootstrap t) UCL	1344
Maximum	2100	95% KM (BCA) UCL	1239
Mean	1058	95% KM (Percentile Bootstrap) UCL	1249
Median	890	95% KM (Chebyshev) UCL	1523
SD	399.1	97.5% KM (Chebyshev) UCL	1724

k star	7.442	99% KM (Chebyshev) UCL	2119
Theta star	142.1		
Nu star	208.4	**Potential UCLs to Use**	
AppChi2	176	95% KM (Chebyshev) UCL	1523
95% Gamma Approximate UCL	1253		
95% Adjusted Gamma UCL	1281		

Note: DL/2 is not a recommended method.

Potassium

General Statistics

Number of Valid Data	14	Number of Detected Data	13
Number of Distinct Detected Data	8	Number of Non-Detect Data	1
Number of Missing Values	7	Percent Non-Detects	7.14%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	430	Minimum Detected	6.064
Maximum Detected	1900	Maximum Detected	7.55
Mean of Detected	1086	Mean of Detected	6.936
SD of Detected	362.7	SD of Detected	0.358
Minimum Non-Detect	410	Minimum Non-Detect	6.016
Maximum Non-Detect	410	Maximum Non-Detect	6.016

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.886	Shapiro Wilk Test Statistic	0.874
5% Shapiro Wilk Critical Value	0.866	5% Shapiro Wilk Critical Value	0.866
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1023	Mean	6.82
SD	420.6	SD	0.551
95% DL/2 (t) UCL	1222	95% H-Stat (DL/2) UCL	1458
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	1025	Mean in Log Scale	6.878
SD	403.2	SD in Log Scale	0.405
95% MLE (t) UCL	1216	Mean in Original Scale	1042
95% MLE (Tiku) UCL	1218	SD in Original Scale	386.3
		95% Percentile Bootstrap UCL	1213
		95% BCA Bootstrap UCL	1221

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	7.187	Data appear Normal at 5% Significance Level	
Theta Star	151.1		
nu star	186.9		
A-D Test Statistic	0.81	**Nonparametric Statistics**	
5% A-D Critical Value	0.734	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.734	Mean	1039
5% K-S Critical Value	0.237	SD	375.9
Data not Gamma Distributed at 5% Significance Level		SE of Mean	104.6
		95% KM (t) UCL	1224
Assuming Gamma Distribution		95% KM (z) UCL	1211
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	1222
Minimum	368	95% KM (bootstrap t) UCL	1244
Maximum	1900	95% KM (BCA) UCL	1243
Mean	1035	95% KM (Percentile Bootstrap) UCL	1227

Median	1000	95% KM (Chebyshev) UCL	1495
SD	397.8	97.5% KM (Chebyshev) UCL	1692
k star	5.093	99% KM (Chebyshev) UCL	2080
Theta star	203.2		
Nu star	142.6	**Potential UCLs to Use**	
AppChi2	116	95% KM (t) UCL	1224
95% Gamma Approximate UCL	1272	95% KM (Percentile Bootstrap) UCL	1227
95% Adjusted Gamma UCL	1308		

Note: DL/2 is not a recommended method.

Selenium (Se)

General Statistics

Number of Valid Data	21	Number of Detected Data	14
Number of Distinct Detected Data	2	Number of Non-Detect Data	7
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	2	Minimum Detected	0.693
Maximum Detected	2.5	Maximum Detected	0.916
Mean of Detected	2.25	Mean of Detected	0.805
SD of Detected	0.259	SD of Detected	0.116
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	0.5	Maximum Non-Detect	-0.693

Warning: Data set has only 2 Distinct Detected Values.
This may not be adequate enough to compute meaningful and reliable test statistics and estimates.
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods. Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.646	Shapiro Wilk Test Statistic	0.646
5% Shapiro Wilk Critical Value	0.874	5% Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.583	Mean	0.0744
SD	0.988	SD	1.062
95% DL/2 (t) UCL	1.955	95% H-Stat (DL/2) UCL	1.765
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	1.432	Mean in Log Scale	0.722
SD	1.222	SD in Log Scale	0.156
95% MLE (t) UCL	1.892	Mean in Original Scale	2.083
95% MLE (Tiku) UCL	1.947	SD in Original Scale	0.326
		95% Percentile Bootstrap UCL	2.196
		95% BCA Bootstrap UCL	2.199

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	63.43
Theta Star	0.0355
nu star	1776
A-D Test Statistic	2.515
5% A-D Critical Value	0.733
K-S Test Statistic	0.733
5% K-S Critical Value	0.228

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1.791
Maximum	2.5
Mean	2.192
Median	2.112
SD	0.243
k star	74.16
Theta star	0.0296
Nu star	3115
AppChi2	2986
95% Gamma Approximate UCL	2.287
95% Adjusted Gamma UCL	2.294

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	2.167
SD	0.236
SE of Mean	0.0534
95% KM (t) UCL	2.259
95% KM (z) UCL	2.254
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	2.399
97.5% KM (Chebyshev) UCL	2.5
99% KM (Chebyshev) UCL	2.698

Potential UCLs to Use

95% KM (BCA) UCL	N/A

Silver (Ag)

General Statistics

Number of Valid Data	21	Number of Detected Data	14
Number of Distinct Detected Data	2	Number of Non-Detect Data	7
		Percent Non-Detects	33.33%

Raw Statistics

Minimum Detected	1
Maximum Detected	2
Mean of Detected	1.5
SD of Detected	0.519
Minimum Non-Detect	0.2
Maximum Non-Detect	0.2

Log-transformed Statistics

Minimum Detected	0
Maximum Detected	0.693
Mean of Detected	0.347
SD of Detected	0.36
Minimum Non-Detect	-1.609
Maximum Non-Detect	-1.609

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.646
5% Shapiro Wilk Critical Value	0.874

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.646
5% Shapiro Wilk Critical Value	0.874

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	1.033
SD	0.795
95% DL/2 (t) UCL	1.333
Maximum Likelihood Estimate(MLE) Method	
Mean	1.503
SD	0.5
95% MLE (t) UCL	1.691
95% MLE (Tiku) UCL	1.733

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-0.536
SD	1.312
95% H-Stat (DL/2) UCL	1.349
Log ROS Method	
Mean in Log Scale	0.0895
SD in Log Scale	0.486
Mean in Original Scale	1.222
SD in Original Scale	0.585
95% Percentile Bootstrap UCL	1.437
95% BCA Bootstrap UCL	1.449

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	6.847
Theta Star	0.219
nu star	191.7
A-D Test Statistic	2.515
5% A-D Critical Value	0.735
K-S Test Statistic	0.735
5% K-S Critical Value	0.229

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.608
Maximum	2
Mean	1.38
Median	1.2
SD	0.485
k star	7.264
Theta star	0.19
Nu star	305.1
AppChi2	265.6
95% Gamma Approximate UCL	1.585
95% Adjusted Gamma UCL	1.602

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	1.333
SD	0.471
SE of Mean	0.107
95% KM (t) UCL	1.517
95% KM (z) UCL	1.509
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	1.799
97.5% KM (Chebyshev) UCL	2
99% KM (Chebyshev) UCL	2.396

Potential UCLs to Use

95% KM (BCA) UCL	N/A

Sodium

General Statistics

Number of Valid Data	14	Number of Detected Data	12
Number of Distinct Detected Data	7	Number of Non-Detect Data	2
Number of Missing Values	7	Percent Non-Detects	14.29%

Raw Statistics

Minimum Detected	130
Maximum Detected	1100
Mean of Detected	501.7
SD of Detected	261.2
Minimum Non-Detect	100
Maximum Non-Detect	100

Log-transformed Statistics

Minimum Detected	4.868
Maximum Detected	7.003
Mean of Detected	6.09
SD of Detected	0.551
Minimum Non-Detect	4.605
Maximum Non-Detect	4.605

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.857

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.904

5% Shapiro Wilk Critical Value	0.859

Data not Normal at 5% Significance Level

5% Shapiro Wilk Critical Value	0.859

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	437.1
SD	290.9
95% DL/2 (t) UCL	574.8
Maximum Likelihood Estimate(MLE) Method	
Mean	421.6
SD	307.7
95% MLE (t) UCL	567.2
95% MLE (Tiku) UCL	569.5

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	5.779
SD	0.939
95% H-Stat (DL/2) UCL	900.8
Log ROS Method	
Mean in Log Scale	5.916
SD in Log Scale	0.676
Mean in Original Scale	448.7
SD in Original Scale	275.4
95% Percentile Bootstrap UCL	565.9
95% BCA Bootstrap UCL	579.4

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	3.108
Theta Star	161.4
nu star	74.6
A-D Test Statistic	0.658
5% A-D Critical Value	0.736
K-S Test Statistic	0.736
5% K-S Critical Value	0.246

Data follow Appr. Gamma Distribution at 5% Significance Level

Data Distribution Test with Detected Values Only

Data Follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	76.49
Maximum	1100
Mean	448.3
Median	500
SD	276.6
k star	2.088
Theta star	214.7
Nu star	58.47
AppChi2	41.89
95% Gamma Approximate UCL	625.8
95% Adjusted Gamma UCL	654.8

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	448.6
SD	265.5
SE of Mean	74.12
95% KM (t) UCL	579.8
95% KM (z) UCL	570.5
95% KM (jackknife) UCL	574.7
95% KM (bootstrap t) UCL	606.2
95% KM (BCA) UCL	595.7
95% KM (Percentile Bootstrap) UCL	589.3
95% KM (Chebyshev) UCL	771.7
97.5% KM (Chebyshev) UCL	911.5
99% KM (Chebyshev) UCL	1186

Potential UCLs to Use

95% KM (BCA) UCL	595.7

Strontium

General Statistics

Number of Valid Data	14	Number of Detected Data	14
Number of Distinct Detected Data	12	Number of Non-Detect Data	0
Number of Missing Values	7	Percent Non-Detects	0.00%

Raw Statistics

Minimum Detected	4
Maximum Detected	25
Mean of Detected	15.86
SD of Detected	6.585
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

Log-transformed Statistics

Minimum Detected	1.386
Maximum Detected	3.219
Mean of Detected	2.654
SD of Detected	0.535
Minimum Non-Detect	N/A
Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.95
5% Shapiro Wilk Critical Value	0.874

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	15.86
SD	6.585
95% DL/2 (t) UCL	18.97
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.876
5% Shapiro Wilk Critical Value	0.874

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	2.654
SD	0.535
95% H-Stat (DL/2) UCL	22.25
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	3.756
Theta Star	4.222
nu star	105.2
A-D Test Statistic	0.463
5% A-D Critical Value	0.739
K-S Test Statistic	0.739
5% K-S Critical Value	0.229

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	4
Maximum	25
Mean	15.86
Median	16
SD	6.585
k star	3.756
Theta star	4.222
Nu star	105.2
AppChi2	82.5
95% Gamma Approximate UCL	20.21
95% Adjusted Gamma UCL	20.89

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	15.86
SD	6.345
SE of Mean	1.76
95% KM (t) UCL	18.97
95% KM (z) UCL	18.75
95% KM (jackknife) UCL	18.97
95% KM (bootstrap t) UCL	19.06
95% KM (BCA) UCL	18.71
95% KM (Percentile Bootstrap) UCL	18.57
95% KM (Chebyshev) UCL	23.53
97.5% KM (Chebyshev) UCL	26.85
99% KM (Chebyshev) UCL	33.37

Potential UCLs to Use

95% KM (t) UCL	18.97
95% KM (Percentile Bootstrap) UCL	18.57

Tin (Sn)

General Statistics

Number of Valid Data	7	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	4
		Percent Non-Detects	57.14%

Raw Statistics

Minimum Detected	8.7
Maximum Detected	9.8
Mean of Detected	9.133
SD of Detected	0.586
Minimum Non-Detect	5
Maximum Non-Detect	5

Log-transformed Statistics

Minimum Detected	2.163
Maximum Detected	2.282
Mean of Detected	2.211
SD of Detected	0.0632
Minimum Non-Detect	1.609
Maximum Non-Detect	1.609

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.881
5% Shapiro Wilk Critical Value	0.767

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.887
5% Shapiro Wilk Critical Value	0.767

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	5.343
SD	3.562
95% DL/2 (t) UCL	7.959

Maximum Likelihood Estimate(MLE) Method

Mean	4.778
SD	4.27
95% MLE (t) UCL	7.914
95% MLE (Tiku) UCL	8.96

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	1.471
SD	0.693
95% H-Stat (DL/2) UCL	5.571

Log ROS Method

Mean in Log Scale	2.081
SD in Log Scale	0.137
Mean in Original Scale	8.077
SD in Original Scale	1.11
95% Percentile Bootstrap UCL	8.75
95% BCA Bootstrap UCL	8.733

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	0.411
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	8.886
SD	0.38
SE of Mean	0.176
95% KM (t) UCL	9.227
95% KM (z) UCL	9.175
95% KM (jackknife) UCL	9.18
95% KM (bootstrap t) UCL	9.477
95% KM (BCA) UCL	9.8
95% KM (Percentile Bootstrap) UCL	9.8
95% KM (Chebyshev) UCL	9.652
97.5% KM (Chebyshev) UCL	9.983
99% KM (Chebyshev) UCL	10.63

Potential UCLs to Use

95% KM (t) UCL	9.227
95% KM (Percentile Bootstrap) UCL	9.8

Vanadium (V)

General Statistics

Number of Valid Data	21	Number of Detected Data	20
Number of Distinct Detected Data	17	Number of Non-Detect Data	1

Percent Non-Detects	4.76%

Raw Statistics

Minimum Detected	23.4
Maximum Detected	66
Mean of Detected	38.01
SD of Detected	9.91
Minimum Non-Detect	25
Maximum Non-Detect	25

Log-transformed Statistics

Minimum Detected	3.153
Maximum Detected	4.19
Mean of Detected	3.607
SD of Detected	0.252
Minimum Non-Detect	3.219
Maximum Non-Detect	3.219

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.932
5% Shapiro Wilk Critical Value	0.905

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.975
5% Shapiro Wilk Critical Value	0.905

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	36.79
SD	11.15
95% DL/2 (t) UCL	40.99
Maximum Likelihood Estimate(MLE) Method	
Mean	36.7
SD	10.99
95% MLE (t) UCL	40.84
95% MLE (Tiku) UCL	40.91

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	3.556
SD	0.341
95% H-Stat (DL/2) UCL	41.26
Log ROS Method	
Mean in Log Scale	3.587
SD in Log Scale	0.263
Mean in Original Scale	37.33
SD in Original Scale	10.14
95% Percentile Bootstrap UCL	40.93
95% BCA Bootstrap UCL	41.25

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	14.1
Theta Star	2.696
nu star	564
A-D Test Statistic	0.251
5% A-D Critical Value	0.741
K-S Test Statistic	0.741
5% K-S Critical Value	0.194

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	22.2
Maximum	66
Mean	37.25
Median	38
SD	10.26
k star	12.54
Theta star	2.972
Nu star	526.5
AppChi2	474.3
95% Gamma Approximate UCL	41.35
95% Adjusted Gamma UCL	41.69

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	37.33
SD	9.904
SE of Mean	2.217
95% KM (t) UCL	41.15
95% KM (z) UCL	40.97
95% KM (jackknife) UCL	41.15
95% KM (bootstrap t) UCL	41.79
95% KM (BCA) UCL	40.83
95% KM (Percentile Bootstrap) UCL	41.05
95% KM (Chebyshev) UCL	46.99
97.5% KM (Chebyshev) UCL	51.17
99% KM (Chebyshev) UCL	59.39

Potential UCLs to Use

95% KM (t) UCL	41.15
95% KM (Percentile Bootstrap) UCL	41.05

Zinc (Zn)

General Statistics

Sediment Results for 95% UCL (Inorganic Fresh Water)

Number of Valid Observations	21	Number of Distinct Observations	20

Raw Statistics

Minimum	29
Maximum	499
Mean	209.3
Median	210
SD	134.9
Coefficient of Variation	0.645
Skewness	0.473

Log-transformed Statistics

Minimum of Log Data	3.367
Maximum of Log Data	6.213
Mean of log Data	5.067
SD of log Data	0.855

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.953
Shapiro Wilk Critical Value	0.908

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.907
Shapiro Wilk Critical Value	0.908

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	260.1

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	261
95% Modified-t UCL	260.6

Assuming Lognormal Distribution

95% H-UCL	359.8
95% Chebyshev (MVUE) UCL	422.6
97.5% Chebyshev (MVUE) UCL	508.8
99% Chebyshev (MVUE) UCL	678.1

Gamma Distribution Test

k star (bias corrected)	1.707
Theta Star	122.6
nu star	71.71
Approximate Chi Square Value (.05)	53.21
Adjusted Level of Significance	0.0383
Adjusted Chi Square Value	51.99
Anderson-Darling Test Statistic	0.466
Anderson-Darling 5% Critical Value	0.754
Kolmogorov-Smirnov Test Statistic	0.143
Kolmogorov-Smirnov 5% Critical Value	0.192

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	282
95% Adjusted Gamma UCL	288.7

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	257.7
95% Jackknife UCL	260.1
95% Standard Bootstrap UCL	257.3
95% Bootstrap-t UCL	264.5
95% Hall's Bootstrap UCL	260.2
95% Percentile Bootstrap UCL	258.9
95% BCA Bootstrap UCL	260.7
95% Chebyshev(Mean, Sd) UCL	337.6
97.5% Chebyshev(Mean, Sd) UCL	393.2
99% Chebyshev(Mean, Sd) UCL	502.3

Potential UCL to Use

Use 95% Student's-t UCL 260.1

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Z:\Projects\2009\1584-0901 TC Iqaluit Landfill\SSRA\COC tables\95UCL\sediment-PHC-fresh.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzene

General Statistics

Number of Valid Data	18	Number of Detected Data	5
Number of Distinct Detected Data	1	Number of Non-Detect Data	13
		Percent Non-Detects	72.22%

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

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Benzene was not processed!

Ethylbenzene

General Statistics

Number of Valid Data	18	Number of Detected Data	14
Number of Distinct Detected Data	5	Number of Non-Detect Data	4
		Percent Non-Detects	22.22%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.004	Minimum Detected	-5.521
Maximum Detected	0.05	Maximum Detected	-2.996
Mean of Detected	0.0219	Mean of Detected	-4.368
SD of Detected	0.0218	SD of Detected	1.094
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.67	Shapiro Wilk Test Statistic	0.773
5% Shapiro Wilk Critical Value	0.874	5% Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0172	Mean	-4.932
SD	0.0211	SD	1.448
95% DL/2 (t) UCL	0.0259	95% H-Stat (DL/2) UCL	0.0355
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0139	Mean in Log Scale	-4.913
SD	0.0245	SD in Log Scale	1.435
95% MLE (t) UCL	0.024	Mean in Original Scale	0.0173
95% MLE (Tiku) UCL	0.0241	SD in Original Scale	0.021
		95% Percentile Bootstrap UCL	0.0252
		95% BCA Bootstrap UCL	0.0257

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.875
Theta Star	0.025
nu star	24.5
A-D Test Statistic	1.733
5% A-D Critical Value	0.759
K-S Test Statistic	0.759
5% K-S Critical Value	0.235

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.05
Mean	0.0172
Median	0.006
SD	0.0211
k star	0.279
Theta star	0.0617
Nu star	10.05
AppChi2	3.974
95% Gamma Approximate UCL	0.0436
95% Adjusted Gamma UCL	0.0479

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0179
SD	0.02
SE of Mean	0.00489
95% KM (t) UCL	0.0264
95% KM (z) UCL	0.0259
95% KM (jackknife) UCL	0.0263
95% KM (bootstrap t) UCL	0.0286
95% KM (BCA) UCL	0.0257
95% KM (Percentile Bootstrap) UCL	0.0256
95% KM (Chebyshev) UCL	0.0392
97.5% KM (Chebyshev) UCL	0.0484
99% KM (Chebyshev) UCL	0.0665

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.0484

Toluene

General Statistics

Number of Valid Data	18	Number of Detected Data	15
Number of Distinct Detected Data	5	Number of Non-Detect Data	3
		Percent Non-Detects	16.67%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.004	Minimum Detected	-5.521
Maximum Detected	0.05	Maximum Detected	-2.996
Mean of Detected	0.0209	Mean of Detected	-4.399
SD of Detected	0.0213	SD of Detected	1.061
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.662	Shapiro Wilk Test Statistic	0.775
5% Shapiro Wilk Critical Value	0.881	5% Shapiro Wilk Critical Value	0.881

Data not Normal at 5% Significance Level

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0176	Mean	-4.817
SD	0.0208	SD	1.361
95% DL/2 (t) UCL	0.0261	95% H-Stat (DL/2) UCL	0.0331

Maximum Likelihood Estimate(MLE) Method	
Mean	0.0154
SD	0.023
95% MLE (t) UCL	0.0248
95% MLE (Tiku) UCL	0.0247

Log ROS Method	
Mean in Log Scale	-4.789
SD in Log Scale	1.324
Mean in Original Scale	0.0177
SD in Original Scale	0.0208
95% Percentile Bootstrap UCL	0.0255
95% BCA Bootstrap UCL	0.0261

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.905
Theta Star	0.0231
nu star	27.14
A-D Test Statistic	1.872
5% A-D Critical Value	0.762
K-S Test Statistic	0.762
5% K-S Critical Value	0.228

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.05
Mean	0.0174
Median	0.007
SD	0.021
k star	0.232
Theta star	0.0752
Nu star	8.348
AppChi2	2.938
95% Gamma Approximate UCL	0.0496
95% Adjusted Gamma UCL	0.0552

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0181
SD	0.0198
SE of Mean	0.00484
95% KM (t) UCL	0.0265
95% KM (z) UCL	0.0261
95% KM (jackknife) UCL	0.0265
95% KM (bootstrap t) UCL	0.0286
95% KM (BCA) UCL	0.026
95% KM (Percentile Bootstrap) UCL	0.026
95% KM (Chebyshev) UCL	0.0392
97.5% KM (Chebyshev) UCL	0.0484
99% KM (Chebyshev) UCL	0.0663

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.0484

o-Xylene

General Statistics

Number of Valid Data	18	Number of Detected Data	13
Number of Distinct Detected Data	5	Number of Non-Detect Data	5
		Percent Non-Detects	27.78%

Raw Statistics

Minimum Detected	0.004
Maximum Detected	0.05
Mean of Detected	0.0229
SD of Detected	0.0223
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics

Minimum Detected	-5.521
Maximum Detected	-2.996
Mean of Detected	-4.333
SD of Detected	1.131
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.675
5% Shapiro Wilk Critical Value	0.866

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.765
5% Shapiro Wilk Critical Value	0.866

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.0168
SD	0.0213
95% DL/2 (t) UCL	0.0256
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0122
SD	0.0262
95% MLE (t) UCL	0.023
95% MLE (Tiku) UCL	0.0234

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.048
SD	1.52
95% H-Stat (DL/2) UCL	0.037
Log ROS Method	
Mean in Log Scale	-5.05
SD in Log Scale	1.552
Mean in Original Scale	0.0169
SD in Original Scale	0.0213
95% Percentile Bootstrap UCL	0.0249
95% BCA Bootstrap UCL	0.0269

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.845
Theta Star	0.0271
nu star	21.98
A-D Test Statistic	1.63
5% A-D Critical Value	0.757
K-S Test Statistic	0.757
5% K-S Critical Value	0.243

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.05
Mean	0.0175
Median	0.006
SD	0.0209
k star	0.289
Theta star	0.0606
Nu star	10.41
AppChi2	4.202
95% Gamma Approximate UCL	0.0434
95% Adjusted Gamma UCL	0.0477

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0177
SD	0.0201
SE of Mean	0.00493
95% KM (t) UCL	0.0263
95% KM (z) UCL	0.0258
95% KM (jackknife) UCL	0.0262
95% KM (bootstrap t) UCL	0.0285
95% KM (BCA) UCL	0.0254
95% KM (Percentile Bootstrap) UCL	0.0257
95% KM (Chebyshev) UCL	0.0392
97.5% KM (Chebyshev) UCL	0.0485
99% KM (Chebyshev) UCL	0.0668

Potential UCLs to Use

97.5% KM (Chebyshev) UCL 0.0485

m & p-Xylene

General Statistics

Number of Valid Data	18	Number of Detected Data	14
Number of Distinct Detected Data	5	Number of Non-Detect Data	4
		Percent Non-Detects	22.22%

Raw Statistics

Minimum Detected	0.004
Maximum Detected	0.05
Mean of Detected	0.0219
SD of Detected	0.0218
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics

Minimum Detected	-5.521
Maximum Detected	-2.996
Mean of Detected	-4.368
SD of Detected	1.094
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.67
5% Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level	

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.773
5% Shapiro Wilk Critical Value	0.874
Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.0172
SD	0.0211
95% DL/2 (t) UCL	0.0259
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0139
SD	0.0245
95% MLE (t) UCL	0.024
95% MLE (Tiku) UCL	0.0241

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-4.932
SD	1.448
95% H-Stat (DL/2) UCL	0.0355
Log ROS Method	
Mean in Log Scale	-4.913
SD in Log Scale	1.435
Mean in Original Scale	0.0173
SD in Original Scale	0.021
95% Percentile Bootstrap UCL	0.0252
95% BCA Bootstrap UCL	0.0272

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.875
Theta Star	0.025
nu star	24.5
A-D Test Statistic	1.733
5% A-D Critical Value	0.759
K-S Test Statistic	0.759
5% K-S Critical Value	0.235
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.05
Mean	0.0172
Median	0.006
SD	0.0211
k star	0.279
Theta star	0.0617
Nu star	10.05
AppChi2	3.974
95% Gamma Approximate UCL	0.0436
95% Adjusted Gamma UCL	0.0479

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.0179
SD	0.02
SE of Mean	0.00489
95% KM (t) UCL	0.0264
95% KM (z) UCL	0.0259
95% KM (jackknife) UCL	0.0263
95% KM (bootstrap t) UCL	0.0286
95% KM (BCA) UCL	0.0256
95% KM (Percentile Bootstrap) UCL	0.0256
95% KM (Chebyshev) UCL	0.0392
97.5% KM (Chebyshev) UCL	0.0484
99% KM (Chebyshev) UCL	0.0665
Potential UCLs to Use	
97.5% KM (Chebyshev) UCL	0.0484

Xylenes (Total)

General Statistics

Number of Valid Data	18	Number of Detected Data	14
Number of Distinct Detected Data	5	Number of Non-Detect Data	4
		Percent Non-Detects	22.22%

Raw Statistics

Minimum Detected	0.004
Maximum Detected	0.1
Mean of Detected	0.0397
SD of Detected	0.0467
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics

Minimum Detected	-5.521
Maximum Detected	-2.303
Mean of Detected	-4.121
SD of Detected	1.431
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.642
5% Shapiro Wilk Critical Value	0.874

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.742
5% Shapiro Wilk Critical Value	0.874

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.0311
SD	0.044
95% DL/2 (t) UCL	0.0492
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0238
SD	0.0512
95% MLE (t) UCL	0.0448
95% MLE (Tiku) UCL	0.0449

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-4.74
SD	1.729
95% H-Stat (DL/2) UCL	0.0927
Log ROS Method	
Mean in Log Scale	-4.822
SD in Log Scale	1.862
Mean in Original Scale	0.0311
SD in Original Scale	0.0441
95% Percentile Bootstrap UCL	0.0472
95% BCA Bootstrap UCL	0.0516

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.581
Theta Star	0.0684
nu star	16.26
A-D Test Statistic	1.982
5% A-D Critical Value	0.777
K-S Test Statistic	0.777
5% K-S Critical Value	0.239

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.1
Mean	0.0309
Median	0.006
SD	0.0442
k star	0.202
Theta star	0.153
Nu star	7.289
AppChi2	2.331
95% Gamma Approximate UCL	0.0966
95% Adjusted Gamma UCL	0.109

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0318
SD	0.0423
SE of Mean	0.0104
95% KM (t) UCL	0.0498
95% KM (z) UCL	0.0488
95% KM (jackknife) UCL	0.0496
95% KM (bootstrap t) UCL	0.054
95% KM (BCA) UCL	0.0523
95% KM (Percentile Bootstrap) UCL	0.048
95% KM (Chebyshev) UCL	0.0769
97.5% KM (Chebyshev) UCL	0.0965
99% KM (Chebyshev) UCL	0.135

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	0.0965

CWS F1 (C06-C10)

General Statistics

Number of Valid Data	18	Number of Detected Data	8
Number of Distinct Detected Data	4	Number of Non-Detect Data	10
		Percent Non-Detects	55.56%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	11	Minimum Detected	2.398
Maximum Detected	40	Maximum Detected	3.689
Mean of Detected	28.88	Mean of Detected	3.297
SD of Detected	9.643	SD of Detected	0.423
Minimum Non-Detect	10	Minimum Non-Detect	2.303
Maximum Non-Detect	10	Maximum Non-Detect	2.303

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.876	Shapiro Wilk Test Statistic	0.801
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	15.61	Mean	2.359
SD	13.69	SD	0.904
95% DL/2 (t) UCL	21.22	95% H-Stat (DL/2) UCL	22.48
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	8.519	Mean in Log Scale	2.691
SD	21.58	SD in Log Scale	0.681
95% MLE (t) UCL	17.37	Mean in Original Scale	18.2
95% MLE (Tiku) UCL	20.12	SD in Original Scale	11.87
		95% Percentile Bootstrap UCL	22.64
		95% BCA Bootstrap UCL	23.18

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	4.923	Data appear Normal at 5% Significance Level
Theta Star	5.865	
nu star	78.77	

A-D Test Statistic	0.711
5% A-D Critical Value	0.717
K-S Test Statistic	0.717
5% K-S Critical Value	0.295

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	11
Maximum	43.89
Mean	30.43
Median	30
SD	9.664
k star	6.865
Theta star	4.433
Nu star	247.1
AppChi2	211.7
95% Gamma Approximate UCL	35.52
95% Adjusted Gamma UCL	36.06

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	18.94
SD	10.73
SE of Mean	2.703
95% KM (t) UCL	23.65
95% KM (z) UCL	23.39
95% KM (jackknife) UCL	24.45
95% KM (bootstrap t) UCL	23.78
95% KM (BCA) UCL	31.67
95% KM (Percentile Bootstrap) UCL	31.11
95% KM (Chebyshev) UCL	30.73
97.5% KM (Chebyshev) UCL	35.82
99% KM (Chebyshev) UCL	45.84

Potential UCLs to Use

95% KM (t) UCL	23.65
95% KM (Percentile Bootstrap) UCL	31.11

F1-BTEX

General Statistics

Number of Valid Data	18	Number of Detected Data	8
Number of Distinct Detected Data	4	Number of Non-Detect Data	10
		Percent Non-Detects	55.56%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	11	Minimum Detected	2.398
Maximum Detected	40	Maximum Detected	3.689
Mean of Detected	28.88	Mean of Detected	3.297
SD of Detected	9.643	SD of Detected	0.423
Minimum Non-Detect	10	Minimum Non-Detect	2.303
Maximum Non-Detect	10	Maximum Non-Detect	2.303

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.876	Shapiro Wilk Test Statistic	0.801
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data appear Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	15.61	Mean	2.359
SD	13.69	SD	0.904
95% DL/2 (t) UCL	21.22	95% H-Stat (DL/2) UCL	22.48

Maximum Likelihood Estimate(MLE) Method	
Mean	8.519
SD	21.58
95% MLE (t) UCL	17.37
95% MLE (Tiku) UCL	20.12

Log ROS Method	
Mean in Log Scale	2.691
SD in Log Scale	0.681
Mean in Original Scale	18.2
SD in Original Scale	11.87
95% Percentile Bootstrap UCL	22.69
95% BCA Bootstrap UCL	23.33

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	4.923
Theta Star	5.865
nu star	78.77
A-D Test Statistic	0.711
5% A-D Critical Value	0.717
K-S Test Statistic	0.717
5% K-S Critical Value	0.295

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	11
Maximum	43.89
Mean	30.43
Median	30
SD	9.664
k star	6.865
Theta star	4.433
Nu star	247.1
AppChi2	211.7
95% Gamma Approximate UCL	35.52
95% Adjusted Gamma UCL	36.06

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	18.94
SD	10.73
SE of Mean	2.703
95% KM (t) UCL	23.65
95% KM (z) UCL	23.39
95% KM (jackknife) UCL	24.45
95% KM (bootstrap t) UCL	23.83
95% KM (BCA) UCL	31.67
95% KM (Percentile Bootstrap) UCL	31.11
95% KM (Chebyshev) UCL	30.73
97.5% KM (Chebyshev) UCL	35.82
99% KM (Chebyshev) UCL	45.84

Potential UCLs to Use

95% KM (t) UCL	23.65
95% KM (Percentile Bootstrap) UCL	31.11

CWS F2 (C10-C16)

General Statistics

Number of Valid Data	18	Number of Detected Data	14
Number of Distinct Detected Data	11	Number of Non-Detect Data	4
		Percent Non-Detects	22.22%

Raw Statistics

Minimum Detected	30
Maximum Detected	1500
Mean of Detected	323.2
SD of Detected	518
Minimum Non-Detect	10
Maximum Non-Detect	10

Log-transformed Statistics

Minimum Detected	3.401
Maximum Detected	7.313
Mean of Detected	4.758
SD of Detected	1.424
Minimum Non-Detect	2.303
Maximum Non-Detect	2.303

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.607
5% Shapiro Wilk Critical Value	0.874
Data not Normal at 5% Significance Level	

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.853
5% Shapiro Wilk Critical Value	0.874
Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	252.5
SD	473
95% DL/2 (t) UCL	446.4
Maximum Likelihood Estimate(MLE) Method	
Mean	168.6
SD	545.5
95% MLE (t) UCL	392.3
95% MLE (Tiku) UCL	390.7

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	4.058
SD	1.834
95% H-Stat (DL/2) UCL	881.3
Log ROS Method	
Mean in Log Scale	4.009
SD in Log Scale	1.927
Mean in Original Scale	252.4
SD in Original Scale	473
95% Percentile Bootstrap UCL	443.5
95% BCA Bootstrap UCL	509.5

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.523
Theta Star	618.2
nu star	14.64
A-D Test Statistic	1.2
5% A-D Critical Value	0.784
K-S Test Statistic	0.784
5% K-S Critical Value	0.24
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1500
Mean	251.4
Median	37.5
SD	473.6
k star	0.139
Theta star	1803
Nu star	5.02
AppChi2	1.162
95% Gamma Approximate UCL	1086
95% Adjusted Gamma UCL	1267

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	258.1
SD	456.8
SE of Mean	111.7
95% KM (t) UCL	452.4
95% KM (z) UCL	441.8
95% KM (jackknife) UCL	450.8
95% KM (bootstrap t) UCL	941.8
95% KM (BCA) UCL	469.7
95% KM (Percentile Bootstrap) UCL	435.6
95% KM (Chebyshev) UCL	745
97.5% KM (Chebyshev) UCL	955.8
99% KM (Chebyshev) UCL	1370
Potential UCLs to Use	
97.5% KM (Chebyshev) UCL	955.8

CWS F3 (C16-C34)

General Statistics

Number of Valid Data	18	Number of Detected Data	17
Number of Distinct Detected Data	17	Number of Non-Detect Data	1
		Percent Non-Detects	5.56%

Raw Statistics	
Minimum Detected	21
Maximum Detected	4100
Mean of Detected	593.9
SD of Detected	977.2
Minimum Non-Detect	10
Maximum Non-Detect	10

Log-transformed Statistics	
Minimum Detected	3.045
Maximum Detected	8.319
Mean of Detected	5.585
SD of Detected	1.304
Minimum Non-Detect	2.303
Maximum Non-Detect	2.303

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.564
5% Shapiro Wilk Critical Value	0.892

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.986
5% Shapiro Wilk Critical Value	0.892

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	561.2
SD	958.2
95% DL/2 (t) UCL	954
Maximum Likelihood Estimate(MLE) Method	
Mean	527.4
SD	968.3
95% MLE (t) UCL	924.5
95% MLE (Tiku) UCL	892.5

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	5.364
SD	1.574
95% H-Stat (DL/2) UCL	2242
Log ROS Method	
Mean in Log Scale	5.407
SD in Log Scale	1.473
Mean in Original Scale	561.5
SD in Original Scale	958
95% Percentile Bootstrap UCL	946
95% BCA Bootstrap UCL	1218

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.655
Theta Star	907.1
nu star	22.26
A-D Test Statistic	0.591
5% A-D Critical Value	0.777
K-S Test Statistic	0.777
5% K-S Critical Value	0.217

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	4100
Mean	560.9
Median	234
SD	958.3
k star	0.296
Theta star	1895
Nu star	10.66
AppChi2	4.357
95% Gamma Approximate UCL	1372
95% Adjusted Gamma UCL	1503

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	562.1
SD	930.7
SE of Mean	226.1
95% KM (t) UCL	955.4
95% KM (z) UCL	934
95% KM (jackknife) UCL	953.5
95% KM (bootstrap t) UCL	1646
95% KM (BCA) UCL	953.6
95% KM (Percentile Bootstrap) UCL	966.1
95% KM (Chebyshev) UCL	1548
97.5% KM (Chebyshev) UCL	1974
99% KM (Chebyshev) UCL	2812

Potential UCLs to Use	
95% KM (Chebyshev) UCL	1548

CWS F4 (C34-C50)

General Statistics

Number of Valid Data	18	Number of Detected Data	15
Number of Distinct Detected Data	13	Number of Non-Detect Data	3
		Percent Non-Detects	16.67%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	40	Minimum Detected	3.689
Maximum Detected	4500	Maximum Detected	8.412
Mean of Detected	505.7	Mean of Detected	5.24
SD of Detected	1121	SD of Detected	1.251
Minimum Non-Detect	10	Minimum Non-Detect	2.303
Maximum Non-Detect	10	Maximum Non-Detect	2.303

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.424	Shapiro Wilk Test Statistic	0.919
5% Shapiro Wilk Critical Value	0.881	5% Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	422.2	Mean	4.635
SD	1035	SD	1.797
95% DL/2 (t) UCL	846.7	95% H-Stat (DL/2) UCL	1262
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	288.2	Mean in Log Scale	4.753
SD	1132	SD in Log Scale	1.605
95% MLE (t) UCL	752.2	Mean in Original Scale	423.2
95% MLE (Tiku) UCL	732.2	SD in Original Scale	1035
		95% Percentile Bootstrap UCL	897.9
		95% BCA Bootstrap UCL	1185

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.543	Data Follow Appr. Gamma Distribution at 5% Significance Level
Theta Star	931	
nu star	16.3	

A-D Test Statistic	1.281
5% A-D Critical Value	0.784
K-S Test Statistic	0.784
5% K-S Critical Value	0.232

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	4500
Mean	421.4
Median	104.5
SD	1035
k star	0.162
Theta star	2603
Nu star	5.828
AppChi2	1.553
95% Gamma Approximate UCL	1582
95% Adjusted Gamma UCL	1817

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	428.1
SD	1004
SE of Mean	244.9
95% KM (t) UCL	854
95% KM (z) UCL	830.8
95% KM (jackknife) UCL	850.1
95% KM (bootstrap t) UCL	2527
95% KM (BCA) UCL	924.8
95% KM (Percentile Bootstrap) UCL	897.7
95% KM (Chebyshev) UCL	1495
97.5% KM (Chebyshev) UCL	1957
99% KM (Chebyshev) UCL	2864

Potential UCLs to Use

95% KM (Chebyshev) UCL	1495

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Z:\Projects\2009\1584-0901 TC Iqaluit Landfill\SSRA\COC tables\95UCL\sediment-VOC-fresh.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ethylbenzene

General Statistics

Number of Valid Data	14	Number of Detected Data	10
Number of Distinct Detected Data	5	Number of Non-Detect Data	4
		Percent Non-Detects	28.57%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.004	Minimum Detected	-5.521
Maximum Detected	0.05	Maximum Detected	-2.996
Mean of Detected	0.0106	Mean of Detected	-4.917
SD of Detected	0.014	SD of Detected	0.747
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.494	Shapiro Wilk Test Statistic	0.746
5% Shapiro Wilk Critical Value	0.842	5% Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00786	Mean	-5.486
SD	0.0125	SD	1.121
95% DL/2 (t) UCL	0.0138	95% H-Stat (DL/2) UCL	0.0143
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.00503	Mean in Log Scale	-5.4
SD	0.015	SD in Log Scale	1.025
95% MLE (t) UCL	0.0121	Mean in Original Scale	0.00798
95% MLE (Tiku) UCL	0.0123	SD in Original Scale	0.0124
		95% Percentile Bootstrap UCL	0.0143
		95% BCA Bootstrap UCL	0.0177

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	1.114	Data do not follow a Discernable Distribution (0.05)
Theta Star	0.00952	
nu star	22.28	

A-D Test Statistic	1.498
5% A-D Critical Value	0.739
K-S Test Statistic	0.739
5% K-S Critical Value	0.271

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.05
Mean	0.00822
Median	0.0057
SD	0.0123
k star	0.388
Theta star	0.0212
Nu star	10.86
AppChi2	4.486
95% Gamma Approximate UCL	0.0199
95% Adjusted Gamma UCL	0.0226

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00871
SD	0.0116
SE of Mean	0.00327
95% KM (t) UCL	0.0145
95% KM (z) UCL	0.0141
95% KM (jackknife) UCL	0.0144
95% KM (bootstrap t) UCL	0.0382
95% KM (BCA) UCL	0.0151
95% KM (Percentile Bootstrap) UCL	0.015
95% KM (Chebyshev) UCL	0.023
97.5% KM (Chebyshev) UCL	0.0291
99% KM (Chebyshev) UCL	0.0412

Potential UCLs to Use

95% KM (BCA) UCL	0.0151

Hexachlorobenzene

General Statistics

Number of Valid Data	13	Number of Detected Data	9
Number of Distinct Detected Data	4	Number of Non-Detect Data	4
		Percent Non-Detects	30.77%

Raw Statistics

Minimum Detected	0.004
Maximum Detected	0.01
Mean of Detected	0.00622
SD of Detected	0.00211
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics

Minimum Detected	-5.521
Maximum Detected	-4.605
Mean of Detected	-5.13
SD of Detected	0.339
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.889
5% Shapiro Wilk Critical Value	0.829

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.885
5% Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00462
SD	0.00304
95% DL/2 (t) UCL	0.00612
Maximum Likelihood Estimate(MLE) Method	
Mean	0.00428
SD	0.00349
95% MLE (t) UCL	0.006
95% MLE (Tiku) UCL	0.00615

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.677
SD	0.897
95% H-Stat (DL/2) UCL	0.00708
Log ROS Method	
Mean in Log Scale	-5.391
SD in Log Scale	0.502
Mean in Original Scale	0.0051
SD in Original Scale	0.00247
95% Percentile Bootstrap UCL	0.00619
95% BCA Bootstrap UCL	0.00634

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	6.74
Theta Star	0.0009231
nu star	121.3
A-D Test Statistic	0.509
5% A-D Critical Value	0.722
K-S Test Statistic	0.722
5% K-S Critical Value	0.279

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00293
Maximum	0.01
Mean	0.00568
Median	0.00568
SD	0.00201
k star	7.085
Theta star	0.0008013
Nu star	184.2
AppChi2	153.8
95% Gamma Approximate UCL	0.0068
95% Adjusted Gamma UCL	0.00698

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00554
SD	0.00195
SE of Mean	0.0005725
95% KM (t) UCL	0.00656
95% KM (z) UCL	0.00648
95% KM (jackknife) UCL	0.00654
95% KM (bootstrap t) UCL	0.00697
95% KM (BCA) UCL	0.00662
95% KM (Percentile Bootstrap) UCL	0.00662
95% KM (Chebyshev) UCL	0.00803
97.5% KM (Chebyshev) UCL	0.00911
99% KM (Chebyshev) UCL	0.0112

Potential UCLs to Use

95% KM (t) UCL	0.00656
95% KM (Percentile Bootstrap) UCL	0.00662

Hexachlorobutadiene

General Statistics

Number of Valid Data	13	Number of Detected Data	9
Number of Distinct Detected Data	4	Number of Non-Detect Data	4
		Percent Non-Detects	30.77%

Raw Statistics	
Minimum Detected	0.02
Maximum Detected	0.05
Mean of Detected	0.0311
SD of Detected	0.0105
Minimum Non-Detect	0.01
Maximum Non-Detect	0.01

Log-transformed Statistics	
Minimum Detected	-3.912
Maximum Detected	-2.996
Mean of Detected	-3.521
SD of Detected	0.339
Minimum Non-Detect	-4.605
Maximum Non-Detect	-4.605

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.889
5% Shapiro Wilk Critical Value	0.829

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.885
5% Shapiro Wilk Critical Value	0.829

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.0231
SD	0.0152
95% DL/2 (t) UCL	0.0306
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0214
SD	0.0174
95% MLE (t) UCL	0.03
95% MLE (Tiku) UCL	0.0308

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-4.068
SD	0.897
95% H-Stat (DL/2) UCL	0.0354
Log ROS Method	
Mean in Log Scale	-3.782
SD in Log Scale	0.502
Mean in Original Scale	0.0255
SD in Original Scale	0.0123
95% Percentile Bootstrap UCL	0.0309
95% BCA Bootstrap UCL	0.0315

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	6.74
Theta Star	0.00462
nu star	121.3

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

A-D Test Statistic	0.509
5% A-D Critical Value	0.722
K-S Test Statistic	0.722
5% K-S Critical Value	0.279

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.0147
Maximum	0.05
Mean	0.0284
Median	0.0284
SD	0.01
k star	7.085
Theta star	0.00401
Nu star	184.2
AppChi2	153.8
95% Gamma Approximate UCL	0.034
95% Adjusted Gamma UCL	0.0349

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0277
SD	0.00973
SE of Mean	0.00286
95% KM (t) UCL	0.0328
95% KM (z) UCL	0.0324
95% KM (jackknife) UCL	0.0327
95% KM (bootstrap t) UCL	0.0338
95% KM (BCA) UCL	0.0323
95% KM (Percentile Bootstrap) UCL	0.0331
95% KM (Chebyshev) UCL	0.0402
97.5% KM (Chebyshev) UCL	0.0456
99% KM (Chebyshev) UCL	0.0562

Potential UCLs to Use

95% KM (t) UCL	0.0328
95% KM (Percentile Bootstrap) UCL	0.0331

Toluene

General Statistics

Number of Valid Data	14	Number of Detected Data	11
Number of Distinct Detected Data	5	Number of Non-Detect Data	3
		Percent Non-Detects	21.43%

Raw Statistics

Minimum Detected	0.004
Maximum Detected	0.12
Mean of Detected	0.0167
SD of Detected	0.0343
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics

Minimum Detected	-5.521
Maximum Detected	-2.12
Mean of Detected	-4.829
SD of Detected	0.953
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.396
5% Shapiro Wilk Critical Value	0.85

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.649
5% Shapiro Wilk Critical Value	0.85

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.0134
SD	0.0308
95% DL/2 (t) UCL	0.0279

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.275
SD	1.217
95% H-Stat (DL/2) UCL	0.0227

Maximum Likelihood Estimate(MLE) Method	
Mean	0.00811
SD	0.0346
95% MLE (t) UCL	0.0245
95% MLE (Tiku) UCL	0.0242

Log ROS Method	
Mean in Log Scale	-5.241
SD in Log Scale	1.178
Mean in Original Scale	0.0134
SD in Original Scale	0.0308
95% Percentile Bootstrap UCL	0.0298
95% BCA Bootstrap UCL	0.0384

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.645
Theta Star	0.0259
nu star	14.18
A-D Test Statistic	2.358
5% A-D Critical Value	0.76
K-S Test Statistic	0.76
5% K-S Critical Value	0.264

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.12
Mean	0.0131
Median	0.006
SD	0.0309
k star	0.197
Theta star	0.0667
Nu star	5.514
AppChi2	1.397
95% Gamma Approximate UCL	0.0519
95% Adjusted Gamma UCL	0.0634

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.014
SD	0.0295
SE of Mean	0.00826
95% KM (t) UCL	0.0286
95% KM (z) UCL	0.0276
95% KM (jackknife) UCL	0.0285
95% KM (bootstrap t) UCL	0.175
95% KM (BCA) UCL	0.0303
95% KM (Percentile Bootstrap) UCL	0.0303
95% KM (Chebyshev) UCL	0.05
97.5% KM (Chebyshev) UCL	0.0656
99% KM (Chebyshev) UCL	0.0962

Potential UCLs to Use

95% KM (BCA) UCL	0.0303

m+p-Xylene

General Statistics

Number of Valid Data	14	Number of Detected Data	10
Number of Distinct Detected Data	5	Number of Non-Detect Data	4
		Percent Non-Detects	28.57%

Raw Statistics

Minimum Detected	0.004
Maximum Detected	0.05
Mean of Detected	0.0106
SD of Detected	0.014
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics

Minimum Detected	-5.521
Maximum Detected	-2.996
Mean of Detected	-4.917
SD of Detected	0.747
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.494
5% Shapiro Wilk Critical Value	0.842

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.746
5% Shapiro Wilk Critical Value	0.842

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00786
SD	0.0125
95% DL/2 (t) UCL	0.0138
Maximum Likelihood Estimate(MLE) Method	
Mean	0.00503
SD	0.015
95% MLE (t) UCL	0.0121
95% MLE (Tiku) UCL	0.0123

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.486
SD	1.121
95% H-Stat (DL/2) UCL	0.0143
Log ROS Method	
Mean in Log Scale	-5.4
SD in Log Scale	1.025
Mean in Original Scale	0.00798
SD in Original Scale	0.0124
95% Percentile Bootstrap UCL	0.0143
95% BCA Bootstrap UCL	0.0175

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.114
Theta Star	0.00952
nu star	22.28
A-D Test Statistic	1.498
5% A-D Critical Value	0.739
K-S Test Statistic	0.739
5% K-S Critical Value	0.271

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.05
Mean	0.00822
Median	0.0057
SD	0.0123
k star	0.388
Theta star	0.0212
Nu star	10.86
AppChi2	4.486
95% Gamma Approximate UCL	0.0199
95% Adjusted Gamma UCL	0.0226

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00871
SD	0.0116
SE of Mean	0.00327
95% KM (t) UCL	0.0145
95% KM (z) UCL	0.0141
95% KM (jackknife) UCL	0.0144
95% KM (bootstrap t) UCL	0.0374
95% KM (BCA) UCL	0.0144
95% KM (Percentile Bootstrap) UCL	0.015
95% KM (Chebyshev) UCL	0.023
97.5% KM (Chebyshev) UCL	0.0291
99% KM (Chebyshev) UCL	0.0412

Potential UCLs to Use

95% KM (BCA) UCL	0.0144

o-Xylene

General Statistics

Number of Valid Data	14	Number of Detected Data	9
Number of Distinct Detected Data	5	Number of Non-Detect Data	5
		Percent Non-Detects	35.71%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.004	Minimum Detected	-5.521
Maximum Detected	0.05	Maximum Detected	-2.996
Mean of Detected	0.0109	Mean of Detected	-4.927
SD of Detected	0.0148	SD of Detected	0.791
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

Warning: There are only 9 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.507	Shapiro Wilk Test Statistic	0.737
5% Shapiro Wilk Critical Value	0.829	5% Shapiro Wilk Critical Value	0.829
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00736	Mean	-5.634
SD	0.0126	SD	1.164
95% DL/2 (t) UCL	0.0133	95% H-Stat (DL/2) UCL	0.0138
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.00326	Mean in Log Scale	-5.603
SD	0.0162	SD in Log Scale	1.162
95% MLE (t) UCL	0.0109	Mean in Original Scale	0.00743
95% MLE (Tiku) UCL	0.0116	SD in Original Scale	0.0126
		95% Percentile Bootstrap UCL	0.0139
		95% BCA Bootstrap UCL	0.0166

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.989	Data do not follow a Discernable Distribution (0.05)
Theta Star	0.011	
nu star	17.79	

A-D Test Statistic	1.419
5% A-D Critical Value	0.737
K-S Test Statistic	0.737
5% K-S Critical Value	0.285

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.05
Mean	0.00843
Median	0.006
SD	0.0123
k star	0.391
Theta star	0.0215
Nu star	10.96
AppChi2	4.547
95% Gamma Approximate UCL	0.0203
95% Adjusted Gamma UCL	0.023

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00843
SD	0.0117
SE of Mean	0.00331
95% KM (t) UCL	0.0143
95% KM (z) UCL	0.0139
95% KM (jackknife) UCL	0.0142
95% KM (bootstrap t) UCL	0.0437
95% KM (BCA) UCL	0.0147
95% KM (Percentile Bootstrap) UCL	0.0146
95% KM (Chebyshev) UCL	0.0228
97.5% KM (Chebyshev) UCL	0.0291
99% KM (Chebyshev) UCL	0.0413

Potential UCLs to Use

95% KM (BCA) UCL	0.0147

Xylenes (total)

General Statistics

Number of Valid Data	14	Number of Detected Data	10
Number of Distinct Detected Data	5	Number of Non-Detect Data	4
		Percent Non-Detects	28.57%

Raw Statistics

Minimum Detected	0.004
Maximum Detected	0.1
Mean of Detected	0.0156
SD of Detected	0.0297
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics

Minimum Detected	-5.521
Maximum Detected	-2.303
Mean of Detected	-4.848
SD of Detected	0.95
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.426
5% Shapiro Wilk Critical Value	0.842

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.0114
SD	0.0257
95% DL/2 (t) UCL	0.0236

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.67
5% Shapiro Wilk Critical Value	0.842

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.436
SD	1.248
95% H-Stat (DL/2) UCL	0.021

Maximum Likelihood Estimate(MLE) Method	
Mean	0.00504
SD	0.0306
95% MLE (t) UCL	0.0195
95% MLE (Tiku) UCL	0.02

Log ROS Method	
Mean in Log Scale	-5.431
SD in Log Scale	1.262
Mean in Original Scale	0.0115
SD in Original Scale	0.0256
95% Percentile Bootstrap UCL	0.0251
95% BCA Bootstrap UCL	0.0322

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.666
Theta Star	0.0234
nu star	13.32
A-D Test Statistic	2.029
5% A-D Critical Value	0.753
K-S Test Statistic	0.753
5% K-S Critical Value	0.275

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.1
Mean	0.0113
Median	0.005
SD	0.0257
k star	0.199
Theta star	0.0569
Nu star	5.56
AppChi2	1.419
95% Gamma Approximate UCL	0.0443
95% Adjusted Gamma UCL	0.0541

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0123
SD	0.0244
SE of Mean	0.00687
95% KM (t) UCL	0.0245
95% KM (z) UCL	0.0236
95% KM (jackknife) UCL	0.0243
95% KM (bootstrap t) UCL	0.133
95% KM (BCA) UCL	0.0257
95% KM (Percentile Bootstrap) UCL	0.0257
95% KM (Chebyshev) UCL	0.0422
97.5% KM (Chebyshev) UCL	0.0552
99% KM (Chebyshev) UCL	0.0807

Potential UCLs to Use

95% KM (BCA) UCL	0.0257

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Z:\Projects\2009\1584-0901 TC Iqaluit Landfill\SSRA\COC tables\95UCL\sediment-pest-fresh.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aldrin

General Statistics

Number of Valid Data	18	Number of Detected Data	12
Number of Distinct Detected Data	4	Number of Non-Detect Data	6
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.004	Minimum Detected	-5.521
Maximum Detected	0.01	Maximum Detected	-4.605
Mean of Detected	0.00633	Mean of Detected	-5.103
SD of Detected	0.00187	SD of Detected	0.302
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.891	Shapiro Wilk Test Statistic	0.884
5% Shapiro Wilk Critical Value	0.859	5% Shapiro Wilk Critical Value	0.859
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00456	Mean	-5.705
SD	0.00299	SD	0.908
95% DL/2 (t) UCL	0.00578	95% H-Stat (DL/2) UCL	0.00638
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.00416	Mean in Log Scale	-5.348
SD	0.00355	SD in Log Scale	0.444
95% MLE (t) UCL	0.00562	Mean in Original Scale	0.00521
95% MLE (Tiku) UCL	0.00577	SD in Original Scale	0.00224
		95% Percentile Bootstrap UCL	0.00609
		95% BCA Bootstrap UCL	0.00611

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	9.338
Theta Star	0.0006783
nu star	224.1
A-D Test Statistic	0.674
5% A-D Critical Value	0.731
K-S Test Statistic	0.731
5% K-S Critical Value	0.245

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00306
Maximum	0.01
Mean	0.00588
Median	0.006
SD	0.00177
k star	9.881
Theta star	0.0005948
Nu star	355.7
AppChi2	313
95% Gamma Approximate UCL	0.00668
95% Adjusted Gamma UCL	0.00676

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00556
SD	0.00183
SE of Mean	0.0004511
95% KM (t) UCL	0.00634
95% KM (z) UCL	0.0063
95% KM (jackknife) UCL	0.00633
95% KM (bootstrap t) UCL	0.00644
95% KM (BCA) UCL	0.00633
95% KM (Percentile Bootstrap) UCL	0.00644
95% KM (Chebyshev) UCL	0.00752
97.5% KM (Chebyshev) UCL	0.00837
99% KM (Chebyshev) UCL	0.01

Potential UCLs to Use

95% KM (t) UCL	0.00634
95% KM (Percentile Bootstrap) UCL	0.00644

Chlordane

General Statistics

Number of Valid Data	17	Number of Detected Data	12
Number of Distinct Detected Data	4	Number of Non-Detect Data	5
Number of Missing Values	1	Percent Non-Detects	29.41%

Raw Statistics

Minimum Detected	0.004
Maximum Detected	0.01
Mean of Detected	0.00633
SD of Detected	0.00187
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics

Minimum Detected	-5.521
Maximum Detected	-4.605
Mean of Detected	-5.103
SD of Detected	0.302
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.891
5% Shapiro Wilk Critical Value	0.859

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	0.00476
SD	0.00295
95% DL/2 (t) UCL	0.00601

Maximum Likelihood Estimate(MLE) Method

Mean	0.00449
SD	0.00335
95% MLE (t) UCL	0.00591
95% MLE (Tiku) UCL	0.00603

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	9.338
Theta Star	0.0006783
nu star	224.1
A-D Test Statistic	0.674
5% A-D Critical Value	0.731
K-S Test Statistic	0.731
5% K-S Critical Value	0.245

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data

Minimum	0.00308
Maximum	0.01
Mean	0.00585
Median	0.006
SD	0.00182
k star	9.264
Theta star	0.000631
Nu star	315
AppChi2	274.8
95% Gamma Approximate UCL	0.0067
95% Adjusted Gamma UCL	0.0068

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.884
5% Shapiro Wilk Critical Value	0.859

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean	-5.634
SD	0.884
95% H-Stat (DL/2) UCL	0.00651

Log ROS Method

Mean in Log Scale	-5.314
SD in Log Scale	0.429
Mean in Original Scale	0.00535
SD in Original Scale	0.00222
95% Percentile Bootstrap UCL	0.00624
95% BCA Bootstrap UCL	0.0063

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.00565
SD	0.00185
SE of Mean	0.0004674
95% KM (t) UCL	0.00646
95% KM (z) UCL	0.00642
95% KM (jackknife) UCL	0.00645
95% KM (bootstrap t) UCL	0.00657
95% KM (BCA) UCL	0.00635
95% KM (Percentile Bootstrap) UCL	0.00659
95% KM (Chebyshev) UCL	0.00768
97.5% KM (Chebyshev) UCL	0.00857
99% KM (Chebyshev) UCL	0.0103

Potential UCLs to Use

95% KM (t) UCL	0.00646
95% KM (Percentile Bootstrap) UCL	0.00659

alpha-Chlordane

General Statistics

Number of Valid Data	17	Number of Detected Data	12
Number of Distinct Detected Data	4	Number of Non-Detect Data	5
Number of Missing Values	1	Percent Non-Detects	29.41%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.004	Minimum Detected	-5.521
Maximum Detected	0.01	Maximum Detected	-4.605
Mean of Detected	0.00633	Mean of Detected	-5.103
SD of Detected	0.00187	SD of Detected	0.302
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.891	Shapiro Wilk Test Statistic	0.884
5% Shapiro Wilk Critical Value	0.859	5% Shapiro Wilk Critical Value	0.859
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00476	Mean	-5.634
SD	0.00295	SD	0.884
95% DL/2 (t) UCL	0.00601	95% H-Stat (DL/2) UCL	0.00651
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.00449	Mean in Log Scale	-5.314
SD	0.00335	SD in Log Scale	0.429
95% MLE (t) UCL	0.00591	Mean in Original Scale	0.00535
95% MLE (Tiku) UCL	0.00603	SD in Original Scale	0.00222
		95% Percentile Bootstrap UCL	0.00623
		95% BCA Bootstrap UCL	0.00625

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	9.338	Data appear Normal at 5% Significance Level
Theta Star	0.0006783	
nu star	224.1	

A-D Test Statistic	0.674
5% A-D Critical Value	0.731
K-S Test Statistic	0.731
5% K-S Critical Value	0.245

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00308
Maximum	0.01
Mean	0.00585
Median	0.006
SD	0.00182
k star	9.264
Theta star	0.000631
Nu star	315
AppChi2	274.8
95% Gamma Approximate UCL	0.0067
95% Adjusted Gamma UCL	0.0068

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00565
SD	0.00185
SE of Mean	0.0004674
95% KM (t) UCL	0.00646
95% KM (z) UCL	0.00642
95% KM (jackknife) UCL	0.00645
95% KM (bootstrap t) UCL	0.00658
95% KM (BCA) UCL	0.00647
95% KM (Percentile Bootstrap) UCL	0.00659
95% KM (Chebyshev) UCL	0.00768
97.5% KM (Chebyshev) UCL	0.00857
99% KM (Chebyshev) UCL	0.0103

Potential UCLs to Use

95% KM (t) UCL	0.00646
95% KM (Percentile Bootstrap) UCL	0.00659

trans-Chlordane (gamma)

General Statistics

Number of Valid Data	18	Number of Detected Data	12
Number of Distinct Detected Data	4	Number of Non-Detect Data	6
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.004	Minimum Detected	-5.521
Maximum Detected	0.01	Maximum Detected	-4.605
Mean of Detected	0.00633	Mean of Detected	-5.103
SD of Detected	0.00187	SD of Detected	0.302
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.891	Shapiro Wilk Test Statistic	0.884
5% Shapiro Wilk Critical Value	0.859	5% Shapiro Wilk Critical Value	0.859

Data appear Normal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00456
SD	0.00299
95% DL/2 (t) UCL	0.00578
Maximum Likelihood Estimate(MLE) Method	
Mean	0.00416
SD	0.00355
95% MLE (t) UCL	0.00562
95% MLE (Tiku) UCL	0.00577

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.705
SD	0.908
95% H-Stat (DL/2) UCL	0.00638
Log ROS Method	
Mean in Log Scale	-5.348
SD in Log Scale	0.444
Mean in Original Scale	0.00521
SD in Original Scale	0.00224
95% Percentile Bootstrap UCL	0.00606
95% BCA Bootstrap UCL	0.00612

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	9.338
Theta Star	0.0006783
nu star	224.1
A-D Test Statistic	0.674
5% A-D Critical Value	0.731
K-S Test Statistic	0.731
5% K-S Critical Value	0.245

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00306
Maximum	0.01
Mean	0.00588
Median	0.006
SD	0.00177
k star	9.881
Theta star	0.0005948
Nu star	355.7
AppChi2	313
95% Gamma Approximate UCL	0.00668
95% Adjusted Gamma UCL	0.00676

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00556
SD	0.00183
SE of Mean	0.0004511
95% KM (t) UCL	0.00634
95% KM (z) UCL	0.0063
95% KM (jackknife) UCL	0.00633
95% KM (bootstrap t) UCL	0.00656
95% KM (BCA) UCL	0.00644
95% KM (Percentile Bootstrap) UCL	0.00644
95% KM (Chebyshev) UCL	0.00752
97.5% KM (Chebyshev) UCL	0.00837
99% KM (Chebyshev) UCL	0.01

Potential UCLs to Use

95% KM (t) UCL	0.00634
95% KM (Percentile Bootstrap) UCL	0.00644

2,4'-DDD

General Statistics

Number of Valid Data	18	Number of Detected Data	13
Number of Distinct Detected Data	8	Number of Non-Detect Data	5
		Percent Non-Detects	27.78%

Raw Statistics	
Minimum Detected	0.004
Maximum Detected	0.04
Mean of Detected	0.017
SD of Detected	0.0122
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics	
Minimum Detected	-5.521
Maximum Detected	-3.219
Mean of Detected	-4.356
SD of Detected	0.817
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.881
5% Shapiro Wilk Critical Value	0.866

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.909
5% Shapiro Wilk Critical Value	0.866

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.0126
SD	0.0126
95% DL/2 (t) UCL	0.0177
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0101
SD	0.0155
95% MLE (t) UCL	0.0165
95% MLE (Tiku) UCL	0.0168

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-5.065
SD	1.362
95% H-Stat (DL/2) UCL	0.0271
Log ROS Method	
Mean in Log Scale	-4.903
SD in Log Scale	1.161
Mean in Original Scale	0.0128
SD in Original Scale	0.0124
95% Percentile Bootstrap UCL	0.0175
95% BCA Bootstrap UCL	0.0179

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	1.535
Theta Star	0.0111
nu star	39.9
A-D Test Statistic	0.527
5% A-D Critical Value	0.744
K-S Test Statistic	0.744
5% K-S Critical Value	0.24

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.04
Mean	0.0137
Median	0.00854
SD	0.0118
k star	0.484
Theta star	0.0283
Nu star	17.42
AppChi2	8.973
95% Gamma Approximate UCL	0.0266
95% Adjusted Gamma UCL	0.0284

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data appear Normal at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.0134
SD	0.0115
SE of Mean	0.00283
95% KM (t) UCL	0.0183
95% KM (z) UCL	0.018
95% KM (jackknife) UCL	0.0183
95% KM (bootstrap t) UCL	0.0191
95% KM (BCA) UCL	0.0179
95% KM (Percentile Bootstrap) UCL	0.0184
95% KM (Chebyshev) UCL	0.0257
97.5% KM (Chebyshev) UCL	0.0311
99% KM (Chebyshev) UCL	0.0416

Potential UCLs to Use	
95% KM (t) UCL	0.0183
95% KM (Percentile Bootstrap) UCL	0.0184

4,4'-DDD

General Statistics

Number of Valid Data	18	Number of Detected Data	16
Number of Distinct Detected Data	12	Number of Non-Detect Data	2
		Percent Non-Detects	11.11%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.005	Minimum Detected	-5.298
Maximum Detected	0.22	Maximum Detected	-1.514
Mean of Detected	0.0564	Mean of Detected	-3.342
SD of Detected	0.0553	SD of Detected	1.064
Minimum Non-Detect	0.004	Minimum Non-Detect	-5.521
Maximum Non-Detect	0.004	Maximum Non-Detect	-5.521

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.806	Shapiro Wilk Test Statistic	0.964
5% Shapiro Wilk Critical Value	0.887	5% Shapiro Wilk Critical Value	0.887
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0503	Mean	-3.661
SD	0.0548	SD	1.364
95% DL/2 (t) UCL	0.0728	95% H-Stat (DL/2) UCL	0.106
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.0468	Mean in Log Scale	-3.62
SD	0.058	SD in Log Scale	1.288
95% MLE (t) UCL	0.0706	Mean in Original Scale	0.0504
95% MLE (Tiku) UCL	0.0698	SD in Original Scale	0.0547
		95% Percentile Bootstrap UCL	0.0732
		95% BCA Bootstrap UCL	0.0778

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	1.026	Data appear Gamma Distributed at 5% Significance Level
Theta Star	0.0549	
nu star	32.84	

A-D Test Statistic	0.294
5% A-D Critical Value	0.76
K-S Test Statistic	0.76
5% K-S Critical Value	0.22

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.22
Mean	0.0501
Median	0.034
SD	0.055
k star	0.289
Theta star	0.173
Nu star	10.4
AppChi2	4.192
95% Gamma Approximate UCL	0.124
95% Adjusted Gamma UCL	0.136

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0507
SD	0.053
SE of Mean	0.0129
95% KM (t) UCL	0.0731
95% KM (z) UCL	0.0719
95% KM (jackknife) UCL	0.0728
95% KM (bootstrap t) UCL	0.0829
95% KM (BCA) UCL	0.0729
95% KM (Percentile Bootstrap) UCL	0.0724
95% KM (Chebyshev) UCL	0.107
97.5% KM (Chebyshev) UCL	0.131
99% KM (Chebyshev) UCL	0.179

Potential UCLs to Use

95% KM (BCA) UCL	0.0729

Total DDD

General Statistics

Number of Valid Data	17	Number of Detected Data	15
Number of Distinct Detected Data	12	Number of Non-Detect Data	2
Number of Missing Values	1	Percent Non-Detects	11.76%

Raw Statistics

Minimum Detected	0.005
Maximum Detected	0.26
Mean of Detected	0.068
SD of Detected	0.067
Minimum Non-Detect	0.004
Maximum Non-Detect	0.004

Log-transformed Statistics

Minimum Detected	-5.298
Maximum Detected	-1.347
Mean of Detected	-3.189
SD of Detected	1.136
Minimum Non-Detect	-5.521
Maximum Non-Detect	-5.521

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.815
5% Shapiro Wilk Critical Value	0.881

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.0602
SD	0.0664
95% DL/2 (t) UCL	0.0883
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0556
SD	0.0706
95% MLE (t) UCL	0.0855
95% MLE (Tiku) UCL	0.0846

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.953
5% Shapiro Wilk Critical Value	0.881

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-3.545
SD	1.463
95% H-Stat (DL/2) UCL	0.154
Log ROS Method	
Mean in Log Scale	-3.501
SD in Log Scale	1.383
Mean in Original Scale	0.0604
SD in Original Scale	0.0663
95% Percentile Bootstrap UCL	0.0892
95% BCA Bootstrap UCL	0.0918

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.953
Theta Star	0.0713
nu star	28.59
A-D Test Statistic	0.263
5% A-D Critical Value	0.761
K-S Test Statistic	0.761
5% K-S Critical Value	0.227

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.26
Mean	0.06
Median	0.041
SD	0.0666
k star	0.274
Theta star	0.219
Nu star	9.317
AppChi2	3.519
95% Gamma Approximate UCL	0.159
95% Adjusted Gamma UCL	0.177

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.0606
SD	0.0641
SE of Mean	0.0161
95% KM (t) UCL	0.0887
95% KM (z) UCL	0.0871
95% KM (jackknife) UCL	0.0883
95% KM (bootstrap t) UCL	0.104
95% KM (BCA) UCL	0.095
95% KM (Percentile Bootstrap) UCL	0.0872
95% KM (Chebyshev) UCL	0.131
97.5% KM (Chebyshev) UCL	0.161
99% KM (Chebyshev) UCL	0.221

Potential UCLs to Use	
95% KM (Chebyshev) UCL	0.131

2,4'-DDE

General Statistics

Number of Valid Data	18	Number of Detected Data	12
Number of Distinct Detected Data	4	Number of Non-Detect Data	6
		Percent Non-Detects	33.33%

Raw Statistics	
Minimum Detected	0.004
Maximum Detected	0.01
Mean of Detected	0.00633
SD of Detected	0.00187
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics	
Minimum Detected	-5.521
Maximum Detected	-4.605
Mean of Detected	-5.103
SD of Detected	0.302
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.891
5% Shapiro Wilk Critical Value	0.859

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00456
SD	0.00299
95% DL/2 (t) UCL	0.00578
Maximum Likelihood Estimate(MLE) Method	
Mean	0.00416
SD	0.00355
95% MLE (t) UCL	0.00562
95% MLE (Tiku) UCL	0.00577

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	9.338
Theta Star	0.0006783
nu star	224.1
A-D Test Statistic	0.674
5% A-D Critical Value	0.731
K-S Test Statistic	0.731
5% K-S Critical Value	0.245

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00306
Maximum	0.01
Mean	0.00588
Median	0.006
SD	0.00177
k star	9.881
Theta star	0.0005948
Nu star	355.7
AppChi2	313
95% Gamma Approximate UCL	0.00668
95% Adjusted Gamma UCL	0.00676

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.884
5% Shapiro Wilk Critical Value	0.859

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.705
SD	0.908
95% H-Stat (DL/2) UCL	0.00638
Log ROS Method	
Mean in Log Scale	-5.348
SD in Log Scale	0.444
Mean in Original Scale	0.00521
SD in Original Scale	0.00224
95% Percentile Bootstrap UCL	0.00612
95% BCA Bootstrap UCL	0.00611

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00556
SD	0.00183
SE of Mean	0.0004511
95% KM (t) UCL	0.00634
95% KM (z) UCL	0.0063
95% KM (jackknife) UCL	0.00633
95% KM (bootstrap t) UCL	0.00644
95% KM (BCA) UCL	0.00633
95% KM (Percentile Bootstrap) UCL	0.00644
95% KM (Chebyshev) UCL	0.00752
97.5% KM (Chebyshev) UCL	0.00837
99% KM (Chebyshev) UCL	0.01

Potential UCLs to Use

95% KM (t) UCL	0.00634
95% KM (Percentile Bootstrap) UCL	0.00644

4,4'-DDE

General Statistics

Number of Valid Data	18	Number of Detected Data	15
Number of Distinct Detected Data	10	Number of Non-Detect Data	3
		Percent Non-Detects	16.67%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.004	Minimum Detected	-5.521
Maximum Detected	0.055	Maximum Detected	-2.9
Mean of Detected	0.0195	Mean of Detected	-4.212
SD of Detected	0.0145	SD of Detected	0.805
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.889	Shapiro Wilk Test Statistic	0.956
5% Shapiro Wilk Critical Value	0.881	5% Shapiro Wilk Critical Value	0.881
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.0164	Mean	-4.662
SD	0.015	SD	1.266
95% DL/2 (t) UCL	0.0226	95% H-Stat (DL/2) UCL	0.0286
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.015	Mean in Log Scale	-4.528
SD	0.0166	SD in Log Scale	1.035
95% MLE (t) UCL	0.0218	Mean in Original Scale	0.0167
95% MLE (Tiku) UCL	0.0219	SD in Original Scale	0.0147
		95% Percentile Bootstrap UCL	0.0225
		95% BCA Bootstrap UCL	0.0235

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	1.609	Data appear Normal at 5% Significance Level
Theta Star	0.0121	
nu star	48.28	

A-D Test Statistic	0.267
5% A-D Critical Value	0.747
K-S Test Statistic	0.747
5% K-S Critical Value	0.224

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.055
Mean	0.0165
Median	0.012
SD	0.0149
k star	0.429
Theta star	0.0384
Nu star	15.46
AppChi2	7.581
95% Gamma Approximate UCL	0.0336
95% Adjusted Gamma UCL	0.0361

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0169
SD	0.014
SE of Mean	0.00343
95% KM (t) UCL	0.0229
95% KM (z) UCL	0.0226
95% KM (jackknife) UCL	0.0229
95% KM (bootstrap t) UCL	0.0243
95% KM (BCA) UCL	0.0224
95% KM (Percentile Bootstrap) UCL	0.0224
95% KM (Chebyshev) UCL	0.0319
97.5% KM (Chebyshev) UCL	0.0383
99% KM (Chebyshev) UCL	0.051

Potential UCLs to Use

95% KM (t) UCL	0.0229
95% KM (Percentile Bootstrap) UCL	0.0224

Total DDE

General Statistics

Number of Valid Data	17	Number of Detected Data	14
Number of Distinct Detected Data	9	Number of Non-Detect Data	3
Number of Missing Values	1	Percent Non-Detects	17.65%

Raw Statistics

Minimum Detected	0.004
Maximum Detected	0.055
Mean of Detected	0.0189
SD of Detected	0.0148
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics

Minimum Detected	-5.521
Maximum Detected	-2.9
Mean of Detected	-4.26
SD of Detected	0.813
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.865
5% Shapiro Wilk Critical Value	0.874

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.959
5% Shapiro Wilk Critical Value	0.874

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.0157
SD	0.0151
95% DL/2 (t) UCL	0.0221
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0141
SD	0.0168
95% MLE (t) UCL	0.0213
95% MLE (Tiku) UCL	0.0213

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-4.728
SD	1.272
95% H-Stat (DL/2) UCL	0.028
Log ROS Method	
Mean in Log Scale	-4.601
SD in Log Scale	1.061
Mean in Original Scale	0.0159
SD in Original Scale	0.0149
95% Percentile Bootstrap UCL	0.0222
95% BCA Bootstrap UCL	0.023

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	1.522
Theta Star	0.0124
nu star	42.6
A-D Test Statistic	0.286
5% A-D Critical Value	0.747
K-S Test Statistic	0.747
5% K-S Critical Value	0.232

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.055
Mean	0.0157
Median	0.012
SD	0.0151
k star	0.399
Theta star	0.0394
Nu star	13.58
AppChi2	6.282
95% Gamma Approximate UCL	0.034
95% Adjusted Gamma UCL	0.037

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.0162
SD	0.0141
SE of Mean	0.00356
95% KM (t) UCL	0.0224
95% KM (z) UCL	0.0221
95% KM (jackknife) UCL	0.0224
95% KM (bootstrap t) UCL	0.0247
95% KM (BCA) UCL	0.0228
95% KM (Percentile Bootstrap) UCL	0.0224
95% KM (Chebyshev) UCL	0.0317
97.5% KM (Chebyshev) UCL	0.0385
99% KM (Chebyshev) UCL	0.0516
Potential UCLs to Use	
95% KM (BCA) UCL	0.0228

2,4'-DDT

General Statistics

Number of Valid Data	18	Number of Detected Data	13
Number of Distinct Detected Data	8	Number of Non-Detect Data	5
		Percent Non-Detects	27.78%

Raw Statistics	
Minimum Detected	0.003
Maximum Detected	0.036
Mean of Detected	0.0128
SD of Detected	0.00935
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics	
Minimum Detected	-5.809
Maximum Detected	-3.324
Mean of Detected	-4.593
SD of Detected	0.726
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.849
5% Shapiro Wilk Critical Value	0.866

Data not Normal at 5% Significance Level

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.00956
SD	0.00957
95% DL/2 (t) UCL	0.0135

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.936
5% Shapiro Wilk Critical Value	0.866

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-5.236
SD	1.229
95% H-Stat (DL/2) UCL	0.0186

Maximum Likelihood Estimate(MLE) Method	
Mean	0.00775
SD	0.0117
95% MLE (t) UCL	0.0125
95% MLE (Tiku) UCL	0.0128

Log ROS Method	
Mean in Log Scale	-5.082
SD in Log Scale	1.036
Mean in Original Scale	0.00979
SD in Original Scale	0.00936
95% Percentile Bootstrap UCL	0.0134
95% BCA Bootstrap UCL	0.0142

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.785
Theta Star	0.0072
nu star	46.4
A-D Test Statistic	0.536
5% A-D Critical Value	0.742
K-S Test Statistic	0.742
5% K-S Critical Value	0.239

Data follow Appr. Gamma Distribution at 5% Significance Level

Data Distribution Test with Detected Values Only

Data Follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.036
Mean	0.0105
Median	0.00635
SD	0.00894
k star	0.509
Theta star	0.0206
Nu star	18.34
AppChi2	9.636
95% Gamma Approximate UCL	0.02
95% Adjusted Gamma UCL	0.0213

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0101
SD	0.00882
SE of Mean	0.00216
95% KM (t) UCL	0.0139
95% KM (z) UCL	0.0137
95% KM (jackknife) UCL	0.0136
95% KM (bootstrap t) UCL	0.0145
95% KM (BCA) UCL	0.0143
95% KM (Percentile Bootstrap) UCL	0.0141
95% KM (Chebyshev) UCL	0.0195
97.5% KM (Chebyshev) UCL	0.0236
99% KM (Chebyshev) UCL	0.0316

Potential UCLs to Use

95% KM (Percentile Bootstrap) UCL	0.0141

4,4'-DDT

General Statistics

Number of Valid Data	18	Number of Detected Data	15
Number of Distinct Detected Data	11	Number of Non-Detect Data	3
		Percent Non-Detects	16.67%

Raw Statistics

Minimum Detected	0.013
Maximum Detected	0.25
Mean of Detected	0.0669
SD of Detected	0.0645
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics

Minimum Detected	-4.343
Maximum Detected	-1.386
Mean of Detected	-3.055
SD of Detected	0.846
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.767
5% Shapiro Wilk Critical Value	0.881

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.965
5% Shapiro Wilk Critical Value	0.881

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.0559
SD	0.0638
95% DL/2 (t) UCL	0.0821
Maximum Likelihood Estimate(MLE) Method	
Mean	0.049
SD	0.0711
95% MLE (t) UCL	0.0781
95% MLE (Tiku) UCL	0.0779

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-3.697
SD	1.665
95% H-Stat (DL/2) UCL	0.228
Log ROS Method	
Mean in Log Scale	-3.391
SD in Log Scale	1.097
Mean in Original Scale	0.0568
SD in Original Scale	0.063
95% Percentile Bootstrap UCL	0.0832
95% BCA Bootstrap UCL	0.0909

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.304
Theta Star	0.0513
nu star	39.12
A-D Test Statistic	0.462
5% A-D Critical Value	0.753
K-S Test Statistic	0.753
5% K-S Critical Value	0.225

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.25
Mean	0.0559
Median	0.04
SD	0.0638
k star	0.288
Theta star	0.194
Nu star	10.36
AppChi2	4.165
95% Gamma Approximate UCL	0.139
95% Adjusted Gamma UCL	0.153

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.0579
SD	0.0603
SE of Mean	0.0147
95% KM (t) UCL	0.0835
95% KM (z) UCL	0.0821
95% KM (jackknife) UCL	0.0829
95% KM (bootstrap t) UCL	0.101
95% KM (BCA) UCL	0.0843
95% KM (Percentile Bootstrap) UCL	0.0831
95% KM (Chebyshev) UCL	0.122
97.5% KM (Chebyshev) UCL	0.15
99% KM (Chebyshev) UCL	0.204

Potential UCLs to Use

95% KM (BCA) UCL	0.0843

DDT plus metabolites

General Statistics

Number of Valid Data	17	Number of Detected Data	15
Number of Distinct Detected Data	11	Number of Non-Detect Data	2
Number of Missing Values	1	Percent Non-Detects	11.76%

Raw Statistics

Minimum Detected	0.015
Maximum Detected	0.58
Mean of Detected	0.13
SD of Detected	0.137
Minimum Non-Detect	0.004
Maximum Non-Detect	0.004

Log-transformed Statistics

Minimum Detected	-4.2
Maximum Detected	-0.545
Mean of Detected	-2.391
SD of Detected	0.855
Minimum Non-Detect	-5.521
Maximum Non-Detect	-5.521

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.669	Shapiro Wilk Test Statistic	0.972
5% Shapiro Wilk Critical Value	0.881	5% Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.115	Mean	-2.841
SD	0.135	SD	1.501
95% DL/2 (t) UCL	0.172	95% H-Stat (DL/2) UCL	0.316
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.105	Mean in Log Scale	-2.624
SD	0.144	SD in Log Scale	1.038
95% MLE (t) UCL	0.166	Mean in Original Scale	0.116
95% MLE (Tiku) UCL	0.164	SD in Original Scale	0.134
		95% Percentile Bootstrap UCL	0.173
		95% BCA Bootstrap UCL	0.199

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.297	Data appear Gamma Distributed at 5% Significance Level	
Theta Star	0.1		
nu star	38.92		
A-D Test Statistic	0.465	**Nonparametric Statistics**	
5% A-D Critical Value	0.753	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.753	Mean	0.117
5% K-S Critical Value	0.225	SD	0.13
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	0.0326
		95% KM (t) UCL	0.174
Assuming Gamma Distribution		95% KM (z) UCL	0.17
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.172
Minimum	1E-09	95% KM (bootstrap t) UCL	0.228
Maximum	0.58	95% KM (BCA) UCL	0.177
Mean	0.115	95% KM (Percentile Bootstrap) UCL	0.176
Median	0.07	95% KM (Chebyshev) UCL	0.259
SD	0.135	97.5% KM (Chebyshev) UCL	0.32
k star	0.279	99% KM (Chebyshev) UCL	0.441
Theta star	0.412		
Nu star	9.475	Potential UCLs to Use	
AppChi2	3.616	95% KM (BCA) UCL	0.177
95% Gamma Approximate UCL	0.301		
95% Adjusted Gamma UCL	0.335		

Note: DL/2 is not a recommended method.

Total DDT

General Statistics

Number of Valid Data	17	Number of Detected Data	14
Number of Distinct Detected Data	10	Number of Non-Detect Data	3
Number of Missing Values	1	Percent Non-Detects	17.65%

Raw Statistics	
Minimum Detected	0.013
Maximum Detected	0.26
Mean of Detected	0.0744
SD of Detected	0.0721
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics	
Minimum Detected	-4.343
Maximum Detected	-1.347
Mean of Detected	-2.957
SD of Detected	0.861
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.762
5% Shapiro Wilk Critical Value	0.874

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.968
5% Shapiro Wilk Critical Value	0.874

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.0614
SD	0.0711
95% DL/2 (t) UCL	0.0915
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0531
SD	0.0798
95% MLE (t) UCL	0.0869
95% MLE (Tiku) UCL	0.0867

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-3.654
SD	1.735
95% H-Stat (DL/2) UCL	0.304
Log ROS Method	
Mean in Log Scale	-3.32
SD in Log Scale	1.127
Mean in Original Scale	0.0625
SD in Original Scale	0.0702
95% Percentile Bootstrap UCL	0.0923
95% BCA Bootstrap UCL	0.1

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	1.258
Theta Star	0.0591
nu star	35.23
A-D Test Statistic	0.474
5% A-D Critical Value	0.75
K-S Test Statistic	0.75
5% K-S Critical Value	0.233

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.26
Mean	0.0615
Median	0.04
SD	0.071
k star	0.277
Theta star	0.222
Nu star	9.428
AppChi2	3.588
95% Gamma Approximate UCL	0.162
95% Adjusted Gamma UCL	0.18

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.0635
SD	0.0673
SE of Mean	0.0169
95% KM (t) UCL	0.0931
95% KM (z) UCL	0.0914
95% KM (jackknife) UCL	0.0921
95% KM (bootstrap t) UCL	0.124
95% KM (BCA) UCL	0.0948
95% KM (Percentile Bootstrap) UCL	0.0927
95% KM (Chebyshev) UCL	0.137
97.5% KM (Chebyshev) UCL	0.169
99% KM (Chebyshev) UCL	0.232

Potential UCLs to Use	
95% KM (BCA) UCL	0.0948

Dieldrin

General Statistics

Number of Valid Data	18	Number of Detected Data	12
Number of Distinct Detected Data	5	Number of Non-Detect Data	6
		Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.004	Minimum Detected	-5.521
Maximum Detected	0.02	Maximum Detected	-3.912
Mean of Detected	0.00883	Mean of Detected	-4.874
SD of Detected	0.00556	SD of Detected	0.533
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.738	Shapiro Wilk Test Statistic	0.864
5% Shapiro Wilk Critical Value	0.859	5% Shapiro Wilk Critical Value	0.859
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00622	Mean	-5.552
SD	0.00587	SD	1.076
95% DL/2 (t) UCL	0.00863	95% H-Stat (DL/2) UCL	0.00961
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.00489	Mean in Log Scale	-5.315
SD	0.00743	SD in Log Scale	0.795
95% MLE (t) UCL	0.00794	Mean in Original Scale	0.0066
95% MLE (Tiku) UCL	0.00818	SD in Original Scale	0.00554
		95% Percentile Bootstrap UCL	0.00877
		95% BCA Bootstrap UCL	0.00934

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	2.768	Data appear Lognormal at 5% Significance Level	
Theta Star	0.00319		
nu star	66.43		
A-D Test Statistic	0.947	Nonparametric Statistics	
5% A-D Critical Value	0.737	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.737	Mean	0.00722
5% K-S Critical Value	0.247	SD	0.00491
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.00121
		95% KM (t) UCL	0.00932
Assuming Gamma Distribution		95% KM (z) UCL	0.00921
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.00929
Minimum	0.00102	95% KM (bootstrap t) UCL	0.0113
Maximum	0.02	95% KM (BCA) UCL	0.00967
Mean	0.00763	95% KM (Percentile Bootstrap) UCL	0.00944
Median	0.006	95% KM (Chebyshev) UCL	0.0125
SD	0.00503	97.5% KM (Chebyshev) UCL	0.0148
k star	2.367	99% KM (Chebyshev) UCL	0.0192
Theta star	0.00322		
Nu star	85.22	Potential UCLs to Use	
AppChi2	64.94	95% KM (BCA) UCL	0.00967
95% Gamma Approximate UCL	0.01		
95% Adjusted Gamma UCL	0.0103		

Note: DL/2 is not a recommended method.

Endosulfan

General Statistics

Number of Valid Data	17	Number of Detected Data	12
Number of Distinct Detected Data	4	Number of Non-Detect Data	5
Number of Missing Values	1	Percent Non-Detects	29.41%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.004	Minimum Detected	-5.521
Maximum Detected	0.01	Maximum Detected	-4.605
Mean of Detected	0.0065	Mean of Detected	-5.069
SD of Detected	0.00173	SD of Detected	0.272
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.884	Shapiro Wilk Test Statistic	0.88
5% Shapiro Wilk Critical Value	0.859	5% Shapiro Wilk Critical Value	0.859
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00488	Mean	-5.61
SD	0.00296	SD	0.892
95% DL/2 (t) UCL	0.00613	95% H-Stat (DL/2) UCL	0.00678
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.00461	Mean in Log Scale	-5.256
SD	0.00335	SD in Log Scale	0.381
95% MLE (t) UCL	0.00603	Mean in Original Scale	0.00558
95% MLE (Tiku) UCL	0.00616	SD in Original Scale	0.00207
		95% Percentile Bootstrap UCL	0.00634
		95% BCA Bootstrap UCL	0.00643

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	11.5	Data appear Normal at 5% Significance Level
Theta Star	0.0005653	
nu star	275.9	

A-D Test Statistic	0.784
5% A-D Critical Value	0.731
K-S Test Statistic	0.731
5% K-S Critical Value	0.245

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00354
Maximum	0.01
Mean	0.00606
Median	0.006
SD	0.00168
k star	11.82
Theta star	0.0005128
Nu star	401.7
AppChi2	356.3
95% Gamma Approximate UCL	0.00683
95% Adjusted Gamma UCL	0.00692

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00576
SD	0.0018
SE of Mean	0.0004559
95% KM (t) UCL	0.00656
95% KM (z) UCL	0.00651
95% KM (jackknife) UCL	0.00655
95% KM (bootstrap t) UCL	0.00666
95% KM (BCA) UCL	0.00671
95% KM (Percentile Bootstrap) UCL	0.00682
95% KM (Chebyshev) UCL	0.00775
97.5% KM (Chebyshev) UCL	0.00861
99% KM (Chebyshev) UCL	0.0103

Potential UCLs to Use

95% KM (t) UCL	0.00656
95% KM (Percentile Bootstrap) UCL	0.00682

alpha-Endosulfan

General Statistics

Number of Valid Data	17	Number of Detected Data	12
Number of Distinct Detected Data	4	Number of Non-Detect Data	5
Number of Missing Values	1	Percent Non-Detects	29.41%

Raw Statistics

Minimum Detected	0.004
Maximum Detected	0.01
Mean of Detected	0.00633
SD of Detected	0.00187
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics

Minimum Detected	-5.521
Maximum Detected	-4.605
Mean of Detected	-5.103
SD of Detected	0.302
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.891
5% Shapiro Wilk Critical Value	0.859

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00476
SD	0.00295
95% DL/2 (t) UCL	0.00601

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.884
5% Shapiro Wilk Critical Value	0.859

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.634
SD	0.884
95% H-Stat (DL/2) UCL	0.00651

Maximum Likelihood Estimate(MLE) Method	
Mean	0.00449
SD	0.00335
95% MLE (t) UCL	0.00591
95% MLE (Tiku) UCL	0.00603

Log ROS Method	
Mean in Log Scale	-5.314
SD in Log Scale	0.429
Mean in Original Scale	0.00535
SD in Original Scale	0.00222
95% Percentile Bootstrap UCL	0.00623
95% BCA Bootstrap UCL	0.00625

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	9.338
Theta Star	0.0006783
nu star	224.1
A-D Test Statistic	0.674
5% A-D Critical Value	0.731
K-S Test Statistic	0.731
5% K-S Critical Value	0.245

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00308
Maximum	0.01
Mean	0.00585
Median	0.006
SD	0.00182
k star	9.264
Theta star	0.000631
Nu star	315
AppChi2	274.8
95% Gamma Approximate UCL	0.0067
95% Adjusted Gamma UCL	0.0068

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00565
SD	0.00185
SE of Mean	0.0004674
95% KM (t) UCL	0.00646
95% KM (z) UCL	0.00642
95% KM (jackknife) UCL	0.00645
95% KM (bootstrap t) UCL	0.00655
95% KM (BCA) UCL	0.00647
95% KM (Percentile Bootstrap) UCL	0.00647
95% KM (Chebyshev) UCL	0.00768
97.5% KM (Chebyshev) UCL	0.00857
99% KM (Chebyshev) UCL	0.0103

Potential UCLs to Use

95% KM (t) UCL	0.00646
95% KM (Percentile Bootstrap) UCL	0.00647

beta-Endosulfan

General Statistics

Number of Valid Data	17	Number of Detected Data	12
Number of Distinct Detected Data	4	Number of Non-Detect Data	5
Number of Missing Values	1	Percent Non-Detects	29.41%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.004	Minimum Detected	-5.521
Maximum Detected	0.01	Maximum Detected	-4.605
Mean of Detected	0.0065	Mean of Detected	-5.069
SD of Detected	0.00173	SD of Detected	0.272
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.884
5% Shapiro Wilk Critical Value	0.859

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.88
5% Shapiro Wilk Critical Value	0.859

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00488
SD	0.00296
95% DL/2 (t) UCL	0.00613
Maximum Likelihood Estimate(MLE) Method	
Mean	0.00461
SD	0.00335
95% MLE (t) UCL	0.00603
95% MLE (Tiku) UCL	0.00616

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.61
SD	0.892
95% H-Stat (DL/2) UCL	0.00678
Log ROS Method	
Mean in Log Scale	-5.256
SD in Log Scale	0.381
Mean in Original Scale	0.00558
SD in Original Scale	0.00207
95% Percentile Bootstrap UCL	0.00637
95% BCA Bootstrap UCL	0.00646

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	11.5
Theta Star	0.0005653
nu star	275.9
A-D Test Statistic	0.784
5% A-D Critical Value	0.731
K-S Test Statistic	0.731
5% K-S Critical Value	0.245

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00354
Maximum	0.01
Mean	0.00606
Median	0.006
SD	0.00168
k star	11.82
Theta star	0.0005128
Nu star	401.7
AppChi2	356.3
95% Gamma Approximate UCL	0.00683
95% Adjusted Gamma UCL	0.00692

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00576
SD	0.0018
SE of Mean	0.0004559
95% KM (t) UCL	0.00656
95% KM (z) UCL	0.00651
95% KM (jackknife) UCL	0.00655
95% KM (bootstrap t) UCL	0.00664
95% KM (BCA) UCL	0.00671
95% KM (Percentile Bootstrap) UCL	0.00682
95% KM (Chebyshev) UCL	0.00775
97.5% KM (Chebyshev) UCL	0.00861
99% KM (Chebyshev) UCL	0.0103

Potential UCLs to Use

95% KM (t) UCL	0.00656
95% KM (Percentile Bootstrap) UCL	0.00682

Endrin

General Statistics

Number of Valid Data	18	Number of Detected Data	13
Number of Distinct Detected Data	6	Number of Non-Detect Data	5
		Percent Non-Detects	27.78%

Raw Statistics	
Minimum Detected	0.004
Maximum Detected	0.06
Mean of Detected	0.0142
SD of Detected	0.0204
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics	
Minimum Detected	-5.521
Maximum Detected	-2.813
Mean of Detected	-4.808
SD of Detected	0.924
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.513
5% Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level	

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.687
5% Shapiro Wilk Critical Value	0.866
Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.0106
SD	0.0182
95% DL/2 (t) UCL	0.018
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0064
SD	0.0219
95% MLE (t) UCL	0.0154
95% MLE (Tiku) UCL	0.0156

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-5.391
SD	1.241
95% H-Stat (DL/2) UCL	0.0155
Log ROS Method	
Mean in Log Scale	-5.37
SD in Log Scale	1.235
Mean in Original Scale	0.0106
SD in Original Scale	0.0182
95% Percentile Bootstrap UCL	0.0171
95% BCA Bootstrap UCL	0.0203

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.847
Theta Star	0.0168
nu star	22.03
A-D Test Statistic	2.401
5% A-D Critical Value	0.757
K-S Test Statistic	0.757
5% K-S Critical Value	0.243
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	0.06
Mean	0.0107
Median	0.0055
SD	0.0182
k star	0.234
Theta star	0.0455
Nu star	8.434
AppChi2	2.989
95% Gamma Approximate UCL	0.0301
95% Adjusted Gamma UCL	0.0334

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.0114
SD	0.0173
SE of Mean	0.00423
95% KM (t) UCL	0.0188
95% KM (z) UCL	0.0184
95% KM (jackknife) UCL	0.0187
95% KM (bootstrap t) UCL	0.0769
95% KM (BCA) UCL	0.0181
95% KM (Percentile Bootstrap) UCL	0.018
95% KM (Chebyshev) UCL	0.0298
97.5% KM (Chebyshev) UCL	0.0378
99% KM (Chebyshev) UCL	0.0535
Potential UCLs to Use	
95% KM (BCA) UCL	0.0181

gamma-HCH

General Statistics

Number of Valid Data	17	Number of Detected Data	12
Number of Distinct Detected Data	4	Number of Non-Detect Data	5
Number of Missing Values	1	Percent Non-Detects	29.41%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.004	Minimum Detected	-5.521
Maximum Detected	0.01	Maximum Detected	-4.605
Mean of Detected	0.00633	Mean of Detected	-5.103
SD of Detected	0.00187	SD of Detected	0.302
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.891	Shapiro Wilk Test Statistic	0.884
5% Shapiro Wilk Critical Value	0.859	5% Shapiro Wilk Critical Value	0.859
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.00476	Mean	-5.634
SD	0.00295	SD	0.884
95% DL/2 (t) UCL	0.00601	95% H-Stat (DL/2) UCL	0.00651
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.00449	Mean in Log Scale	-5.314
SD	0.00335	SD in Log Scale	0.429
95% MLE (t) UCL	0.00591	Mean in Original Scale	0.00535
95% MLE (Tiku) UCL	0.00603	SD in Original Scale	0.00222
		95% Percentile Bootstrap UCL	0.00624
		95% BCA Bootstrap UCL	0.00631

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	9.338	Data appear Normal at 5% Significance Level
Theta Star	0.0006783	
nu star	224.1	

A-D Test Statistic	0.674
5% A-D Critical Value	0.731
K-S Test Statistic	0.731
5% K-S Critical Value	0.245

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00308
Maximum	0.01
Mean	0.00585
Median	0.006
SD	0.00182
k star	9.264
Theta star	0.000631
Nu star	315
AppChi2	274.8
95% Gamma Approximate UCL	0.0067
95% Adjusted Gamma UCL	0.0068

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00565
SD	0.00185
SE of Mean	0.0004674
95% KM (t) UCL	0.00646
95% KM (z) UCL	0.00642
95% KM (jackknife) UCL	0.00645
95% KM (bootstrap t) UCL	0.00658
95% KM (BCA) UCL	0.00635
95% KM (Percentile Bootstrap) UCL	0.00659
95% KM (Chebyshev) UCL	0.00768
97.5% KM (Chebyshev) UCL	0.00857
99% KM (Chebyshev) UCL	0.0103

Potential UCLs to Use

95% KM (t) UCL	0.00646
95% KM (Percentile Bootstrap) UCL	0.00659

Heptachlor

General Statistics

Number of Valid Data	18	Number of Detected Data	12
Number of Distinct Detected Data	4	Number of Non-Detect Data	6
		Percent Non-Detects	33.33%

Raw Statistics

Minimum Detected	0.004
Maximum Detected	0.01
Mean of Detected	0.00633
SD of Detected	0.00187
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics

Minimum Detected	-5.521
Maximum Detected	-4.605
Mean of Detected	-5.103
SD of Detected	0.302
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.891
5% Shapiro Wilk Critical Value	0.859

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00456
SD	0.00299
95% DL/2 (t) UCL	0.00578

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.884
5% Shapiro Wilk Critical Value	0.859

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.705
SD	0.908
95% H-Stat (DL/2) UCL	0.00638

Maximum Likelihood Estimate(MLE) Method	
Mean	0.00416
SD	0.00355
95% MLE (t) UCL	0.00562
95% MLE (Tiku) UCL	0.00577

Log ROS Method	
Mean in Log Scale	-5.348
SD in Log Scale	0.444
Mean in Original Scale	0.00521
SD in Original Scale	0.00224
95% Percentile Bootstrap UCL	0.00607
95% BCA Bootstrap UCL	0.00615

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	9.338
Theta Star	0.0006783
nu star	224.1
A-D Test Statistic	0.674
5% A-D Critical Value	0.731
K-S Test Statistic	0.731
5% K-S Critical Value	0.245

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00306
Maximum	0.01
Mean	0.00588
Median	0.006
SD	0.00177
k star	9.881
Theta star	0.0005948
Nu star	355.7
AppChi2	313
95% Gamma Approximate UCL	0.00668
95% Adjusted Gamma UCL	0.00676

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00556
SD	0.00183
SE of Mean	0.0004511
95% KM (t) UCL	0.00634
95% KM (z) UCL	0.0063
95% KM (jackknife) UCL	0.00633
95% KM (bootstrap t) UCL	0.00644
95% KM (BCA) UCL	0.00633
95% KM (Percentile Bootstrap) UCL	0.00644
95% KM (Chebyshev) UCL	0.00752
97.5% KM (Chebyshev) UCL	0.00837
99% KM (Chebyshev) UCL	0.01

Potential UCLs to Use

95% KM (t) UCL	0.00634
95% KM (Percentile Bootstrap) UCL	0.00644

Heptachlor Epoxide

General Statistics

Number of Valid Data	18
Number of Distinct Detected Data	4
Number of Detected Data	12
Number of Non-Detect Data	6
Percent Non-Detects	33.33%

Raw Statistics

Minimum Detected	0.004
Maximum Detected	0.01
Mean of Detected	0.00633
SD of Detected	0.00187
Minimum Non-Detect	0.002
Maximum Non-Detect	0.002

Log-transformed Statistics

Minimum Detected	-5.521
Maximum Detected	-4.605
Mean of Detected	-5.103
SD of Detected	0.302
Minimum Non-Detect	-6.215
Maximum Non-Detect	-6.215

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.891
5% Shapiro Wilk Critical Value	0.859

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.884
5% Shapiro Wilk Critical Value	0.859

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00456
SD	0.00299
95% DL/2 (t) UCL	0.00578
Maximum Likelihood Estimate(MLE) Method	
Mean	0.00416
SD	0.00355
95% MLE (t) UCL	0.00562
95% MLE (Tiku) UCL	0.00577

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.705
SD	0.908
95% H-Stat (DL/2) UCL	0.00638
Log ROS Method	
Mean in Log Scale	-5.348
SD in Log Scale	0.444
Mean in Original Scale	0.00521
SD in Original Scale	0.00224
95% Percentile Bootstrap UCL	0.00611
95% BCA Bootstrap UCL	0.00612

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	9.338
Theta Star	0.0006783
nu star	224.1
A-D Test Statistic	0.674
5% A-D Critical Value	0.731
K-S Test Statistic	0.731
5% K-S Critical Value	0.245

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00306
Maximum	0.01
Mean	0.00588
Median	0.006
SD	0.00177
k star	9.881
Theta star	0.0005948
Nu star	355.7
AppChi2	313
95% Gamma Approximate UCL	0.00668
95% Adjusted Gamma UCL	0.00676

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00556
SD	0.00183
SE of Mean	0.0004511
95% KM (t) UCL	0.00634
95% KM (z) UCL	0.0063
95% KM (jackknife) UCL	0.00633
95% KM (bootstrap t) UCL	0.00648
95% KM (BCA) UCL	0.00633
95% KM (Percentile Bootstrap) UCL	0.00656
95% KM (Chebyshev) UCL	0.00752
97.5% KM (Chebyshev) UCL	0.00837
99% KM (Chebyshev) UCL	0.01

Potential UCLs to Use

95% KM (t) UCL	0.00634
95% KM (Percentile Bootstrap) UCL	0.00656

Methoxychlor

General Statistics

Number of Valid Observations	18	Number of Distinct Observations	5

Raw Statistics

Minimum	0.005
Maximum	0.04
Mean	0.0186
Median	0.02
SD	0.00973
Coefficient of Variation	0.523
Skewness	0.412

Log-transformed Statistics

Minimum of Log Data	-5.298
Maximum of Log Data	-3.219
Mean of log Data	-4.137
SD of log Data	0.603

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.881	Shapiro Wilk Test Statistic	0.861
Shapiro Wilk Critical Value	0.897	Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.0226	95% H-UCL	0.0261
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.0312
95% Adjusted-CLT UCL	0.0226	97.5% Chebyshev (MVUE) UCL	0.0365
95% Modified-t UCL	0.0226	99% Chebyshev (MVUE) UCL	0.047
Gamma Distribution Test		**Data Distribution**	
k star (bias corrected)	2.883	Data do not follow a Discernable Distribution (0.05)	
Theta Star	0.00646		
nu star	103.8		
Approximate Chi Square Value (.05)	81.29	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0357	95% CLT UCL	0.0224
Adjusted Chi Square Value	79.37	95% Jackknife UCL	0.0226
		95% Standard Bootstrap UCL	0.0224
Anderson-Darling Test Statistic	1.234	95% Bootstrap-t UCL	0.0229
Anderson-Darling 5% Critical Value	0.744	95% Hall's Bootstrap UCL	0.023
Kolmogorov-Smirnov Test Statistic	0.29	95% Percentile Bootstrap UCL	0.0223
Kolmogorov-Smirnov 5% Critical Value	0.205	95% BCA Bootstrap UCL	0.0223
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.0286
		97.5% Chebyshev(Mean, Sd) UCL	0.0329
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	0.0414
95% Approximate Gamma UCL	0.0238		
95% Adjusted Gamma UCL	0.0243		
Potential UCL to Use		Use 95% Chebyshev (Mean, Sd) UCL	0.0286

Hexachlorobenzene

General Statistics

Number of Valid Data	17	Number of Detected Data	12
Number of Distinct Detected Data	4	Number of Non-Detect Data	5
Number of Missing Values	1	Percent Non-Detects	29.41%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.004	Minimum Detected	-5.521
Maximum Detected	0.01	Maximum Detected	-4.605
Mean of Detected	0.00633	Mean of Detected	-5.103
SD of Detected	0.00187	SD of Detected	0.302
Minimum Non-Detect	0.002	Minimum Non-Detect	-6.215
Maximum Non-Detect	0.002	Maximum Non-Detect	-6.215

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.891
5% Shapiro Wilk Critical Value	0.859

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.00476
SD	0.00295
95% DL/2 (t) UCL	0.00601
Maximum Likelihood Estimate(MLE) Method	
Mean	0.00449
SD	0.00335
95% MLE (t) UCL	0.00591
95% MLE (Tiku) UCL	0.00603

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	9.338
Theta Star	0.0006783
nu star	224.1
A-D Test Statistic	0.674
5% A-D Critical Value	0.731
K-S Test Statistic	0.731
5% K-S Critical Value	0.245

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00308
Maximum	0.01
Mean	0.00585
Median	0.006
SD	0.00182
k star	9.264
Theta star	0.000631
Nu star	315
AppChi2	274.8
95% Gamma Approximate UCL	0.0067
95% Adjusted Gamma UCL	0.0068

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.884
5% Shapiro Wilk Critical Value	0.859

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-5.634
SD	0.884
95% H-Stat (DL/2) UCL	0.00651
Log ROS Method	
Mean in Log Scale	-5.314
SD in Log Scale	0.429
Mean in Original Scale	0.00535
SD in Original Scale	0.00222
95% Percentile Bootstrap UCL	0.00624
95% BCA Bootstrap UCL	0.00629

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.00565
SD	0.00185
SE of Mean	0.0004674
95% KM (t) UCL	0.00646
95% KM (z) UCL	0.00642
95% KM (jackknife) UCL	0.00645
95% KM (bootstrap t) UCL	0.00657
95% KM (BCA) UCL	0.00635
95% KM (Percentile Bootstrap) UCL	0.00647
95% KM (Chebyshev) UCL	0.00768
97.5% KM (Chebyshev) UCL	0.00857
99% KM (Chebyshev) UCL	0.0103

Potential UCLs to Use

95% KM (t) UCL	0.00646
95% KM (Percentile Bootstrap) UCL	0.00647

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Z:\Projects\2009\1584-0901 TC Iqaluit Landfill\SSRA\COC tables\95UCL\surface water\sw-inorganic-fresh.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (Al) pH6.5

General Statistics

Number of Valid Data	21	Number of Detected Data	11
Number of Distinct Detected Data	9	Number of Non-Detect Data	10
Number of Missing Values	4	Percent Non-Detects	47.62%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	6	Minimum Detected	1.792
Maximum Detected	119	Maximum Detected	4.779
Mean of Detected	28.5	Mean of Detected	2.871
SD of Detected	33.31	SD of Detected	0.994
Minimum Non-Detect	5	Minimum Non-Detect	1.609
Maximum Non-Detect	5	Maximum Non-Detect	1.609

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.705	Shapiro Wilk Test Statistic	0.917
5% Shapiro Wilk Critical Value	0.85	5% Shapiro Wilk Critical Value	0.85
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	16.12	Mean	1.94
SD	27.05	SD	1.222
95% DL/2 (t) UCL	26.3	95% H-Stat (DL/2) UCL	13.22
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	1.198	Mean in Log Scale	1.516
SD	40.62	SD in Log Scale	1.733
95% MLE (t) UCL	16.49	Mean in Original Scale	15.6
95% MLE (Tiku) UCL	19.69	SD in Original Scale	27.34
		95% Percentile Bootstrap UCL	26.4
		95% BCA Bootstrap UCL	30.5

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.921
Theta Star	30.96
nu star	20.25
A-D Test Statistic	0.516
5% A-D Critical Value	0.748
K-S Test Statistic	0.748
5% K-S Critical Value	0.261

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	119
Mean	26.91
Median	18.84
SD	27.93
k star	0.266
Theta star	101.3
Nu star	11.16
AppChi2	4.678
95% Gamma Approximate UCL	64.18
95% Adjusted Gamma UCL	68.88

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	17.79
SD	25.59
SE of Mean	5.856
95% KM (t) UCL	27.89
95% KM (z) UCL	27.42
95% KM (jackknife) UCL	27.65
95% KM (bootstrap t) UCL	40.18
95% KM (BCA) UCL	29.99
95% KM (Percentile Bootstrap) UCL	28.04
95% KM (Chebyshev) UCL	43.31
97.5% KM (Chebyshev) UCL	54.36
99% KM (Chebyshev) UCL	76.05

Potential UCLs to Use

95% KM (BCA) UCL	29.99

Antimony (Sb)

General Statistics

Number of Valid Data	25	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	22
		Percent Non-Detects	88.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.62	Minimum Detected	-0.478
Maximum Detected	25	Maximum Detected	3.219
Mean of Detected	10.21	Mean of Detected	1.45
SD of Detected	13	SD of Detected	1.854
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	0.5	Maximum Non-Detect	-0.693

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.88	Shapiro Wilk Test Statistic	0.994
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	1.445
SD	4.998
95% DL/2 (t) UCL	3.155
Maximum Likelihood Estimate(MLE) Method	N/A

MLE yields a negative mean

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	0.249
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-1.046
SD	1.082
95% H-Stat (DL/2) UCL	0.807
Log ROS Method	
Mean in Log Scale	-9.138
SD in Log Scale	6.229
Mean in Original Scale	1.23
SD in Original Scale	5.052
95% Percentile Bootstrap UCL	3.208
95% BCA Bootstrap UCL	4.403

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	1.77
SD	4.819
SE of Mean	1.18
95% KM (t) UCL	3.79
95% KM (z) UCL	3.712
95% KM (jackknife) UCL	4.801
95% KM (bootstrap t) UCL	5.324
95% KM (BCA) UCL	25
95% KM (Percentile Bootstrap) UCL	25
95% KM (Chebyshev) UCL	6.915
97.5% KM (Chebyshev) UCL	9.142
99% KM (Chebyshev) UCL	13.51

Nu star	N/A	**Potential UCLs to Use**	
AppChi2	N/A	95% KM (t) UCL	3.79
95% Gamma Approximate UCL	N/A	95% KM (Percentile Bootstrap) UCL	25
95% Adjusted Gamma UCL	N/A		

Note: DL/2 is not a recommended method.

Arsenic (As)

General Statistics

Number of Valid Data	25	Number of Detected Data	17
Number of Distinct Detected Data	3	Number of Non-Detect Data	8
		Percent Non-Detects	32.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	1	Minimum Detected	0
Maximum Detected	25	Maximum Detected	3.219
Mean of Detected	3.118	Mean of Detected	0.473
SD of Detected	5.851	SD of Detected	0.946
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	0.5	Maximum Non-Detect	-0.693

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.413	Shapiro Wilk Test Statistic	0.569
5% Shapiro Wilk Critical Value	0.892	5% Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.2	Mean	-0.122
SD	4.969	SD	1.175
95% DL/2 (t) UCL	3.9	95% H-Stat (DL/2) UCL	3.278

Maximum Likelihood Estimate(MLE) Method	
Mean	0.721
SD	6.204
95% MLE (t) UCL	2.844
95% MLE (Tiku) UCL	2.961

Log ROS Method	
Mean in Log Scale	-0.152
SD in Log Scale	1.242
Mean in Original Scale	2.201
SD in Original Scale	4.969
95% Percentile Bootstrap UCL	4.032
95% BCA Bootstrap UCL	5.351

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.766
Theta Star	4.068
nu star	26.06
A-D Test Statistic	3.686
5% A-D Critical Value	0.771
K-S Test Statistic	0.771
5% K-S Critical Value	0.216

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	25
Mean	2.272
Median	1
SD	4.954
k star	0.195
Theta star	11.66
Nu star	9.742
AppChi2	3.781
95% Gamma Approximate UCL	5.853
95% Adjusted Gamma UCL	6.268

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	2.44
SD	4.784
SE of Mean	0.986
95% KM (t) UCL	4.127
95% KM (z) UCL	4.062
95% KM (jackknife) UCL	4.111
95% KM (bootstrap t) UCL	10.2
95% KM (BCA) UCL	4.04
95% KM (Percentile Bootstrap) UCL	4.2
95% KM (Chebyshev) UCL	6.739
97.5% KM (Chebyshev) UCL	8.599
99% KM (Chebyshev) UCL	12.25

Potential UCLs to Use

95% KM (BCA) UCL	4.04

Barium (Ba)

General Statistics

Number of Valid Data	10	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	9
		Percent Non-Detects	90.00%

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

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Barium (Ba) was not processed!

Beryllium (Be)

General Statistics

Number of Valid Data	25	Number of Detected Data	10
Number of Distinct Detected Data	3	Number of Non-Detect Data	15
		Percent Non-Detects	60.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1	Minimum Detected	0
Maximum Detected	50	Maximum Detected	3.912
Mean of Detected	6.8	Mean of Detected	0.621
SD of Detected	15.44	SD of Detected	1.364
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	0.5	Maximum Non-Detect	-0.693

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.45	Shapiro Wilk Test Statistic	0.539
5% Shapiro Wilk Critical Value	0.842	5% Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.87	Mean	-0.583
SD	10.01	SD	1.306
95% DL/2 (t) UCL	6.294	95% H-Stat (DL/2) UCL	1.46
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-1.577
		SD in Log Scale	2.268
		Mean in Original Scale	2.775
		SD in Original Scale	10.03
		95% Percentile Bootstrap UCL	6.727
		95% BCA Bootstrap UCL	9.473

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.411
Theta Star	16.55
nu star	8.216
A-D Test Statistic	2.498
5% A-D Critical Value	0.779
K-S Test Statistic	0.779
5% K-S Critical Value	0.281

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	85.92
Mean	18.07
Median	1.451
SD	25.71
k star	0.171
Theta star	105.5
Nu star	8.563
AppChi2	3.065
95% Gamma Approximate UCL	50.48
95% Adjusted Gamma UCL	54.4

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	3.32
SD	9.69
SE of Mean	2.043
95% KM (t) UCL	6.815
95% KM (z) UCL	6.68
95% KM (jackknife) UCL	6.704
95% KM (bootstrap t) UCL	1.8E+308
95% KM (BCA) UCL	5.64
95% KM (Percentile Bootstrap) UCL	7.24
95% KM (Chebyshev) UCL	12.22
97.5% KM (Chebyshev) UCL	16.08
99% KM (Chebyshev) UCL	23.65

Potential UCLs to Use	
95% KM (BCA) UCL	5.64

Boron (B)

General Statistics			
Number of Valid Data	25	Number of Detected Data	16
Number of Distinct Detected Data	10	Number of Non-Detect Data	9
		Percent Non-Detects	36.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	17	Minimum Detected	2.833
Maximum Detected	920	Maximum Detected	6.824
Mean of Detected	196.9	Mean of Detected	4.774
SD of Detected	222.1	SD of Detected	1.1
Minimum Non-Detect	10	Minimum Non-Detect	2.303
Maximum Non-Detect	10	Maximum Non-Detect	2.303

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.694
5% Shapiro Wilk Critical Value	0.887

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	127.8
SD	199.1
95% DL/2 (t) UCL	195.9
Maximum Likelihood Estimate(MLE) Method	
Mean	58.48
SD	268.5
95% MLE (t) UCL	150.4
95% MLE (Tiku) UCL	158.5

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.952
Theta Star	206.8
nu star	30.47
A-D Test Statistic	0.728
5% A-D Critical Value	0.761
K-S Test Statistic	0.761
5% K-S Critical Value	0.221

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	920
Mean	152.8
Median	100
SD	190.3
k star	0.217
Theta star	705.1
Nu star	10.83
AppChi2	4.469
95% Gamma Approximate UCL	370.3
95% Adjusted Gamma UCL	394.7

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.908
5% Shapiro Wilk Critical Value	0.887

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	3.635
SD	1.778
95% H-Stat (DL/2) UCL	282.1
Log ROS Method	
Mean in Log Scale	3.819
SD in Log Scale	1.624
Mean in Original Scale	129.7
SD in Original Scale	198
95% Percentile Bootstrap UCL	201.3
95% BCA Bootstrap UCL	225.6

Data Distribution Test with Detected Values Only

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	132.1
SD	192.5
SE of Mean	39.76
95% KM (t) UCL	200.1
95% KM (z) UCL	197.5
95% KM (jackknife) UCL	198.2
95% KM (bootstrap t) UCL	251.5
95% KM (BCA) UCL	210.1
95% KM (Percentile Bootstrap) UCL	204.8
95% KM (Chebyshev) UCL	305.4
97.5% KM (Chebyshev) UCL	380.4
99% KM (Chebyshev) UCL	527.7

Potential UCLs to Use

95% KM (BCA) UCL	210.1

Cadmium (Cd)

General Statistics

Number of Valid Data	25	Number of Detected Data	23
Number of Distinct Detected Data	10	Number of Non-Detect Data	2
		Percent Non-Detects	8.00%

Raw Statistics | **Log-transformed Statistics**

Minimum Detected	0.018	Minimum Detected	-4.017
Maximum Detected	0.85	Maximum Detected	-0.163
Mean of Detected	0.129	Mean of Detected	-2.364
SD of Detected	0.162	SD of Detected	0.735
Minimum Non-Detect	0.017	Minimum Non-Detect	-4.075
Maximum Non-Detect	0.017	Maximum Non-Detect	-4.075

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.41	Shapiro Wilk Test Statistic	0.781
5% Shapiro Wilk Critical Value	0.914	5% Shapiro Wilk Critical Value	0.914
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.119	Mean	-2.556
SD	0.159	SD	0.968
95% DL/2 (t) UCL	0.173	95% H-Stat (DL/2) UCL	0.201
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.112	Mean in Log Scale	-2.483
SD	0.165	SD in Log Scale	0.815
95% MLE (t) UCL	0.168	Mean in Original Scale	0.12
95% MLE (Tiku) UCL	0.164	SD in Original Scale	0.158
		95% Percentile Bootstrap UCL	0.18
		95% BCA Bootstrap UCL	0.219
Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	1.541	**Data do not follow a Discernable Distribution (0.05)**	
Theta Star	0.0836		
nu star	70.88		
A-D Test Statistic	2.971	**Nonparametric Statistics**	
5% A-D Critical Value	0.758	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.758	Mean	0.12
5% K-S Critical Value	0.184	SD	0.155
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.0317
		95% KM (t) UCL	0.174
Assuming Gamma Distribution		95% KM (z) UCL	0.172
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	0.174
Minimum	1E-09	95% KM (bootstrap t) UCL	0.281
Maximum	0.85	95% KM (BCA) UCL	0.181
Mean	0.118	95% KM (Percentile Bootstrap) UCL	0.18
Median	0.1	95% KM (Chebyshev) UCL	0.258
SD	0.159	97.5% KM (Chebyshev) UCL	0.318
k star	0.369	99% KM (Chebyshev) UCL	0.435
Theta star	0.321		
Nu star	18.45	**Potential UCLs to Use**	
AppChi2	9.713	95% KM (Chebyshev) UCL	0.258
95% Gamma Approximate UCL	0.225		
95% Adjusted Gamma UCL	0.235		

Note: DL/2 is not a recommended method.

Calcium (Ca)

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	9

Raw Statistics		Log-transformed Statistics	
Minimum	11200	Minimum of Log Data	9.324
Maximum	91500	Maximum of Log Data	11.42
Mean	24960	Mean of log Data	9.855
Median	13750	SD of log Data	0.69
SD	24762		
Coefficient of Variation	0.992		
Skewness	2.586		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.62	Shapiro Wilk Test Statistic	0.793
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	39314	95% H-UCL	43119
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	46559
95% Adjusted-CLT UCL	44681	97.5% Chebyshev (MVUE) UCL	56531
95% Modified-t UCL	40381	99% Chebyshev (MVUE) UCL	76120

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.468	Data Follow Appr. Gamma Distribution at 5% Significance Level	
Theta Star	16999		
nu star	29.37		
Approximate Chi Square Value (.05)	18	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	37840
Adjusted Chi Square Value	16.47	95% Jackknife UCL	39314
		95% Standard Bootstrap UCL	37255
Anderson-Darling Test Statistic	1.074	95% Bootstrap-t UCL	61857
Anderson-Darling 5% Critical Value	0.736	95% Hall's Bootstrap UCL	86710
Kolmogorov-Smirnov Test Statistic	0.259	95% Percentile Bootstrap UCL	38630
Kolmogorov-Smirnov 5% Critical Value	0.27	95% BCA Bootstrap UCL	45230
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	59092
		97.5% Chebyshev(Mean, Sd) UCL	73861
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	102871
95% Approximate Gamma UCL	40732		
95% Adjusted Gamma UCL	44517		

Potential UCL to Use		Use 95% Approximate Gamma UCL	40732

Chromium (Cr)

General Statistics

Number of Valid Data	25	Number of Detected Data	17
Number of Distinct Detected Data	3	Number of Non-Detect Data	8
		Percent Non-Detects	32.00%

Raw Statistics	
Minimum Detected	5
Maximum Detected	50
Mean of Detected	7.941
SD of Detected	10.91
Minimum Non-Detect	1
Maximum Non-Detect	1

Log-transformed Statistics	
Minimum Detected	1.609
Maximum Detected	3.912
Mean of Detected	1.786
SD of Detected	0.573
Minimum Non-Detect	0
Maximum Non-Detect	0

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.303	Shapiro Wilk Test Statistic	0.358
5% Shapiro Wilk Critical Value	0.892	5% Shapiro Wilk Critical Value	0.892
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	5.56	Mean	0.992
SD	9.583	SD	1.27
95% DL/2 (t) UCL	8.839	95% H-Stat (DL/2) UCL	11.68
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	2.822	Mean in Log Scale	1.491
SD	12.14	SD in Log Scale	0.655
95% MLE (t) UCL	6.977	Mean in Original Scale	6.18
95% MLE (Tiku) UCL	7.208	SD in Original Scale	9.287
		95% Percentile Bootstrap UCL	9.772
		95% BCA Bootstrap UCL	11.95

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	1.6	Data do not follow a Discernable Distribution (0.05)	
Theta Star	4.963		
nu star	54.41		
A-D Test Statistic	5.328	**Nonparametric Statistics**	
5% A-D Critical Value	0.751	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.751	Mean	7
5% K-S Critical Value	0.212	SD	8.832
Data not Gamma Distributed at 5% Significance Level		SE of Mean	1.821
		95% KM (t) UCL	10.12
Assuming Gamma Distribution		95% KM (z) UCL	9.995
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	10.08
Minimum	0.168	95% KM (bootstrap t) UCL	1.8E+308
Maximum	50	95% KM (BCA) UCL	8.8
Mean	6.676	95% KM (Percentile Bootstrap) UCL	10.6
Median	5	95% KM (Chebyshev) UCL	14.94
SD	9.194	97.5% KM (Chebyshev) UCL	18.37
k star	1.369	99% KM (Chebyshev) UCL	25.12
Theta star	4.877		
Nu star	68.45	**Potential UCLs to Use**	
AppChi2	50.4	95% KM (BCA) UCL	8.8
95% Gamma Approximate UCL	9.066		
95% Adjusted Gamma UCL	9.26		

Note: DL/2 is not a recommended method.

Chromium (Cr)(VI)

General Statistics

Number of Valid Data	15	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	12
Number of Missing Values	10	Percent Non-Detects	80.00%

Raw Statistics | **Log-transformed Statistics**

Minimum Detected	2.5	Minimum Detected	0.916
Maximum Detected	3.7	Maximum Detected	1.308
Mean of Detected	3	Mean of Detected	1.085
SD of Detected	0.624	SD of Detected	0.202
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	0.5	Maximum Non-Detect	-0.693

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.923	Shapiro Wilk Test Statistic	0.944
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.8	Mean	-0.892
SD	1.163	SD	1.026
95% DL/2 (t) UCL	1.329	95% H-Stat (DL/2) UCL	0.837
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.642	Mean in Log Scale	0.229
SD	2.481	SD in Log Scale	0.594
95% MLE (t) UCL	1.771	Mean in Original Scale	1.482
95% MLE (Tiku) UCL	2.837	SD in Original Scale	0.912
		95% Percentile Bootstrap UCL	1.851
		95% BCA Bootstrap UCL	1.957

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	0.335
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	2.6
SD	0.303
SE of Mean	0.0959
95% KM (t) UCL	2.769
95% KM (z) UCL	2.758
95% KM (jackknife) UCL	2.818
95% KM (bootstrap t) UCL	2.8
95% KM (BCA) UCL	3.7
95% KM (Percentile Bootstrap) UCL	3.7
95% KM (Chebyshev) UCL	3.018
97.5% KM (Chebyshev) UCL	3.199
99% KM (Chebyshev) UCL	3.554

Potential UCLs to Use

95% KM (t) UCL	2.769
95% KM (Percentile Bootstrap) UCL	3.7

Cobalt (Co)

General Statistics

Number of Valid Data	25	Number of Detected Data	21
Number of Distinct Detected Data	9	Number of Non-Detect Data	4
		Percent Non-Detects	16.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.32	Minimum Detected	-1.139
Maximum Detected	15	Maximum Detected	2.708
Mean of Detected	1.49	Mean of Detected	-0.286
SD of Detected	3.183	SD of Detected	0.9
Minimum Non-Detect	0.3	Minimum Non-Detect	-1.204
Maximum Non-Detect	0.3	Maximum Non-Detect	-1.204

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.36	Shapiro Wilk Test Statistic	0.642
5% Shapiro Wilk Critical Value	0.908	5% Shapiro Wilk Critical Value	0.908
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.276	Mean	-0.543
SD	2.948	SD	1.019
95% DL/2 (t) UCL	2.284	95% H-Stat (DL/2) UCL	1.566
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	0.924	Mean in Log Scale	-0.567
SD	3.213	SD in Log Scale	1.059
95% MLE (t) UCL	2.023	Mean in Original Scale	1.273
95% MLE (Tiku) UCL	1.969	SD in Original Scale	2.949
		95% Percentile Bootstrap UCL	2.385
		95% BCA Bootstrap UCL	3.096

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.768	Data do not follow a Discernable Distribution (0.05)	
Theta Star	1.939		
nu star	32.27		
A-D Test Statistic	4.146	**Nonparametric Statistics**	
5% A-D Critical Value	0.777	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.777	Mean	1.303
5% K-S Critical Value	0.196	SD	2.879
Data not Gamma Distributed at 5% Significance Level		SE of Mean	0.59
		95% KM (t) UCL	2.312
Assuming Gamma Distribution		95% KM (z) UCL	2.273
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	2.289
Minimum	1E-09	95% KM (bootstrap t) UCL	5.697
Maximum	15	95% KM (BCA) UCL	2.496
Mean	1.252	95% KM (Percentile Bootstrap) UCL	2.416
Median	0.5	95% KM (Chebyshev) UCL	3.875
SD	2.958	97.5% KM (Chebyshev) UCL	4.987
k star	0.199	99% KM (Chebyshev) UCL	7.173
Theta star	6.302		
Nu star	9.931	**Potential UCLs to Use**	
AppChi2	3.899	95% KM (Chebyshev) UCL	3.875
95% Gamma Approximate UCL	3.188		
95% Adjusted Gamma UCL	3.411		

Note: DL/2 is not a recommended method.

Copper (Cu) H: 0 - 120,000ug/L

General Statistics

Number of Valid Data	23	Number of Detected Data	6
Number of Distinct Detected Data	5	Number of Non-Detect Data	17
Number of Missing Values	2	Percent Non-Detects	73.91%

Raw Statistics | **Log-transformed Statistics**

Minimum Detected	1.3	Minimum Detected	0.262
Maximum Detected	7.1	Maximum Detected	1.96
Mean of Detected	3.8	Mean of Detected	1.203
SD of Detected	2.011	SD of Detected	0.589
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

Warning: There are only 6 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.959	Shapiro Wilk Test Statistic	0.962
5% Shapiro Wilk Critical Value	0.788	5% Shapiro Wilk Critical Value	0.788
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	1.361	Mean	-0.198
SD	1.765	SD	0.897
95% DL/2 (t) UCL	1.993	95% H-Stat (DL/2) UCL	1.265
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-0.519
		SD in Log Scale	1.352
		Mean in Original Scale	1.333
		SD in Original Scale	1.806
		95% Percentile Bootstrap UCL	1.961
		95% BCA Bootstrap UCL	2.107

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	2.088
Theta Star	1.82
nu star	25.06
A-D Test Statistic	0.218
5% A-D Critical Value	0.7
K-S Test Statistic	0.7
5% K-S Critical Value	0.334

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	0.964
Maximum	12.28
Mean	6.619
Median	6.795
SD	3.507
k star	2.457
Theta star	2.694
Nu star	113
AppChi2	89.49
95% Gamma Approximate UCL	8.361
95% Adjusted Gamma UCL	8.505

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data appear Normal at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	1.952
SD	1.444
SE of Mean	0.33
95% KM (t) UCL	2.518
95% KM (z) UCL	2.495
95% KM (jackknife) UCL	2.634
95% KM (bootstrap t) UCL	2.558
95% KM (BCA) UCL	4.274
95% KM (Percentile Bootstrap) UCL	3.978
95% KM (Chebyshev) UCL	3.39
97.5% KM (Chebyshev) UCL	4.012
99% KM (Chebyshev) UCL	5.233

Potential UCLs to Use	
95% KM (t) UCL	2.518
95% KM (Percentile Bootstrap) UCL	3.978

Iron (Fe)

General Statistics			
Number of Valid Data	25	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	25
		Percent Non-Detects	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Iron (Fe) was not processed!

Lead (Pb) H: 0 - 60,000ug/L

General Statistics

Number of Valid Data	21	Number of Detected Data	3
Number of Distinct Detected Data	2	Number of Non-Detect Data	18
Number of Missing Values	4	Percent Non-Detects	85.71%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.7	Minimum Detected	-0.357
Maximum Detected	2	Maximum Detected	0.693
Mean of Detected	1.133	Mean of Detected	-0.00673
SD of Detected	0.751	SD of Detected	0.606
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	0.5	Maximum Non-Detect	-0.693

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.75	Shapiro Wilk Test Statistic	0.75
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.376	Mean	-1.189
SD	0.396	SD	0.531
95% DL/2 (t) UCL	0.525	95% H-Stat (DL/2) UCL	0.382
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	1.365	Mean in Log Scale	-2.951
SD	0.613	SD in Log Scale	1.822
95% MLE (t) UCL	1.596	Mean in Original Scale	0.222
95% MLE (Tiku) UCL	1.955	SD in Original Scale	0.456
		95% Percentile Bootstrap UCL	0.408
		95% BCA Bootstrap UCL	0.491

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	0.62
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.762
SD	0.277
SE of Mean	0.074
95% KM (t) UCL	0.89
95% KM (z) UCL	0.884
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	1.084
97.5% KM (Chebyshev) UCL	1.224
99% KM (Chebyshev) UCL	1.498

Potential UCLs to Use

95% KM (t) UCL	0.89
95% KM (% Bootstrap) UCL	N/A

Lithium (Li)

General Statistics

Number of Valid Data	10	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	8
		Percent Non-Detects	80.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	50	Minimum Detected	3.912
Maximum Detected	250	Maximum Detected	5.521
Mean of Detected	150	Mean of Detected	4.717
SD of Detected	141.4	SD of Detected	1.138
Minimum Non-Detect	5	Minimum Non-Detect	1.609
Maximum Non-Detect	5	Maximum Non-Detect	1.609

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	1
5% Shapiro Wilk Critical Value	N/A

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	32
SD	78.04
95% DL/2 (t) UCL	77.24
Maximum Likelihood Estimate(MLE) Method	N/A

MLE method failed to converge properly

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	1
5% Shapiro Wilk Critical Value	N/A

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	1.676
SD	1.647
95% H-Stat (DL/2) UCL	156
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	0.358
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	70
SD	60
SE of Mean	26.83
95% KM (t) UCL	119.2
95% KM (z) UCL	114.1
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	187
97.5% KM (Chebyshev) UCL	237.6
99% KM (Chebyshev) UCL	337

Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Potential UCLs to Use

95% KM (BCA) UCL N/A

Note: DL/2 is not a recommended method.

Magnesium (Mg)

General Statistics

Number of Valid Observations 10

Number of Distinct Observations 9

Raw Statistics		Log-transformed Statistics	
Minimum	2800	Minimum of Log Data	7.937
Maximum	242000	Maximum of Log Data	12.4
Mean	36474	Mean of log Data	8.915
Median	3390	SD of log Data	1.624
SD	77498		
Coefficient of Variation	2.125		
Skewness	2.56		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.523	Shapiro Wilk Test Statistic	0.659
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	81398	95% H-UCL	317861
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	73801
95% Adjusted-CLT UCL	97986	97.5% Chebyshev (MVUE) UCL	96219
95% Modified-t UCL	84705	99% Chebyshev (MVUE) UCL	140255

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	0.355	Data do not follow a Discernable Distribution (0.05)	
Theta Star	102706		
nu star	7.103		
Approximate Chi Square Value (.05)	2.227	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	76785
Adjusted Chi Square Value	1.784	95% Jackknife UCL	81398
		95% Standard Bootstrap UCL	75003
Anderson-Darling Test Statistic	1.978	95% Bootstrap-t UCL	1904356
Anderson-Darling 5% Critical Value	0.793	95% Hall's Bootstrap UCL	1925302
Kolmogorov-Smirnov Test Statistic	0.407	95% Percentile Bootstrap UCL	83670
Kolmogorov-Smirnov 5% Critical Value	0.284	95% BCA Bootstrap UCL	99450
Data not Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	143298
		97.5% Chebyshev(Mean, Sd) UCL	189521
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	280316
95% Approximate Gamma UCL	116326		
95% Adjusted Gamma UCL	145253		

Potential UCL to Use	Use 99% Chebyshev (Mean, Sd) UCL 280316

Recommended UCL exceeds the maximum observation

Manganese (Mn)

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	10

Raw Statistics		Log-transformed Statistics	
Minimum	15.7	Minimum of Log Data	2.754
Maximum	151	Maximum of Log Data	5.017
Mean	69.26	Mean of log Data	4.056
Median	64.1	SD of log Data	0.696
SD	39.22		
Coefficient of Variation	0.566		
Skewness	0.718		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.937	Shapiro Wilk Test Statistic	0.891
Shapiro Wilk Critical Value	0.842	Shapiro Wilk Critical Value	0.842
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	92	95% H-UCL	132.2
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	142.2
95% Adjusted-CLT UCL	92.67	97.5% Chebyshev (MVUE) UCL	172.8
95% Modified-t UCL	92.46	99% Chebyshev (MVUE) UCL	233

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	2.105	Data appear Normal at 5% Significance Level	
Theta Star	32.91		
nu star	42.1		
Approximate Chi Square Value (.05)	28.22	**Nonparametric Statistics**	
Adjusted Level of Significance	0.0267	95% CLT UCL	89.66
Adjusted Chi Square Value	26.26	95% Jackknife UCL	92
		95% Standard Bootstrap UCL	88.86
Anderson-Darling Test Statistic	0.417	95% Bootstrap-t UCL	95.96
Anderson-Darling 5% Critical Value	0.732	95% Hall's Bootstrap UCL	109.4
Kolmogorov-Smirnov Test Statistic	0.211	95% Percentile Bootstrap UCL	90.17
Kolmogorov-Smirnov 5% Critical Value	0.269	95% BCA Bootstrap UCL	91.13
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	123.3
		97.5% Chebyshev(Mean, Sd) UCL	146.7
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	192.7
95% Approximate Gamma UCL	103.3		
95% Adjusted Gamma UCL	111		

Potential UCL to Use	Use 95% Student's-t UCL 92

Mercury (Hg)

General Statistics

Number of Valid Data	25	Number of Detected Data	11
Number of Distinct Detected Data	1	Number of Non-Detect Data	14
		Percent Non-Detects	56.00%

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

The data set for variable Mercury (Hg) was not processed!

Molybdenum (Mo)

General Statistics

Number of Valid Data	25	Number of Detected Data	4
Number of Distinct Detected Data	3	Number of Non-Detect Data	21
		Percent Non-Detects	84.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1	Minimum Detected	0
Maximum Detected	50	Maximum Detected	3.912
Mean of Detected	15.5	Mean of Detected	1.554
SD of Detected	23.39	SD of Detected	1.911
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.754	Shapiro Wilk Test Statistic	0.863
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.9	Mean	-0.334
SD	9.994	SD	1.078
95% DL/2 (t) UCL	6.32	95% H-Stat (DL/2) UCL	1.859
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-7.1
		SD in Log Scale	5.574
		Mean in Original Scale	2.49
		SD in Original Scale	10.1
		95% Percentile Bootstrap UCL	6.128
		95% BCA Bootstrap UCL	8.532

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.299
Theta Star	51.8
nu star	2.394
A-D Test Statistic	0.427
5% A-D Critical Value	0.68
K-S Test Statistic	0.68
5% K-S Critical Value	0.41

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	13095
Mean	2802
Median	768
SD	3886
k star	0.232
Theta star	12065
Nu star	11.61
AppChi2	4.974
95% Gamma Approximate UCL	6544
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data appear Normal at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	3.32
SD	9.69
SE of Mean	2.238
95% KM (t) UCL	7.149
95% KM (z) UCL	7.001
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	13.07
97.5% KM (Chebyshev) UCL	17.3
99% KM (Chebyshev) UCL	25.59

Potential UCLs to Use	
95% KM (t) UCL	7.149
95% KM (Percentile Bootstrap) UCL	N/A

Nickel (Ni) H: 0 - 60,000ug/L

General Statistics			
Number of Valid Data	21	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	19
Number of Missing Values	4	Percent Non-Detects	90.48%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1	Minimum Detected	0
Maximum Detected	2	Maximum Detected	0.693
Mean of Detected	1.5	Mean of Detected	0.347
SD of Detected	0.707	SD of Detected	0.49
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	1
5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.595
SD	0.34
95% DL/2 (t) UCL	0.723
Maximum Likelihood Estimate(MLE) Method	N/A
MLE method failed to converge properly	

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	1
5% Shapiro Wilk Critical Value	N/A
Data not Lognormal at 5% Significance Level	

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-0.594
SD	0.331
95% H-Stat (DL/2) UCL	0.669
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	0.359
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	1.048
SD	0.213
SE of Mean	0.0657
95% KM (t) UCL	1.161
95% KM (z) UCL	1.156
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	1.334
97.5% KM (Chebyshev) UCL	1.458
99% KM (Chebyshev) UCL	1.702
Potential UCLs to Use	
95% KM (t) UCL	1.161
95% KM (% Bootstrap) UCL	N/A

Phosphorus

General Statistics

Number of Valid Data	15	Number of Detected Data	15
Number of Distinct Detected Data	13	Number of Non-Detect Data	0
Number of Missing Values	10	Percent Non-Detects	0.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	6	Minimum Detected	1.792
Maximum Detected	220	Maximum Detected	5.394
Mean of Detected	36.13	Mean of Detected	2.925
SD of Detected	55.38	SD of Detected	1.087
Minimum Non-Detect	N/A	Minimum Non-Detect	N/A
Maximum Non-Detect	N/A	Maximum Non-Detect	N/A

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.582	Shapiro Wilk Test Statistic	0.889
5% Shapiro Wilk Critical Value	0.881	5% Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	36.13	Mean	2.925
SD	55.38	SD	1.087
95% DL/2 (t) UCL	61.32	95% H-Stat (DL/2) UCL	77.68
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	N/A
		SD in Log Scale	N/A
		Mean in Original Scale	N/A
		SD in Original Scale	N/A
		95% Percentile Bootstrap UCL	N/A
		95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only	
k star (bias corrected)	0.752	Data appear Lognormal at 5% Significance Level	
Theta Star	48.05		
nu star	22.56		
A-D Test Statistic	1.087	Nonparametric Statistics	
5% A-D Critical Value	0.769	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.769	Mean	36.13
5% K-S Critical Value	0.229	SD	53.5
Data not Gamma Distributed at 5% Significance Level		SE of Mean	14.3
		95% KM (t) UCL	61.32
Assuming Gamma Distribution		95% KM (z) UCL	59.65
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	61.32
Minimum	6	95% KM (bootstrap t) UCL	97.35
Maximum	220	95% KM (BCA) UCL	61.2
Mean	36.13	95% KM (Percentile Bootstrap) UCL	61.93
Median	15	95% KM (Chebyshev) UCL	98.46
SD	55.38	97.5% KM (Chebyshev) UCL	125.4
k star	0.752	99% KM (Chebyshev) UCL	178.4

Theta star	48.05

Nu star	22.56	**Potential UCLs to Use**	
AppChi2	12.76	97.5% KM (Chebyshev) UCL	125.4
95% Gamma Approximate UCL	63.89		
95% Adjusted Gamma UCL	68.74		

Note: DL/2 is not a recommended method.

Potassium (K)

General Statistics

Number of Valid Data	10	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	6
		Percent Non-Detects	60.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	2500	Minimum Detected	7.824
Maximum Detected	78000	Maximum Detected	11.26
Mean of Detected	27750	Mean of Detected	9.336
SD of Detected	35451	SD of Detected	1.68
Minimum Non-Detect	2000	Minimum Non-Detect	7.601
Maximum Non-Detect	2000	Maximum Non-Detect	7.601

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.831	Shapiro Wilk Test Statistic	0.88
5% Shapiro Wilk Critical Value	0.748	5% Shapiro Wilk Critical Value	0.748
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	11700	Mean	7.879
SD	24693	SD	1.585
95% DL/2 (t) UCL	26014	95% H-Stat (DL/2) UCL	50362
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	5.769
		SD in Log Scale	3.572
		Mean in Original Scale	11161
		SD in Original Scale	24956
		95% Percentile Bootstrap UCL	24396
		95% BCA Bootstrap UCL	31883

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**
k star (bias corrected)	0.336	**Data appear Normal at 5% Significance Level**
Theta Star	82513	
nu star	2.69	

A-D Test Statistic	0.386
5% A-D Critical Value	0.673
K-S Test Statistic	0.673
5% K-S Critical Value	0.406

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	263453
Mean	63946
Median	28893
SD	85097
k star	0.199
Theta star	321334
Nu star	3.98
AppChi2	0.714
95% Gamma Approximate UCL	356543
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	12600
SD	23023
SE of Mean	8407
95% KM (t) UCL	28011
95% KM (z) UCL	26428
95% KM (jackknife) UCL	26419
95% KM (bootstrap t) UCL	36824
95% KM (BCA) UCL	37520
95% KM (Percentile Bootstrap) UCL	32460
95% KM (Chebyshev) UCL	49244
97.5% KM (Chebyshev) UCL	65100
99% KM (Chebyshev) UCL	96246

Potential UCLs to Use

95% KM (t) UCL	28011
95% KM (Percentile Bootstrap) UCL	32460

Selenium (Se)

General Statistics

Number of Valid Data	25	Number of Detected Data	17
Number of Distinct Detected Data	3	Number of Non-Detect Data	8
		Percent Non-Detects	32.00%

Raw Statistics

Minimum Detected	2
Maximum Detected	50
Mean of Detected	5.294
SD of Detected	11.68
Minimum Non-Detect	1
Maximum Non-Detect	1

Log-transformed Statistics

Minimum Detected	0.693
Maximum Detected	3.912
Mean of Detected	0.977
SD of Detected	0.851
Minimum Non-Detect	0
Maximum Non-Detect	0

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.321
5% Shapiro Wilk Critical Value	0.892

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.39
5% Shapiro Wilk Critical Value	0.892

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	3.76
SD	9.808
95% DL/2 (t) UCL	7.116
Maximum Likelihood Estimate(MLE) Method	
Mean	0.792
SD	12.16
95% MLE (t) UCL	4.951
95% MLE (Tiku) UCL	5.188

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	0.443
SD	1.056
95% H-Stat (DL/2) UCL	4.563
Log ROS Method	
Mean in Log Scale	0.516
SD in Log Scale	0.998
Mean in Original Scale	3.814
SD in Original Scale	9.79
95% Percentile Bootstrap UCL	7.596
95% BCA Bootstrap UCL	9.784

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.742
Theta Star	7.133
nu star	25.23
A-D Test Statistic	5.279
5% A-D Critical Value	0.772
K-S Test Statistic	0.772
5% K-S Critical Value	0.216
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	50
Mean	3.853
Median	2
SD	9.796
k star	0.191
Theta star	20.17
Nu star	9.553
AppChi2	3.664
95% Gamma Approximate UCL	10.04
95% Adjusted Gamma UCL	10.77

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	4.24
SD	9.471
SE of Mean	1.953
95% KM (t) UCL	7.581
95% KM (z) UCL	7.452
95% KM (jackknife) UCL	7.548
95% KM (bootstrap t) UCL	1.8E+308
95% KM (BCA) UCL	6.48
95% KM (Percentile Bootstrap) UCL	8.08
95% KM (Chebyshev) UCL	12.75
97.5% KM (Chebyshev) UCL	16.43
99% KM (Chebyshev) UCL	23.67
Potential UCLs to Use	
95% KM (BCA) UCL	6.48

Silver (Ag)

General Statistics			
Number of Valid Data	25	Number of Detected Data	17
Number of Distinct Detected Data	3	Number of Non-Detect Data	8
		Percent Non-Detects	32.00%

Raw Statistics	
Minimum Detected	0.1
Maximum Detected	1
Mean of Detected	0.159
SD of Detected	0.218
Minimum Non-Detect	0.02
Maximum Non-Detect	0.02

Log-transformed Statistics	
Minimum Detected	-2.303
Maximum Detected	0
Mean of Detected	-2.126
SD of Detected	0.573
Minimum Non-Detect	-3.912
Maximum Non-Detect	-3.912

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.303
5% Shapiro Wilk Critical Value	0.892

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.358
5% Shapiro Wilk Critical Value	0.892

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.111
SD	0.192
95% DL/2 (t) UCL	0.177
Maximum Likelihood Estimate(MLE) Method	
Mean	0.0564
SD	0.243
95% MLE (t) UCL	0.14
95% MLE (Tiku) UCL	0.144

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-2.92
SD	1.27
95% H-Stat (DL/2) UCL	0.234
Log ROS Method	
Mean in Log Scale	-2.421
SD in Log Scale	0.655
Mean in Original Scale	0.124
SD in Original Scale	0.186
95% Percentile Bootstrap UCL	0.195
95% BCA Bootstrap UCL	0.236

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.6
Theta Star	0.0993
nu star	54.41
A-D Test Statistic	5.328
5% A-D Critical Value	0.751
K-S Test Statistic	0.751
5% K-S Critical Value	0.212

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.00336
Maximum	1
Mean	0.134
Median	0.1
SD	0.184
k star	1.369
Theta star	0.0975
Nu star	68.45
AppChi2	50.4
95% Gamma Approximate UCL	0.181
95% Adjusted Gamma UCL	0.185

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.14
SD	0.177
SE of Mean	0.0364
95% KM (t) UCL	0.202
95% KM (z) UCL	0.2
95% KM (jackknife) UCL	0.202
95% KM (bootstrap t) UCL	1.8E+308
95% KM (BCA) UCL	0.18
95% KM (Percentile Bootstrap) UCL	0.212
95% KM (Chebyshev) UCL	0.299
97.5% KM (Chebyshev) UCL	0.367
99% KM (Chebyshev) UCL	0.502

Potential UCLs to Use

95% KM (BCA) UCL	0.18

Sodium (Na)

General Statistics

Number of Valid Observations	10	Number of Distinct Observations	9

Raw Statistics

Minimum	5200
Maximum	2040000
Mean	296100
Median	6600
SD	668891
Coefficient of Variation	2.259
Skewness	2.456

Log-transformed Statistics

Minimum of Log Data	8.556
Maximum of Log Data	14.53
Mean of log Data	9.887
SD of log Data	2.257

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.524
Shapiro Wilk Critical Value	0.842

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.641
Shapiro Wilk Critical Value	0.842

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	683843

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL	819535
95% Modified-t UCL	711220

Assuming Lognormal Distribution

95% H-UCL	23359556
95% Chebyshev (MVUE) UCL	574037
97.5% Chebyshev (MVUE) UCL	762068
99% Chebyshev (MVUE) UCL	1131419

Gamma Distribution Test

k star (bias corrected)	0.249
Theta Star	1189795
nu star	4.977
Approximate Chi Square Value (.05)	1.142
Adjusted Level of Significance	0.0267
Adjusted Chi Square Value	0.858
Anderson-Darling Test Statistic	2.066
Anderson-Darling 5% Critical Value	0.83
Kolmogorov-Smirnov Test Statistic	0.431
Kolmogorov-Smirnov 5% Critical Value	0.29

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	1290847
95% Adjusted Gamma UCL	1717504

Data Distribution

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

95% CLT UCL	644022
95% Jackknife UCL	683843
95% Standard Bootstrap UCL	622676
95% Bootstrap-t UCL	53150092
95% Hall's Bootstrap UCL	51536658
95% Percentile Bootstrap UCL	670440
95% BCA Bootstrap UCL	872730
95% Chebyshev(Mean, Sd) UCL	1218102
97.5% Chebyshev(Mean, Sd) UCL	1617053
99% Chebyshev(Mean, Sd) UCL	2400715

Potential UCL to Use Use 99% Chebyshev (Mean, Sd) UCL 2400715

Recommended UCL exceeds the maximum observation

Thallium (Tl)

General Statistics

Number of Valid Data	25	Number of Detected Data	12
Number of Distinct Detected Data	5	Number of Non-Detect Data	13
		Percent Non-Detects	52.00%

Raw Statistics	
Minimum Detected	0.07
Maximum Detected	10
Mean of Detected	1.146
SD of Detected	2.838
Minimum Non-Detect	0.05
Maximum Non-Detect	0.05

Log-transformed Statistics	
Minimum Detected	-2.659
Maximum Detected	2.303
Mean of Detected	-1.255
SD of Detected	1.383
Minimum Non-Detect	-2.996
Maximum Non-Detect	-2.996

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.417
5% Shapiro Wilk Critical Value	0.859

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.681
5% Shapiro Wilk Critical Value	0.859

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.563
SD	2.004
95% DL/2 (t) UCL	1.249
Maximum Likelihood Estimate(MLE) Method	N/A

MLE yields a negative mean

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-2.521
SD	1.555
95% H-Stat (DL/2) UCL	0.372
Log ROS Method	
Mean in Log Scale	-3.096
SD in Log Scale	2.212
Mean in Original Scale	0.557
SD in Original Scale	2.006
95% Percentile Bootstrap UCL	1.315
95% BCA Bootstrap UCL	1.825

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.402
Theta Star	2.849
nu star	9.652
A-D Test Statistic	2.575
5% A-D Critical Value	0.792
K-S Test Statistic	0.792
5% K-S Critical Value	0.26

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	10
Mean	1.478
Median	0.2
SD	2.515
k star	0.163
Theta star	9.056
Nu star	8.163
AppChi2	2.83
95% Gamma Approximate UCL	4.265
95% Adjusted Gamma UCL	4.607

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.586
SD	1.958
SE of Mean	0.409
95% KM (t) UCL	1.286
95% KM (z) UCL	1.259
95% KM (jackknife) UCL	1.265
95% KM (bootstrap t) UCL	16.58
95% KM (BCA) UCL	1.52
95% KM (Percentile Bootstrap) UCL	1.366
95% KM (Chebyshev) UCL	2.369
97.5% KM (Chebyshev) UCL	3.14
99% KM (Chebyshev) UCL	4.655

Potential UCLs to Use	
95% KM (BCA) UCL	1.52

Tungsten

General Statistics

Number of Valid Data	15	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	15
Number of Missing Values	10	Percent Non-Detects	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Tungsten was not processed!

Tin (Sn)

General Statistics

Number of Valid Data	10	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	7
		Percent Non-Detects	70.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.57	Minimum Detected	-0.562
Maximum Detected	25	Maximum Detected	3.219
Mean of Detected	10.19	Mean of Detected	1.422
SD of Detected	13.02	SD of Detected	1.897
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	0.5	Maximum Non-Detect	-0.693

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.881	Shapiro Wilk Test Statistic	0.993
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	3.232	Mean	-0.544
SD	7.791	SD	1.625
95% DL/2 (t) UCL	7.748	95% H-Stat (DL/2) UCL	14.96
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-4.356
		SD in Log Scale	4.815
		Mean in Original Scale	3.065
		SD in Original Scale	7.863
		95% Percentile Bootstrap UCL	7.565

95% BCA Bootstrap UCL	10.51

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	0.248
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	3.456
SD	7.302
SE of Mean	2.828
95% KM (t) UCL	8.64
95% KM (z) UCL	8.108
95% KM (jackknife) UCL	8.03
95% KM (bootstrap t) UCL	12.48
95% KM (BCA) UCL	25
95% KM (Percentile Bootstrap) UCL	25
95% KM (Chebyshev) UCL	15.78
97.5% KM (Chebyshev) UCL	21.12
99% KM (Chebyshev) UCL	31.59

Potential UCLs to Use

95% KM (t) UCL	8.64
95% KM (Percentile Bootstrap) UCL	25

Titanium (Ti)

General Statistics

Number of Valid Data	10	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	9
		Percent Non-Detects	90.00%

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

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Titanium (Ti) was not processed!

Uranium (U)

General Statistics

Number of Valid Data	25	Number of Detected Data	12
Number of Distinct Detected Data	3	Number of Non-Detect Data	13
		Percent Non-Detects	52.00%

Raw Statistics

Minimum Detected	0.2
Maximum Detected	10
Mean of Detected	1.167
SD of Detected	2.829
Minimum Non-Detect	0.1
Maximum Non-Detect	0.1

Log-transformed Statistics

Minimum Detected	-1.609
Maximum Detected	2.303
Mean of Detected	-1.092
SD of Detected	1.257
Minimum Non-Detect	-2.303
Maximum Non-Detect	-2.303

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.404
5% Shapiro Wilk Critical Value	0.859
Data not Normal at 5% Significance Level	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.586
SD	1.998
95% DL/2 (t) UCL	1.27
Maximum Likelihood Estimate(MLE) Method	N/A
MLE yields a negative mean	

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.486
5% Shapiro Wilk Critical Value	0.859
Data not Lognormal at 5% Significance Level	

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-2.082
SD	1.291
95% H-Stat (DL/2) UCL	0.355
Log ROS Method	
Mean in Log Scale	-2.6
SD in Log Scale	1.85
Mean in Original Scale	0.574
SD in Original Scale	2.002
95% Percentile Bootstrap UCL	1.309
95% BCA Bootstrap UCL	1.905

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.437
Theta Star	2.67
nu star	10.49
A-D Test Statistic	3.291
5% A-D Critical Value	0.784
K-S Test Statistic	0.784
5% K-S Critical Value	0.259
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	10
Mean	1.475
Median	0.2
SD	2.458
k star	0.166
Theta star	8.899
Nu star	8.286
AppChi2	2.902
95% Gamma Approximate UCL	4.211
95% Adjusted Gamma UCL	4.546

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.664
SD	1.938
SE of Mean	0.405
95% KM (t) UCL	1.357
95% KM (z) UCL	1.33
95% KM (jackknife) UCL	1.341
95% KM (bootstrap t) UCL	1.8E+308
95% KM (BCA) UCL	1.128
95% KM (Percentile Bootstrap) UCL	1.376
95% KM (Chebyshev) UCL	2.429
97.5% KM (Chebyshev) UCL	3.192
99% KM (Chebyshev) UCL	4.692

Potential UCLs to Use	
95% KM (BCA) UCL	1.128

Vanadium (V)

General Statistics

Number of Valid Data	25	Number of Detected Data	5
Number of Distinct Detected Data	3	Number of Non-Detect Data	20
		Percent Non-Detects	80.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	5	Minimum Detected	1.609
Maximum Detected	50	Maximum Detected	3.912
Mean of Detected	15	Mean of Detected	2.209
SD of Detected	19.69	SD of Detected	0.998
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.625	Shapiro Wilk Test Statistic	0.723
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	3.4	Mean	-0.113
SD	9.981	SD	1.253
95% DL/2 (t) UCL	6.815	95% H-Stat (DL/2) UCL	3.434
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	22.65	Mean in Log Scale	-1.379
SD	17.61	SD in Log Scale	2.511
95% MLE (t) UCL	28.68	Mean in Original Scale	3.267
95% MLE (Tiku) UCL	35.51	SD in Original Scale	10.03
		95% Percentile Bootstrap UCL	6.931
		95% BCA Bootstrap UCL	9.458

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.589	Data Follow Appr. Gamma Distribution at 5% Significance Level
Theta Star	25.47	
nu star	5.889	
A-D Test Statistic	0.895	
5% A-D Critical Value	0.69	
K-S Test Statistic	0.69	
5% K-S Critical Value	0.364	
Data follow Appr. Gamma Distribution at 5% Significance Level		

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	7
SD	8.832
SE of Mean	1.975
95% KM (t) UCL	10.38

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	457.2
Mean	145
Median	91.69
SD	147.1
k star	0.355
Theta star	408.5
Nu star	17.75
AppChi2	9.212
95% Gamma Approximate UCL	279.5
95% Adjusted Gamma UCL	292.8

95% KM (z) UCL	10.25
95% KM (jackknife) UCL	10.08
95% KM (bootstrap t) UCL	1.8E+308
95% KM (BCA) UCL	10.4
95% KM (Percentile Bootstrap) UCL	10.8
95% KM (Chebyshev) UCL	15.61
97.5% KM (Chebyshev) UCL	19.33
99% KM (Chebyshev) UCL	26.65
Potential UCLs to Use	
95% KM (t) UCL	10.38

Note: DL/2 is not a recommended method.

Zinc (Zn)

General Statistics

Number of Valid Data	25	Number of Detected Data	11
Number of Distinct Detected Data	9	Number of Non-Detect Data	14
		Percent Non-Detects	56.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	6	Minimum Detected	1.792
Maximum Detected	163	Maximum Detected	5.094
Mean of Detected	23.4	Mean of Detected	2.436
SD of Detected	46.47	SD of Detected	0.956
Minimum Non-Detect	5	Minimum Non-Detect	1.609
Maximum Non-Detect	25	Maximum Non-Detect	3.219

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	24
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	1
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	96.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.415	Shapiro Wilk Test Statistic	0.682
5% Shapiro Wilk Critical Value	0.85	5% Shapiro Wilk Critical Value	0.85
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	12.1	Mean	1.649
SD	31.76	SD	0.994
95% DL/2 (t) UCL	22.96	95% H-Stat (DL/2) UCL	9.922
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	1.078
		SD in Log Scale	1.521
		Mean in Original Scale	11.06
		SD in Original Scale	32.02
		95% Percentile Bootstrap UCL	23.56
		95% BCA Bootstrap UCL	30.23

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.66
Theta Star	35.44
nu star	14.53
A-D Test Statistic	2.123
5% A-D Critical Value	0.759
K-S Test Statistic	0.759
5% K-S Critical Value	0.264

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	163
Mean	32.54
Median	11
SD	40.93
k star	0.219
Theta star	148.7
Nu star	10.94
AppChi2	4.54
95% Gamma Approximate UCL	78.44
95% Adjusted Gamma UCL	83.57

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	13.72
SD	30.63
SE of Mean	6.426
95% KM (t) UCL	24.71
95% KM (z) UCL	24.29
95% KM (jackknife) UCL	24.41
95% KM (bootstrap t) UCL	133.1
95% KM (BCA) UCL	26.53
95% KM (Percentile Bootstrap) UCL	26.02
95% KM (Chebyshev) UCL	41.73
97.5% KM (Chebyshev) UCL	53.85
99% KM (Chebyshev) UCL	77.65

Potential UCLs to Use	
95% KM (t) UCL	24.71
95% KM (% Bootstrap) UCL	26.02

Zirconium

General Statistics			
Number of Valid Data	15	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	15
Number of Missing Values	10	Percent Non-Detects	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Zirconium was not processed!

1				**General UCL Statistics for Data Sets with Non-Detects**								
2		**User Selected Options**										
3		From File		Z:\Projects\2009\1584-0901 TC Iqaluit Landfill\SSRA\COC tables\95UCL\surface water\sw-inorganic-fresh.wst								
4		Full Precision		OFF								
5		Confidence Coefficient		95%								
6		Number of Bootstrap Operations		2000								
7												
8												
9	**Iron (Fe)**											
10												
11						**General Statistics**							
12				Number of Valid Observations	25			Number of Distinct Observations	24			
13												
14				**Raw Statistics**				**Log-transformed Statistics**				
15				Minimum	86			Minimum of Log Data	4.454			
16				Maximum	10000			Maximum of Log Data	9.21			
17				Mean	1911			Mean of log Data	6.853			
18				Median	790			SD of log Data	1.157			
19				SD	2795							
20				Coefficient of Variation	1.463							
21				Skewness	2.276							
22												
23						**Relevant UCL Statistics**							
24				**Normal Distribution Test**				**Lognormal Distribution Test**				
25				Shapiro Wilk Test Statistic	0.597			Shapiro Wilk Test Statistic	0.955			
26				Shapiro Wilk Critical Value	0.918			Shapiro Wilk Critical Value	0.918			
27				**Data not Normal at 5% Significance Level**				**Data appear Lognormal at 5% Significance Level**				
28												
29				**Assuming Normal Distribution**				**Assuming Lognormal Distribution**				
30				95% Student's-t UCL	2867			95% H-UCL	3503			
31				**95% UCLs (Adjusted for Skewness)**				95% Chebyshev (MVUE) UCL	3867			
32				95% Adjusted-CLT UCL	3102			97.5% Chebyshev (MVUE) UCL	4773			
33				95% Modified-t UCL	2910			99% Chebyshev (MVUE) UCL	6552			
34												
35				**Gamma Distribution Test**				**Data Distribution**				
36				k star (bias corrected)	0.766			**Data appear Lognormal at 5% Significance Level**				
37				Theta Star	2496							
38				nu star	38.28							
39				Approximate Chi Square Value (.05)	25.11			**Nonparametric Statistics**				
40				Adjusted Level of Significance	0.0395			95% CLT UCL	2830			
41				Adjusted Chi Square Value	24.39			95% Jackknife UCL	2867			
42								95% Standard Bootstrap UCL	2820			
43				Anderson-Darling Test Statistic	1.444			95% Bootstrap-t UCL	3420			
44				Anderson-Darling 5% Critical Value	0.78			95% Hall's Bootstrap UCL	2738			
45				Kolmogorov-Smirnov Test Statistic	0.219			95% Percentile Bootstrap UCL	2855			
46				Kolmogorov-Smirnov 5% Critical Value	0.181			95% BCA Bootstrap UCL	3087			
47				**Data not Gamma Distributed at 5% Significance Level**				95% Chebyshev(Mean, Sd) UCL	4347			
48								97.5% Chebyshev(Mean, Sd) UCL	5402			
49				**Assuming Gamma Distribution**				99% Chebyshev(Mean, Sd) UCL	7473			
50				95% Approximate Gamma UCL	2913							
51				95% Adjusted Gamma UCL	3000							
52												
53				**Potential UCL to Use**				Use 95% H-UCL	3503			
54												

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	Z:\Projects\2009\1584-0901 TC Iqaluit Landfill\SSRA\COC tables\95UCL\surface water\sw-inorganic-brackish.ws
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (Al) pH6.5

General Statistics

Number of Valid Data	16	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	16
Number of Missing Values	7	Percent Non-Detects	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aluminum (Al) pH6.5 was not processed!

Antimony (Sb)

General Statistics

Number of Valid Data	23	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	22
		Percent Non-Detects	95.65%

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

The data set for variable Antimony (Sb) was not processed!

Arsenic (As)

General Statistics

Number of Valid Data	23	Number of Detected Data	19
Number of Distinct Detected Data	5	Number of Non-Detect Data	4
		Percent Non-Detects	17.39%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1	Minimum Detected	0
Maximum Detected	25	Maximum Detected	3.219
Mean of Detected	4.737	Mean of Detected	1.041
SD of Detected	5.704	SD of Detected	1.027
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	0.5	Maximum Non-Detect	-0.693

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.646
5% Shapiro Wilk Critical Value	0.901

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	3.957
SD	5.445
95% DL/2 (t) UCL	5.906
Maximum Likelihood Estimate(MLE) Method	
Mean	3.313
SD	6.071
95% MLE (t) UCL	5.486
95% MLE (Tiku) UCL	5.435

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.969
Theta Star	4.886
nu star	36.84
A-D Test Statistic	1.419
5% A-D Critical Value	0.767
K-S Test Statistic	0.767
5% K-S Critical Value	0.204

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	25
Mean	3.913
Median	1
SD	5.477
k star	0.187
Theta star	20.92
Nu star	8.605
AppChi2	3.09
95% Gamma Approximate UCL	10.9
95% Adjusted Gamma UCL	11.79

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.825
5% Shapiro Wilk Critical Value	0.901

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	0.619
SD	1.322
95% H-Stat (DL/2) UCL	9.159
Log ROS Method	
Mean in Log Scale	0.643
SD in Log Scale	1.295
Mean in Original Scale	3.966
SD in Original Scale	5.438
95% Percentile Bootstrap UCL	6.026
95% BCA Bootstrap UCL	6.703

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	4.087
SD	5.241
SE of Mean	1.123
95% KM (t) UCL	6.015
95% KM (z) UCL	5.934
95% KM (jackknife) UCL	6.006
95% KM (bootstrap t) UCL	7.646
95% KM (BCA) UCL	5.957
95% KM (Percentile Bootstrap) UCL	6
95% KM (Chebyshev) UCL	8.981
97.5% KM (Chebyshev) UCL	11.1
99% KM (Chebyshev) UCL	15.26

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	11.1

Beryllium (Be)

General Statistics

Number of Valid Data	23	Number of Detected Data	8
Number of Distinct Detected Data	5	Number of Non-Detect Data	15
		Percent Non-Detects	65.22%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	1	Minimum Detected	0
Maximum Detected	50	Maximum Detected	3.912
Mean of Detected	10.13	Mean of Detected	1.151
SD of Detected	17.37	SD of Detected	1.547
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	0.5	Maximum Non-Detect	-0.693

Warning: There are only 8 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.628	Shapiro Wilk Test Statistic	0.789
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	3.685	Mean	-0.504
SD	10.92	SD	1.513
95% DL/2 (t) UCL	7.593	95% H-Stat (DL/2) UCL	2.361
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-2.327
		SD in Log Scale	3.196
		Mean in Original Scale	3.558
		SD in Original Scale	10.96
		95% Percentile Bootstrap UCL	7.644
		95% BCA Bootstrap UCL	10.21

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.421	Data Follow Appr. Gamma Distribution at 5% Significance Level
Theta Star	24.08	
nu star	6.728	

A-D Test Statistic	0.984
5% A-D Critical Value	0.76
K-S Test Statistic	0.76
5% K-S Critical Value	0.308

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	188
Mean	42.05
Median	16.33
SD	56.17
k star	0.188
Theta star	223.2
Nu star	8.666
AppChi2	3.127
95% Gamma Approximate UCL	116.5
95% Adjusted Gamma UCL	126.1

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	4.174
SD	10.52
SE of Mean	2.346
95% KM (t) UCL	8.202
95% KM (z) UCL	8.033
95% KM (jackknife) UCL	8.027
95% KM (bootstrap t) UCL	41.2
95% KM (BCA) UCL	7.783
95% KM (Percentile Bootstrap) UCL	8.435
95% KM (Chebyshev) UCL	14.4
97.5% KM (Chebyshev) UCL	18.82
99% KM (Chebyshev) UCL	27.52

Potential UCLs to Use

95% KM (t) UCL	8.202

Boron (B)

General Statistics

Number of Valid Data	23	Number of Detected Data	22
Number of Distinct Detected Data	15	Number of Non-Detect Data	1
		Percent Non-Detects	4.35%

Raw Statistics

Minimum Detected	96
Maximum Detected	1800
Mean of Detected	435.3
SD of Detected	462.6
Minimum Non-Detect	10
Maximum Non-Detect	10

Log-transformed Statistics

Minimum Detected	4.564
Maximum Detected	7.496
Mean of Detected	5.604
SD of Detected	0.968
Minimum Non-Detect	2.303
Maximum Non-Detect	2.303

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.75
5% Shapiro Wilk Critical Value	0.911

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.879
5% Shapiro Wilk Critical Value	0.911

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	416.6
SD	460.8
95% DL/2 (t) UCL	581.6
Maximum Likelihood Estimate(MLE) Method	
Mean	405.5
SD	465.8
95% MLE (t) UCL	572.3
95% MLE (Tiku) UCL	562.8

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	5.431
SD	1.26
95% H-Stat (DL/2) UCL	844.9
Log ROS Method	
Mean in Log Scale	5.502
SD in Log Scale	1.065
Mean in Original Scale	417.5
SD in Original Scale	460
95% Percentile Bootstrap UCL	576.1
95% BCA Bootstrap UCL	613.7

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.066
Theta Star	408.3
nu star	46.9
A-D Test Statistic	1.292
5% A-D Critical Value	0.766
K-S Test Statistic	0.766
5% K-S Critical Value	0.19

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1800
Mean	416.3
Median	200
SD	461
k star	0.391
Theta star	1066
Nu star	17.97
AppChi2	9.371
95% Gamma Approximate UCL	798.5
95% Adjusted Gamma UCL	838.7

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	420.5
SD	447.5
SE of Mean	95.5
95% KM (t) UCL	584.5
95% KM (z) UCL	577.6
95% KM (jackknife) UCL	584.2
95% KM (bootstrap t) UCL	643.4
95% KM (BCA) UCL	588.8
95% KM (Percentile Bootstrap) UCL	583.3
95% KM (Chebyshev) UCL	836.8
97.5% KM (Chebyshev) UCL	1017
99% KM (Chebyshev) UCL	1371

Potential UCLs to Use

95% KM (Chebyshev) UCL	836.8

Cadmium (Cd)

General Statistics

Number of Valid Data	23	Number of Detected Data	8
Number of Distinct Detected Data	7	Number of Non-Detect Data	15
		Percent Non-Detects	65.22%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.017	Minimum Detected	-4.075
Maximum Detected	1	Maximum Detected	0
Mean of Detected	0.312	Mean of Detected	-2.117
SD of Detected	0.395	SD of Detected	1.614
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303

Warning: There are only 8 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.766	Shapiro Wilk Test Statistic	0.918
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.141	Mean	-2.69
SD	0.257	SD	1.006
95% DL/2 (t) UCL	0.233	95% H-Stat (DL/2) UCL	0.137
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-3.005
		SD in Log Scale	1.43
		Mean in Original Scale	0.141
		SD in Original Scale	0.259
		95% Percentile Bootstrap UCL	0.235
		95% BCA Bootstrap UCL	0.27

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.485	Data appear Gamma Distributed at 5% Significance Level
Theta Star	0.644	
nu star	7.755	

A-D Test Statistic	0.387
5% A-D Critical Value	0.753
K-S Test Statistic	0.753
5% K-S Critical Value	0.306

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1
Mean	0.255
Median	0.212
SD	0.261
k star	0.248
Theta star	1.03
Nu star	11.4
AppChi2	4.834
95% Gamma Approximate UCL	0.602
95% Adjusted Gamma UCL	0.643

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.135
SD	0.254
SE of Mean	0.0576
95% KM (t) UCL	0.234
95% KM (z) UCL	0.229
95% KM (jackknife) UCL	0.23
95% KM (bootstrap t) UCL	0.396
95% KM (BCA) UCL	0.237
95% KM (Percentile Bootstrap) UCL	0.231
95% KM (Chebyshev) UCL	0.386
97.5% KM (Chebyshev) UCL	0.494
99% KM (Chebyshev) UCL	0.708

Potential UCLs to Use

95% KM (t) UCL	0.234

Chromium (Cr)

General Statistics

Number of Valid Data	23	Number of Detected Data	19
Number of Distinct Detected Data	4	Number of Non-Detect Data	4
		Percent Non-Detects	17.39%

Raw Statistics

Minimum Detected	2
Maximum Detected	50
Mean of Detected	10.37
SD of Detected	14.41
Minimum Non-Detect	1
Maximum Non-Detect	1

Log-transformed Statistics

Minimum Detected	0.693
Maximum Detected	3.912
Mean of Detected	1.877
SD of Detected	0.817
Minimum Non-Detect	0
Maximum Non-Detect	0

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.46
5% Shapiro Wilk Critical Value	0.901

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	8.652
SD	13.58
95% DL/2 (t) UCL	13.52
Maximum Likelihood Estimate(MLE) Method	
Mean	6.978
SD	15.11
95% MLE (t) UCL	12.39
95% MLE (Tiku) UCL	12.23

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.064
Theta Star	9.747
nu star	40.42
A-D Test Statistic	4.62
5% A-D Critical Value	0.764
K-S Test Statistic	0.764
5% K-S Critical Value	0.203

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	50
Mean	8.581
Median	5
SD	13.63
k star	0.218
Theta star	39.4
Nu star	10.02
AppChi2	3.954
95% Gamma Approximate UCL	21.75
95% Adjusted Gamma UCL	23.36

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.583
5% Shapiro Wilk Critical Value	0.901

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	1.43
SD	1.24
95% H-Stat (DL/2) UCL	15.36
Log ROS Method	
Mean in Log Scale	1.616
SD in Log Scale	0.946
Mean in Original Scale	8.826
SD in Original Scale	13.48
95% Percentile Bootstrap UCL	13.96
95% BCA Bootstrap UCL	14.99

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	8.913
SD	13.13
SE of Mean	2.814
95% KM (t) UCL	13.74
95% KM (z) UCL	13.54
95% KM (jackknife) UCL	13.38
95% KM (bootstrap t) UCL	24.15
95% KM (BCA) UCL	14
95% KM (Percentile Bootstrap) UCL	14.13
95% KM (Chebyshev) UCL	21.18
97.5% KM (Chebyshev) UCL	26.49
99% KM (Chebyshev) UCL	36.91

Potential UCLs to Use

95% KM (Chebyshev) UCL	21.18

Chromium (Cr)(VI)

General Statistics

Number of Valid Data	16	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	16
Number of Missing Values	7	Percent Non-Detects	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Chromium (Cr)(VI) was not processed!

Cobalt (Co)

General Statistics

Number of Valid Data	23	Number of Detected Data	0
Number of Distinct Detected Data	0	Number of Non-Detect Data	23
		Percent Non-Detects	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Cobalt (Co) was not processed!

Copper (Cu) H: 0 - 120,000ug/L

General Statistics

Number of Valid Data	21	Number of Detected Data	18
Number of Distinct Detected Data	1	Number of Non-Detect Data	3
Number of Missing Values	2	Percent Non-Detects	14.29%

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

The data set for variable Copper (Cu) H: 0 - 120,000ug/L was not processed!

Iron (Fe)

General Statistics

Number of Valid Data	23	Number of Detected Data	22
Number of Distinct Detected Data	17	Number of Non-Detect Data	1
		Percent Non-Detects	4.35%

Raw Statistics	
Minimum Detected	38
Maximum Detected	1400
Mean of Detected	344.2
SD of Detected	350.7
Minimum Non-Detect	30
Maximum Non-Detect	30

Log-transformed Statistics	
Minimum Detected	3.638
Maximum Detected	7.244
Mean of Detected	5.384
SD of Detected	1.013
Minimum Non-Detect	3.401
Maximum Non-Detect	3.401

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.784
5% Shapiro Wilk Critical Value	0.911

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.968
5% Shapiro Wilk Critical Value	0.911

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	329.9
SD	349.5
95% DL/2 (t) UCL	455
Maximum Likelihood Estimate(MLE) Method	
Mean	321.9
SD	352.7
95% MLE (t) UCL	448.2
95% MLE (Tiku) UCL	440.8

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	5.268
SD	1.137
95% H-Stat (DL/2) UCL	702.1
Log ROS Method	
Mean in Log Scale	5.275
SD in Log Scale	1.121
Mean in Original Scale	330
SD in Original Scale	349.4
95% Percentile Bootstrap UCL	450.5
95% BCA Bootstrap UCL	468.3

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	1.096
Theta Star	314
nu star	48.23
A-D Test Statistic	0.363
5% A-D Critical Value	0.765
K-S Test Statistic	0.765
5% K-S Critical Value	0.19

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1400
Mean	329.2
Median	219
SD	350.1
k star	0.396
Theta star	832.2

Data Distribution Test with Detected Values Only
Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	330.9
SD	340.9
SE of Mean	72.75
95% KM (t) UCL	455.8
95% KM (z) UCL	450.5
95% KM (jackknife) UCL	455.6
95% KM (bootstrap t) UCL	504.9
95% KM (BCA) UCL	472.1
95% KM (Percentile Bootstrap) UCL	461.1
95% KM (Chebyshev) UCL	648
97.5% KM (Chebyshev) UCL	785.2
99% KM (Chebyshev) UCL	1055

Nu star	18.2	**Potential UCLs to Use**	
AppChi2	9.534	95% KM (Chebyshev) UCL	648
95% Gamma Approximate UCL	628.4		
95% Adjusted Gamma UCL	659.8		

Note: DL/2 is not a recommended method.

Lead (Pb) H: 0 - 60,000ug/L

General Statistics

Number of Valid Data	20	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	17
Number of Missing Values	3	Percent Non-Detects	85.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.7	Minimum Detected	-0.357
Maximum Detected	1	Maximum Detected	0
Mean of Detected	0.867	Mean of Detected	-0.154
SD of Detected	0.153	SD of Detected	0.183
Minimum Non-Detect	0.5	Minimum Non-Detect	-0.693
Maximum Non-Detect	5	Maximum Non-Detect	1.609

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	20
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	0
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	100.00%

Warning: There are only 3 Distinct Detected Values in this data set

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.964	Shapiro Wilk Test Statistic	0.947
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.455	Mean	-1.086
SD	0.534	SD	0.654
95% DL/2 (t) UCL	0.661	95% H-Stat (DL/2) UCL	0.512
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE method failed to converge properly		Mean in Log Scale	-1.013
		SD in Log Scale	0.534
		Mean in Original Scale	0.416
		SD in Original Scale	0.233
		95% Percentile Bootstrap UCL	0.499
		95% BCA Bootstrap UCL	0.518

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	0.312
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.726
SD	0.0784
SE of Mean	0.022
95% KM (t) UCL	0.764
95% KM (z) UCL	0.763
95% KM (jackknife) UCL	0.854
95% KM (bootstrap t) UCL	0.741
95% KM (BCA) UCL	1
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	0.822
97.5% KM (Chebyshev) UCL	0.864
99% KM (Chebyshev) UCL	0.946

Potential UCLs to Use

95% KM (t) UCL	0.764
95% KM (Percentile Bootstrap) UCL	N/A

Mercury (Hg)

General Statistics

Number of Valid Data	23	Number of Detected Data	3
Number of Distinct Detected Data	1	Number of Non-Detect Data	20
		Percent Non-Detects	86.96%

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

The data set for variable Mercury (Hg) was not processed!

Molybdenum (Mo)

General Statistics

Number of Valid Data	23	Number of Detected Data	7
Number of Distinct Detected Data	5	Number of Non-Detect Data	16
		Percent Non-Detects	69.57%

Raw Statistics	
Minimum Detected	2
Maximum Detected	50
Mean of Detected	13
SD of Detected	17.55
Minimum Non-Detect	1
Maximum Non-Detect	1

Log-transformed Statistics	
Minimum Detected	0.693
Maximum Detected	3.912
Mean of Detected	1.886
SD of Detected	1.211
Minimum Non-Detect	0
Maximum Non-Detect	0

Warning: There are only 7 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.703
5% Shapiro Wilk Critical Value	0.803

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.86
5% Shapiro Wilk Critical Value	0.803

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	4.304
SD	10.89
95% DL/2 (t) UCL	8.203
Maximum Likelihood Estimate(MLE) Method	N/A

MLE yields a negative mean

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	0.0917
SD	1.368
95% H-Stat (DL/2) UCL	3.211
Log ROS Method	
Mean in Log Scale	-1.29
SD in Log Scale	2.693
Mean in Original Scale	4.096
SD in Original Scale	10.97
95% Percentile Bootstrap UCL	8.229
95% BCA Bootstrap UCL	10.55

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.589
Theta Star	22.05
nu star	8.252
A-D Test Statistic	0.669
5% A-D Critical Value	0.732
K-S Test Statistic	0.732
5% K-S Critical Value	0.321

Data follow Appr. Gamma Distribution at 5% Significance Level

Data Distribution Test with Detected Values Only

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	5.348
SD	10.29
SE of Mean	2.318
95% KM (t) UCL	9.329

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	172.4
Mean	49.76
Median	27.28
SD	54.24
k star	0.252
Theta star	197.1
Nu star	11.61
AppChi2	4.973
95% Gamma Approximate UCL	116.2
95% Adjusted Gamma UCL	124

95% KM (z) UCL	9.161
95% KM (jackknife) UCL	8.684
95% KM (bootstrap t) UCL	22.84
95% KM (BCA) UCL	11.13
95% KM (Percentile Bootstrap) UCL	10.17
95% KM (Chebyshev) UCL	15.45
97.5% KM (Chebyshev) UCL	19.83
99% KM (Chebyshev) UCL	28.42
Potential UCLs to Use	
95% KM (t) UCL	9.329

Note: DL/2 is not a recommended method.

Nickel (Ni) H: 0 - 60,000ug/L

General Statistics

Number of Valid Data	20	Number of Detected Data	2
Number of Distinct Detected Data	2	Number of Non-Detect Data	18
Number of Missing Values	3	Percent Non-Detects	90.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	3	Minimum Detected	1.099
Maximum Detected	10	Maximum Detected	2.303
Mean of Detected	6.5	Mean of Detected	1.701
SD of Detected	4.95	SD of Detected	0.851
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

Warning: Data set has only 2 Distinct Detected Values.

This may not be adequate enough to compute meaningful and reliable test statistics and estimates.

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.

The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.

Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.

It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	1	Shapiro Wilk Test Statistic	1
5% Shapiro Wilk Critical Value	N/A	5% Shapiro Wilk Critical Value	N/A
Data not Normal at 5% Significance Level		Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	1.1
SD	2.168
95% DL/2 (t) UCL	1.938
Maximum Likelihood Estimate(MLE) Method	N/A
MLE method failed to converge properly	

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-0.454
SD	0.762
95% H-Stat (DL/2) UCL	0.987
Log ROS Method	
Mean in Log Scale	N/A
SD in Log Scale	N/A
Mean in Original Scale	N/A
SD in Original Scale	N/A
95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	0.359
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	3.35
SD	1.526
SE of Mean	0.482
95% KM (t) UCL	4.184
95% KM (z) UCL	4.144
95% KM (jackknife) UCL	N/A
95% KM (bootstrap t) UCL	N/A
95% KM (BCA) UCL	N/A
95% KM (Percentile Bootstrap) UCL	N/A
95% KM (Chebyshev) UCL	5.453
97.5% KM (Chebyshev) UCL	6.363
99% KM (Chebyshev) UCL	8.15
Potential UCLs to Use	
95% KM (t) UCL	4.184
95% KM (% Bootstrap) UCL	N/A

Phosphorus

General Statistics

Number of Valid Data	16	Number of Detected Data	15
Number of Distinct Detected Data	12	Number of Non-Detect Data	1
Number of Missing Values	7	Percent Non-Detects	6.25%

Raw Statistics	
Minimum Detected	3
Maximum Detected	98
Mean of Detected	17.47
SD of Detected	22.83
Minimum Non-Detect	2
Maximum Non-Detect	2

Log-transformed Statistics	
Minimum Detected	1.099
Maximum Detected	4.585
Mean of Detected	2.491
SD of Detected	0.788
Minimum Non-Detect	0.693
Maximum Non-Detect	0.693

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.49
5% Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level	

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.894
5% Shapiro Wilk Critical Value	0.881
Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	16.44
SD	22.43
95% DL/2 (t) UCL	26.27
Maximum Likelihood Estimate(MLE) Method	
Mean	15.63
SD	22.69
95% MLE (t) UCL	25.57
95% MLE (Tiku) UCL	24.86

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	2.335
SD	0.984
95% H-Stat (DL/2) UCL	27.05
Log ROS Method	
Mean in Log Scale	2.378
SD in Log Scale	0.886
Mean in Original Scale	16.5
SD in Original Scale	22.39
95% Percentile Bootstrap UCL	26.93
95% BCA Bootstrap UCL	32.44

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	1.244
Theta Star	14.04
nu star	37.32
A-D Test Statistic	1.245
5% A-D Critical Value	0.754
K-S Test Statistic	0.754
5% K-S Critical Value	0.226
Data not Gamma Distributed at 5% Significance Level	

Data Distribution Test with Detected Values Only
Data appear Lognormal at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	98
Mean	16.38
Median	12
SD	22.48
k star	0.349
Theta star	46.92

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	16.56
SD	21.64
SE of Mean	5.6
95% KM (t) UCL	26.38
95% KM (z) UCL	25.77
95% KM (jackknife) UCL	26.31
95% KM (bootstrap t) UCL	48.47
95% KM (BCA) UCL	27.94
95% KM (Percentile Bootstrap) UCL	27.06
95% KM (Chebyshev) UCL	40.97
97.5% KM (Chebyshev) UCL	51.53
99% KM (Chebyshev) UCL	72.28

Nu star	11.17	**Potential UCLs to Use**	
AppChi2	4.684	95% KM (Chebyshev) UCL	40.97
95% Gamma Approximate UCL	39.04		
95% Adjusted Gamma UCL	43.38		

Note: DL/2 is not a recommended method.

Selenium (Se)

General Statistics

Number of Valid Data	23	Number of Detected Data	19
Number of Distinct Detected Data	5	Number of Non-Detect Data	4
		Percent Non-Detects	17.39%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	2	Minimum Detected	0.693
Maximum Detected	50	Maximum Detected	3.912
Mean of Detected	6.947	Mean of Detected	1.226
SD of Detected	11.91	SD of Detected	1.018
Minimum Non-Detect	1	Minimum Non-Detect	0
Maximum Non-Detect	1	Maximum Non-Detect	0

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.493	Shapiro Wilk Test Statistic	0.594
5% Shapiro Wilk Critical Value	0.901	5% Shapiro Wilk Critical Value	0.901
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	5.826	Mean	0.892
SD	11.06	SD	1.183
95% DL/2 (t) UCL	9.787	95% H-Stat (DL/2) UCL	8.801
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	4.415	Mean in Log Scale	0.881
SD	12.23	SD in Log Scale	1.208
95% MLE (t) UCL	8.793	Mean in Original Scale	5.825
95% MLE (Tiku) UCL	8.63	SD in Original Scale	11.06
		95% Percentile Bootstrap UCL	9.937
		95% BCA Bootstrap UCL	11.66

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**
k star (bias corrected)	0.734	**Data do not follow a Discernable Distribution (0.05)**
Theta Star	9.472	
nu star	27.87	

A-D Test Statistic	3.963
5% A-D Critical Value	0.776
K-S Test Statistic	0.776
5% K-S Critical Value	0.206

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	50
Mean	5.739
Median	2
SD	11.11
k star	0.18
Theta star	31.93
Nu star	8.269
AppChi2	2.892
95% Gamma Approximate UCL	16.41
95% Adjusted Gamma UCL	17.8

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	6.087
SD	10.71
SE of Mean	2.293
95% KM (t) UCL	10.02
95% KM (z) UCL	9.859
95% KM (jackknife) UCL	10.01
95% KM (bootstrap t) UCL	15.21
95% KM (BCA) UCL	10.87
95% KM (Percentile Bootstrap) UCL	10.26
95% KM (Chebyshev) UCL	16.08
97.5% KM (Chebyshev) UCL	20.41
99% KM (Chebyshev) UCL	28.91

Potential UCLs to Use

97.5% KM (Chebyshev) UCL	20.41

Silver (Ag)

General Statistics

Number of Valid Data	23	Number of Detected Data	19
Number of Distinct Detected Data	4	Number of Non-Detect Data	4
		Percent Non-Detects	17.39%

Raw Statistics

Minimum Detected	0.04
Maximum Detected	1
Mean of Detected	0.207
SD of Detected	0.288
Minimum Non-Detect	0.02
Maximum Non-Detect	0.02

Log-transformed Statistics

Minimum Detected	-3.219
Maximum Detected	0
Mean of Detected	-2.035
SD of Detected	0.817
Minimum Non-Detect	-3.912
Maximum Non-Detect	-3.912

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.46
5% Shapiro Wilk Critical Value	0.901

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.583
5% Shapiro Wilk Critical Value	0.901

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.173
SD	0.272
95% DL/2 (t) UCL	0.27
Maximum Likelihood Estimate(MLE) Method	
Mean	0.14
SD	0.302
95% MLE (t) UCL	0.248
95% MLE (Tiku) UCL	0.245

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-2.482
SD	1.24
95% H-Stat (DL/2) UCL	0.307
Log ROS Method	
Mean in Log Scale	-2.296
SD in Log Scale	0.946
Mean in Original Scale	0.177
SD in Original Scale	0.27
95% Percentile Bootstrap UCL	0.272
95% BCA Bootstrap UCL	0.316

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.064
Theta Star	0.195
nu star	40.42
A-D Test Statistic	4.62
5% A-D Critical Value	0.764
K-S Test Statistic	0.764
5% K-S Critical Value	0.203

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	1
Mean	0.172
Median	0.1
SD	0.273
k star	0.247
Theta star	0.696
Nu star	11.35
AppChi2	4.803
95% Gamma Approximate UCL	0.406
95% Adjusted Gamma UCL	0.433

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.178
SD	0.263
SE of Mean	0.0563
95% KM (t) UCL	0.275
95% KM (z) UCL	0.271
95% KM (jackknife) UCL	0.268
95% KM (bootstrap t) UCL	0.488
95% KM (BCA) UCL	0.283
95% KM (Percentile Bootstrap) UCL	0.28
95% KM (Chebyshev) UCL	0.424
97.5% KM (Chebyshev) UCL	0.53
99% KM (Chebyshev) UCL	0.738

Potential UCLs to Use

95% KM (Chebyshev) UCL	0.424

Thallium (Tl)

General Statistics

Number of Valid Data	23	Number of Detected Data	13
Number of Distinct Detected Data	9	Number of Non-Detect Data	10
		Percent Non-Detects	43.48%

Raw Statistics	
Minimum Detected	0.05
Maximum Detected	10
Mean of Detected	1.256
SD of Detected	2.835
Minimum Non-Detect	0.05
Maximum Non-Detect	0.05

Log-transformed Statistics	
Minimum Detected	-2.996
Maximum Detected	2.303
Mean of Detected	-1.352
SD of Detected	1.643
Minimum Non-Detect	-2.996
Maximum Non-Detect	-2.996

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.492
5% Shapiro Wilk Critical Value	0.866
Data not Normal at 5% Significance Level	

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.85
5% Shapiro Wilk Critical Value	0.866
Data not Lognormal at 5% Significance Level	

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.721
SD	2.185
95% DL/2 (t) UCL	1.503
Maximum Likelihood Estimate(MLE) Method	N/A
MLE yields a negative mean	

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-2.368
SD	1.695
95% H-Stat (DL/2) UCL	0.516
Log ROS Method	
Mean in Log Scale	-3.264
SD in Log Scale	2.687
Mean in Original Scale	0.713
SD in Original Scale	2.188
95% Percentile Bootstrap UCL	1.571
95% BCA Bootstrap UCL	2.034

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	0.37
Theta Star	3.397
nu star	9.616
A-D Test Statistic	1.629
5% A-D Critical Value	0.807
K-S Test Statistic	0.807
5% K-S Critical Value	0.253
Data not Gamma Distributed at 5% Significance Level	

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	10
Mean	0.902
Median	0.2
SD	2.183
k star	0.141
Theta star	6.388

Data Distribution Test with Detected Values Only
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.732
SD	2.134
SE of Mean	0.463
95% KM (t) UCL	1.527
95% KM (z) UCL	1.493
95% KM (jackknife) UCL	1.509
95% KM (bootstrap t) UCL	8.471
95% KM (BCA) UCL	1.559
95% KM (Percentile Bootstrap) UCL	1.56
95% KM (Chebyshev) UCL	2.75
97.5% KM (Chebyshev) UCL	3.623
99% KM (Chebyshev) UCL	5.339

Nu star	6.492	**Potential UCLs to Use**	
AppChi2	1.896	99% KM (Chebyshev) UCL	5.339
95% Gamma Approximate UCL	3.087		
95% Adjusted Gamma UCL	3.399		

Note: DL/2 is not a recommended method.

Tungsten

General Statistics

Number of Valid Data	16	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	15
Number of Missing Values	7	Percent Non-Detects	93.75%

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

The data set for variable Tungsten was not processed!

Uranium (U)

General Statistics

Number of Valid Data	23	Number of Detected Data	15
Number of Distinct Detected Data	8	Number of Non-Detect Data	8
		Percent Non-Detects	34.78%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.2	Minimum Detected	-1.609
Maximum Detected	10	Maximum Detected	2.303
Mean of Detected	1.273	Mean of Detected	-0.728
SD of Detected	2.599	SD of Detected	1.201
Minimum Non-Detect	0.1	Minimum Non-Detect	-2.303
Maximum Non-Detect	0.1	Maximum Non-Detect	-2.303

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.476	Shapiro Wilk Test Statistic	0.767
5% Shapiro Wilk Critical Value	0.881	5% Shapiro Wilk Critical Value	0.881
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	0.848	Mean	-1.517
SD	2.157	SD	1.462
95% DL/2 (t) UCL	1.62	95% H-Stat (DL/2) UCL	0.832

Maximum Likelihood Estimate(MLE) Method	
Mean	0.0952
SD	2.772
95% MLE (t) UCL	1.088
95% MLE (Tiku) UCL	1.166

Log ROS Method	
Mean in Log Scale	-1.739
SD in Log Scale	1.769
Mean in Original Scale	0.842
SD in Original Scale	2.159
95% Percentile Bootstrap UCL	1.632
95% BCA Bootstrap UCL	2.264

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.55
Theta Star	2.314
nu star	16.51
A-D Test Statistic	2.1
5% A-D Critical Value	0.784
K-S Test Statistic	0.784
5% K-S Critical Value	0.232

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	10
Mean	0.877
Median	0.2
SD	2.15
k star	0.162
Theta star	5.433
Nu star	7.429
AppChi2	2.409
95% Gamma Approximate UCL	2.706
95% Adjusted Gamma UCL	2.954

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.9
SD	2.091
SE of Mean	0.451
95% KM (t) UCL	1.675
95% KM (z) UCL	1.642
95% KM (jackknife) UCL	1.665
95% KM (bootstrap t) UCL	6.994
95% KM (BCA) UCL	1.691
95% KM (Percentile Bootstrap) UCL	1.709
95% KM (Chebyshev) UCL	2.867
97.5% KM (Chebyshev) UCL	3.718
99% KM (Chebyshev) UCL	5.39

Potential UCLs to Use

97.5% KM (Chebyshev) UCL 3.718

Vanadium (V)

General Statistics

Number of Valid Data	23
Number of Distinct Detected Data	5

Number of Detected Data	14
Number of Non-Detect Data	9
Percent Non-Detects	39.13%

Raw Statistics

Minimum Detected	2
Maximum Detected	50
Mean of Detected	8.786
SD of Detected	12.74
Minimum Non-Detect	1
Maximum Non-Detect	1

Log-transformed Statistics

Minimum Detected	0.693
Maximum Detected	3.912
Mean of Detected	1.661
SD of Detected	0.921
Minimum Non-Detect	0
Maximum Non-Detect	0

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.538
5% Shapiro Wilk Critical Value	0.874

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	5.543
SD	10.63
95% DL/2 (t) UCL	9.35
Maximum Likelihood Estimate(MLE) Method	
Mean	1.258
SD	14.47
95% MLE (t) UCL	6.439
95% MLE (Tiku) UCL	7.038

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.922
Theta Star	9.53
nu star	25.81
A-D Test Statistic	1.562
5% A-D Critical Value	0.758
K-S Test Statistic	0.758
5% K-S Critical Value	0.235

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	50
Mean	6.916
Median	5
SD	10.37
k star	0.225
Theta star	30.75
Nu star	10.35
AppChi2	4.159
95% Gamma Approximate UCL	17.2
95% Adjusted Gamma UCL	18.45

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.825
5% Shapiro Wilk Critical Value	0.874

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	0.74
SD	1.371
95% H-Stat (DL/2) UCL	9.703
Log ROS Method	
Mean in Log Scale	0.763
SD in Log Scale	1.407
Mean in Original Scale	5.596
SD in Original Scale	10.61
95% Percentile Bootstrap UCL	9.489
95% BCA Bootstrap UCL	11.42

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	6.13
SD	10.14
SE of Mean	2.193
95% KM (t) UCL	9.896
95% KM (z) UCL	9.738
95% KM (jackknife) UCL	9.841
95% KM (bootstrap t) UCL	21.38
95% KM (BCA) UCL	10.13
95% KM (Percentile Bootstrap) UCL	10
95% KM (Chebyshev) UCL	15.69
97.5% KM (Chebyshev) UCL	19.83
99% KM (Chebyshev) UCL	27.95

Potential UCLs to Use

95% KM (BCA) UCL	10.13

Zinc (Zn)

General Statistics

Number of Valid Data	23	Number of Detected Data	5
Number of Distinct Detected Data	5	Number of Non-Detect Data	18
		Percent Non-Detects	78.26%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	6	Minimum Detected	1.792
Maximum Detected	50	Maximum Detected	3.912
Mean of Detected	19.22	Mean of Detected	2.586
SD of Detected	18.92	SD of Detected	0.941
Minimum Non-Detect	5	Minimum Non-Detect	1.609
Maximum Non-Detect	5	Maximum Non-Detect	1.609

Warning: There are only 5 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough tp draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.798	Shapiro Wilk Test Statistic	0.863
5% Shapiro Wilk Critical Value	0.762	5% Shapiro Wilk Critical Value	0.762
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	6.135	Mean	1.279
SD	10.72	SD	0.81
95% DL/2 (t) UCL	9.971	95% H-Stat (DL/2) UCL	5.545
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	-0.805
		SD in Log Scale	2.448
		Mean in Original Scale	4.584
		SD in Original Scale	11.3
		95% Percentile Bootstrap UCL	8.781
		95% BCA Bootstrap UCL	10.78

Gamma Distribution Test with Detected Values Only		Data Distribution Test with Detected Values Only
k star (bias corrected)	0.731	Data appear Normal at 5% Significance Level
Theta Star	26.28	
nu star	7.313	

A-D Test Statistic	0.483
5% A-D Critical Value	0.686
K-S Test Statistic	0.686
5% K-S Critical Value	0.362

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	1E-09
Maximum	279.4
Mean	99.65
Median	71.6
SD	90.44
k star	0.384
Theta star	259.5
Nu star	17.67
AppChi2	9.152
95% Gamma Approximate UCL	192.4
95% Adjusted Gamma UCL	202.2

Note: DL/2 is not a recommended method.

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	8.874
SD	9.592
SE of Mean	2.236
95% KM (t) UCL	12.71
95% KM (z) UCL	12.55
95% KM (jackknife) UCL	12.32
95% KM (bootstrap t) UCL	37.57
95% KM (BCA) UCL	26.09
95% KM (Percentile Bootstrap) UCL	14.35
95% KM (Chebyshev) UCL	18.62
97.5% KM (Chebyshev) UCL	22.84
99% KM (Chebyshev) UCL	31.12

Potential UCLs to Use

95% KM (t) UCL	12.71
95% KM (Percentile Bootstrap) UCL	14.35

Zirconium

General Statistics

Number of Valid Data	16	Number of Detected Data	1
Number of Distinct Detected Data	1	Number of Non-Detect Data	15
Number of Missing Values	7	Percent Non-Detects	93.75%

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

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Zirconium was not processed!

APPENDIX D

Model Print-Outs – Ecological Risk Assessment

Risk Quotient Calculations for Media - all contaminants except PHCs

Site_Name	Medium_Name	Chemical	PHC_fraction	Concentration	Concentration_Units	TRV_value	TRV_Unit	Receptor Type	Risk Quotient
Iqaluit Landfill	Soil	Cadmium	NA	2.777	mg/kg	12	mg/kg	NA	0.231416667
Iqaluit Landfill	Soil	Zinc	NA	122.5	mg/kg	400	mg/kg	NA	0.30625
Iqaluit Landfill	Sediment (Brackish)	Barium	NA	20.21	mg/kg	20	mg/kg	NA	1.0105
Iqaluit Landfill	Surface Water (Brackish)	Cadmium	NA	0.001	mg/L	0.0093	mg/L	NA	0.107526882
Iqaluit Landfill	Surface Water (Fresh)	Cadmium	NA	0.000129	mg/L	0.0022	mg/L	NA	0.058636364
Iqaluit Landfill	Surface Water (Fresh)	Chromium 6+	NA	0.0037	mg/L	0.011	mg/L	NA	0.336363636
Iqaluit Landfill	Surface Water (Brackish)	Copper	NA	0.0057	mg/L	0.0031	mg/L	NA	1.838709677
Iqaluit Landfill	Surface Water (Fresh)	Copper	NA	0.004	mg/L	0.009	mg/L	NA	0.444444444
Iqaluit Landfill	Sediment (Brackish)	Lead	NA	25.83	mg/kg	21	mg/kg	NA	1.23
Iqaluit Landfill	Surface Water (Brackish)	Mercury	NA	0.0001	mg/L	0.00094	mg/L		0.106382979
Iqaluit Landfill	Surface Water (Brackish)	Anthracene	NA	0.00005	mg/L	0.0001	mg/L	NA	0.5
Iqaluit Landfill	Surface Water (Brackish)	Pyrene	NA	0.00005	mg/L	0.0004	mg/L	NA	0.125
Iqaluit Landfill	Surface Water (Brackish)	cis-1,2-Dichloroethene	NA	0.004	mg/L	11.6	mg/L	NA	0.000344828
Iqaluit Landfill	Surface Water (Brackish)	PCBs	NA	0.001	mg/L	0.000014	mg/L	NA	71.42857143
Iqaluit Landfill	Surface Water (Brackish)	Lindane (gamma HCH)	NA	0.00005	mg/L	0.00008	mg/L	NA	0.625
Iqaluit Landfill	Surface Water (Brackish)	DDT total	NA	0.000005	mg/L	0.000001	mg/L	NA	5
Iqaluit Landfill	Surface Water (Brackish)	Endrin	NA	0.0002	mg/L	0.000036	mg/L	NA	5.555555556
Iqaluit Landfill	Surface Water (Fresh)	Zinc	NA	0.026	mg/L	0.12	mg/L	NA	0.216666667
Iqaluit Landfill	Surface Water (Fresh)	Aluminum	NA	0.119	mg/L	0.087	mg/L	NA	1.367816092
Iqaluit Landfill	Soil	Aluminum	NA	4677	mg/kg	50	mg/kg	Plant	93.54
Iqaluit Landfill	Surface Water (Fresh)	Iron	NA	3.5	mg/L	1	mg/L	NA	3.5
Iqaluit Landfill	Surface Water (Brackish)	Iron	NA	0.648	mg/L	1	mg/L	NA	0.648
Iqaluit Landfill	Surface Water (Brackish)	Magnesium	NA	248	mg/L	82	mg/L	NA	3.024390244
Iqaluit Landfill	Surface Water (Brackish)	Sodium	NA	2080	mg/L	680	mg/L	NA	3.058823529
Iqaluit Landfill	Sediment (Brackish)	PCBs	NA	0.09	mg/kg	0.0227	mg/kg	NA	3.964757709
Iqaluit Landfill	Sediment (Brackish)	Chromium 6+	NA	0.8	mg/kg	8.1	mg/kg	NA	0.098765432
Iqaluit Landfill	Sediment (Brackish)	Iron	NA	29778	mg/kg	20000	mg/kg	NA	1.4889

Calculation of Risk Quotients for Site Media - PHCs

Site_Name	Medium_Name	PHC_fraction	Sum Of Concentration (mg/kg soil or mg/L water)	Receptor_Type	TRV_value (mg/kg soil or mg/L water)	Risk Quotient
Iqaluit Landfill	Soil	F2	143.4	Plant	1370	0.104671533
Iqaluit Landfill	Soil	F2	143.4	Invertebrate	1470	0.09755102
Iqaluit Landfill	Soil	F3	15457	Plant	2100	7.36047619
Iqaluit Landfill	Soil	F3	15457	Invertebrate	2000	7.7285
Iqaluit Landfill	Soil	F4	1680	Invertebrate	2800	0.6
Iqaluit Landfill	Surface Water (Fresh)	F2	0.3	NA	0.0152	19.73684211

Calculation of Hazard Quotients - Prey Species (except PHCs)

Chemical_Class	Chemical	Prey_Item	Sum Of Exposure - Prey (mg/d)	Time On Site (proportion)	Total Ingestion - Prey (mg/d)	Total Intake - Prey (mg/kg-d)	Receptor Type	TRV_value (mg/kg-d)	Hazard Quotient - Prey
Metals/Inorganics	Aluminum	Snowshoe Hare	33.390542	0.90625	30.26017869	21.61441335	Mammal	19.3	1.11991779
Metals/Inorganics	Aluminum	ST_Shrew	12.05077674	1	12.05077674	803.385116	Mammal	19.3	41.62617181
Metals/Inorganics	Aluminum	Caribou	1125.017457	0.00029	0.326255063	0.003107191	Mammal	19.3	0.000160994
Metals/Inorganics	Aluminum	Robin	38.26027432	0.5	19.13013716	248.4433397	Bird	1100	0.225857582
Metals/Inorganics	Aluminum	Meadow Vole	0.908052	1	0.908052	20.63754545	Mammal	19.3	1.069302873
Metals/Inorganics	Aluminum	Deer_Mouse	2.8852496	1	2.8852496	131.1477091	Mammal	19.3	6.795218088
PAHs	Anthracene	Muscrat	0.000006	1	0.000006	0.000005	Mammal	1000	0.000000005
Metals/Inorganics	Barium	Merganser	0.038315	0.02	0.0007663	0.000934512	Bird	41.7	2.24104E-05
Metals/Inorganics	Barium	Muscrat	4534.131456	1	4534.131456	3778.44288	Mammal	19.8	190.8304485
Metals/Inorganics	Barium	Mallard	799.6352389	0.02	15.99270478	14.80805998	Bird	41.7	0.355109352
VOCs	Bromoform	Snowshoe Hare	0.003313	0.90625	0.003002406	0.002144576	Mammal	50	4.28915E-05
VOCs	Bromoform	Caribou	0.034044301	0.00029	9.87285E-06	9.40271E-08	Mammal	50	1.88054E-09
VOCs	Bromoform	Deer_Mouse	0.002881965	1	0.002881965	0.130998404	Mammal	50	0.002619968
VOCs	Bromoform	Meadow Vole	0.000668665	1	0.000668665	0.015196927	Mammal	50	0.000303939
VOCs	Bromoform	ST_Shrew	0.007205922	1	0.007205922	0.480394816	Mammal	50	0.009607896
Metals/Inorganics	Cadmium	Muscrat	0.00012	1	0.00012	0.0001	Mammal	10	0.00001
Metals/Inorganics	Cadmium	Snowshoe Hare	0.053823922	0.90625	0.048777929	0.034841378	Mammal	10	0.003484138
Metals/Inorganics	Cadmium	ST_Shrew	0.022848526	1	0.022848526	1.523235096	Mammal	10	0.15232351
Metals/Inorganics	Cadmium	Caribou	0.706730194	0.00029	0.000204952	1.95192E-06	Mammal	10	1.95192E-07
Metals/Inorganics	Cadmium	Merganser	0.334763	0.02	0.00669526	0.008164951	Bird	20	0.000408248
Metals/Inorganics	Cadmium	Meadow Vole	0.005801927	1	0.005801927	0.131861977	Mammal	10	0.013186198
Metals/Inorganics	Cadmium	Mallard	0.00006	0.02	0.0000012	1.11111E-06	Bird	20	5.55556E-08
Metals/Inorganics	Cadmium	Robin	0.089845309	0.5	0.044922655	0.5834111	Bird	20	0.029170555
Metals/Inorganics	Cadmium	Deer_Mouse	0.009197385	1	0.009197385	0.418062936	Mammal	10	0.041806294
Metals/Inorganics	Chromium 6+	Mallard	0.060265	0.02	0.0012053	0.001116019	Bird	5	0.000223204
Metals/Inorganics	Chromium 6+	Snowshoe Hare	0.000481	0.90625	0.000435906	0.000311362	Mammal	27400	1.13636E-08
Metals/Inorganics	Chromium 6+	Deer_Mouse	0.0000148	1	0.0000148	0.000672727	Mammal	27400	2.45521E-08
Metals/Inorganics	Chromium 6+	Robin	0.0000518	0.5	0.0000259	0.000336364	Bird	5	6.72727E-05
Metals/Inorganics	Chromium 6+	Caribou	0.03515	0.00029	1.01935E-05	9.7081E-08	Mammal	27400	3.5431E-12
Metals/Inorganics	Chromium 6+	ST_Shrew	0.00001221	1	0.00001221	0.000814	Mammal	27400	2.9708E-08
Metals/Inorganics	Chromium 6+	Merganser	0.00124	0.02	0.0000248	3.02439E-05	Bird	5	6.04878E-06
Metals/Inorganics	Chromium 6+	Muscrat	0.00522348	1	0.00522348	0.0043529	Mammal	27400	1.58865E-07
Metals/Inorganics	Chromium 6+	Meadow Vole	0.0000222	1	0.0000222	0.000504545	Mammal	27400	1.84141E-08
VOCs	cis-1,2-Dichloroethene	Muscrat	0.00048	1	0.00048	0.0004	Mammal	452	8.84956E-07
Metals/Inorganics	Copper	Deer_Mouse	0.000016	1	0.000016	0.000727273	Mammal	15.4	4.72255E-05
Metals/Inorganics	Copper	ST_Shrew	0.0000132	1	0.0000132	0.00088	Mammal	15.4	5.71429E-05
Metals/Inorganics	Copper	Snowshoe Hare	0.00052	0.90625	0.00047125	0.000336607	Mammal	15.4	2.18576E-05
Metals/Inorganics	Copper	Muscrat	0.000684	1	0.000684	0.00057	Mammal	15.4	3.7013E-05
Metals/Inorganics	Copper	Merganser	1.493799	0.02	0.02987598	0.036434122	Bird	61.7	0.000590504
Metals/Inorganics	Copper	Mallard	0.000342	0.02	0.00000684	6.33333E-06	Bird	61.7	1.02647E-07
Metals/Inorganics	Copper	Robin	0.000056	0.5	0.000028	0.000363636	Bird	61.7	5.89362E-06
Metals/Inorganics	Copper	Meadow Vole	0.000024	1	0.000024	0.000545455	Mammal	15.4	3.54191E-05
Metals/Inorganics	Copper	Caribou	0.038	0.00029	0.00001102	1.04952E-07	Mammal	15.4	6.81509E-09
pest/herb	DDT total	Merganser	0.0144283	0.02	0.000288566	0.00035191	Bird	280	1.25682E-06
pest/herb	DDT total	Muscrat	0.0000006	1	0.0000006	0.0000005	Mammal	4	0.000000125

Calculation of Hazard Quotients - Prey Species (except PHCs)

Chemical_Class	Chemical	Prey_Item	Sum Of Exposure - Prey (mg/d)	Time On Site (proportion)	Total Ingestion - Prey (mg/d)	Total Intake - Prey (mg/kg-d)	Receptor Type	TRV_value (mg/kg-d)	Hazard Quotient - Prey
pest/herb	DDT total	Mallard	0.0000003	0.02	0.000000006	5.55556E-09	Bird	280	1.98413E-11
pest/herb	Endrin	Muscrat	0.000024	1	0.000024	0.00002	Mammal	0.92	2.17391E-05
pest/herb	Endrin	Merganser	0.532114	0.02	0.01064228	0.01297839	Bird	0.1	0.129783902
pest/herb	Endrin	Mallard	0.000012	0.02	0.00000024	2.22222E-07	Bird	0.1	2.22222E-06
Metals/Inorganics	Lead	Merganser	0.038825	0.02	0.0007765	0.000946951	Bird	11.3	8.3801E-05
Metals/Inorganics	Lead	Muscrat	0.906375882	1	0.906375882	0.755313235	Mammal	80	0.009441415
Metals/Inorganics	Lead	Mallard	1.25475225	0.02	0.025095045	0.023236153	Bird	11.3	0.002056297
pest/herb	Lindane (gamma HCH)	Merganser	0.01736545	0.02	0.000347309	0.000423548	Bird	20	2.11774E-05
pest/herb	Lindane (gamma HCH)	Muscrat	0.000006	1	0.000006	0.000005	Mammal	80	6.25E-08
pest/herb	Lindane (gamma HCH)	Mallard	0.000003	0.02	0.00000006	5.55556E-08	Bird	20	2.77778E-09
Metals/Inorganics	Manganese	Merganser	0.00832	0.02	0.0001664	0.000202927	Bird	9770	2.07704E-08
Metals/Inorganics	Manganese	Muscrat	0.01248	1	0.01248	0.0104	Mammal	284	3.66197E-05
Metals/Inorganics	Manganese	Mallard	0.00624	0.02	0.0001248	0.000115556	Bird	9770	1.18276E-08
Metals/Inorganics	Mercury	Muscrat	0.000012	1	0.000012	0.00001	Mammal	10	0.000001
Metals/Inorganics	Mercury	Merganser	0.130265	0.02	0.0026053	0.003177195	Bird	0.9	0.003530217
Metals/Inorganics	Mercury	Mallard	0.000006	0.02	0.00000012	1.11111E-07	Bird	0.9	1.23457E-07
PCBs	PCBs	Mallard	0.009213	0.02	0.00018426	0.000170611	Bird	1.8	9.4784E-05
PCBs	PCBs	Merganser	6.051815	0.02	0.1210363	0.147605244	Bird	1.8	0.082002913
PCBs	PCBs	Muscrat	0.000825744	1	0.000825744	0.00068812	Mammal	0.1	0.0068812
PAHs	Pyrene	Muscrat	0.000006	1	0.000006	0.000005	Mammal	750	6.66667E-09
pest/herb	Toxaphene	Muscrat	0.000024	1	0.000024	0.00002	Mammal	80	0.00000025
pest/herb	Toxaphene	ST_Shrew	0.0000033	1	0.0000033	0.00022	Mammal	80	0.00000275
pest/herb	Toxaphene	Snowshoe Hare	0.00013	0.90625	0.000117813	8.41518E-05	Mammal	80	1.0519E-06
pest/herb	Toxaphene	Merganser	0.376396	0.02	0.00752792	0.00918039	Bird	10	0.000918039
pest/herb	Toxaphene	Deer_Mouse	0.000004	1	0.000004	0.000181818	Mammal	80	2.27273E-06
pest/herb	Toxaphene	Meadow Vole	0.000006	1	0.000006	0.000136364	Mammal	80	1.70455E-06
pest/herb	Toxaphene	Robin	0.000014	0.5	0.000007	9.09091E-05	Bird	10	9.09091E-06
pest/herb	Toxaphene	Mallard	0.000012	0.02	0.00000024	2.22222E-07	Bird	10	2.22222E-08
pest/herb	Toxaphene	Caribou	0.0095	0.00029	0.000002755	2.62381E-08	Mammal	80	3.27976E-10
VOCs	Trichloroethene	Muscrat	0.002712	1	0.002712	0.00226	Mammal	7	0.000322857
Metals/Inorganics	Vanadium	Mallard	1866.208924	0.02	37.32417848	34.55942452	Bird	114	0.303152847
Metals/Inorganics	Vanadium	Merganser	0.537994	0.02	0.01075988	0.013121805	Bird	114	0.000115104
Metals/Inorganics	Zinc	ST_Shrew	0.5786778	1	0.5786778	38.57852	Mammal	320	0.120557875
Metals/Inorganics	Zinc	Deer_Mouse	0.176504	1	0.176504	8.022909091	Mammal	320	0.025071591
Metals/Inorganics	Zinc	Meadow Vole	0.032006	1	0.032006	0.727409091	Mammal	320	0.002273153
Metals/Inorganics	Zinc	Caribou	29.66513303	0.00029	0.008602889	8.19323E-05	Mammal	320	2.56038E-07
Metals/Inorganics	Zinc	Snowshoe Hare	0.86088	0.90625	0.7801725	0.557266071	Mammal	320	0.001741456
Metals/Inorganics	Zinc	Robin	9.880381	0.5	4.9401905	64.15831818	Bird	130.9	0.490132301

Calculaiton of Exposure of Predators to PHCs via Ingestion

PHC fraction	Prey Item	Sum of Exposure - Prey (mg/d)	Total Ingestion by Prey (mg/d) * time on site	Predator	Total Ingestion Rate (of food, water, soil, sediment) (kg/d)	Proportion consumed	Exposure - Predator (mg/d)
F2	Water_PF	0.3	0.3	Arctic Fox	0.38	1	0.114
F2	Meadow Vole	0.135261995	0.135261995	Arctic Fox	0.45	90	5.478110805
F2	Soil_P	143.4	143.4	Arctic Fox	0.0126	1	1.80684
F3	Soil_P	15457	15457	Arctic Fox	0.0126	1	194.7582
F3	Meadow Vole	17.66350741	17.66350741	Arctic Fox	0.45	90	715.3720503
F3	Water_PF	0.55	0.55	Arctic Fox	0.38	1	0.209
F4	Soil_P	1680	1680	Arctic Fox	0.0126	1	21.168
F4	Meadow Vole	248.7114955	248.7114955	Arctic Fox	0.45	90	10072.81557
F4	Water_PF	0.23	0.23	Arctic Fox	0.38	1	0.0874
F2	Soil_P	143.4	143.4	Grey Wolf	0.046	1	6.5964
F2	Snowshoe Hare	1.44016886	1.305153029	Grey Wolf	5.456	0.277	1.972493435
F2	Caribou	37.73368234	0.010942768	Grey Wolf	5.456	0.578	0.034508763
F2	Water_PF	0.3	0.3	Grey Wolf	2.9	1	0.87
F3	Water_PF	0.55	0.55	Grey Wolf	2.9	1	1.595
F3	Caribou	3730.832308	1.081941369	Grey Wolf	5.456	0.578	3.41197568
F3	Snowshoe Hare	120.4101825	109.1217279	Grey Wolf	5.456	0.277	164.9169769
F3	Soil_P	15457	15457	Grey Wolf	0.046	1	711.022
F4	Soil_P	1680	1680	Grey Wolf	0.046	1	77.28
F4	Snowshoe Hare	11.8401199	10.73010866	Grey Wolf	5.456	0.277	16.21654198
F4	Caribou	405.6780143	0.117646624	Grey Wolf	5.456	0.578	0.371006629
F4	Water_PF	0.23	0.23	Grey Wolf	2.9	1	0.667
F2	Snowshoe Hare	1.44016886	1.305153029	Mink	0.218	0.05	0.014226168
F3	Muscrat	8.553041363	8.553041363	Mink	0.218	0.1	0.186456302
F3	Snowshoe Hare	120.4101825	109.1217279	Mink	0.218	0.05	1.189426834
F3	Mallard	247.6098052	4.952196104	Mink	0.218	0.05	0.053978938
F4	Snowshoe Hare	11.8401199	10.73010866	Mink	0.218	0.05	0.116958184
F4	Mallard	52172.06599	1043.44132	Mink	0.218	0.05	11.37351038
F4	Muscrat	1163.27981	1163.27981	Mink	0.218	0.1	25.35949985
F2	Meadow Vole	0.135261995	0.135261995	Red Fox	0.45	0.22	0.013390938
F2	ST_Shrew	1.741359441	1.741359441	Red Fox	0.45	0.22	0.172394585
F2	Deer_Mouse	0.634829567	0.634829567	Red Fox	0.45	0.22	0.062848127
F2	Water_PF	0.3	0.3	Red Fox	0.38	1	0.114
F2	Soil_P	143.4	143.4	Red Fox	0.0126	1	1.80684
F2	Snowshoe Hare	1.44016886	1.305153029	Red Fox	0.45	0.22	0.12921015
F3	Soil_P	15457	15457	Red Fox	0.0126	1	194.7582
F3	Water_PF	0.55	0.55	Red Fox	0.38	1	0.209

Calculaiton of Exposure of Predators to PHCs via Ingestion

PHC fraction	Prey Item	Sum of Exposure - Prey (mg/d)	Total Ingestion by Prey (mg/d) * time on site	Predator	Total Ingestion Rate (of food, water, soil, sediment) (kg/d)	Proportion consumed	Exposure - Predator (mg/d)
F3	Meadow Vole	17.66350741	17.66350741	Red Fox	0.45	0.22	1.748687234
F3	ST_Shrew	377.1305955	377.1305955	Red Fox	0.45	0.22	37.33592895
F3	Snowshoe Hare	120.4101825	109.1217279	Red Fox	0.45	0.22	10.80305106
F3	Deer_Mouse	140.1999943	140.1999943	Red Fox	0.45	0.22	13.87979944
F4	Soil_P	1680	1680	Red Fox	0.0126	1	21.168
F4	Snowshoe Hare	11.8401199	10.73010866	Red Fox	0.45	0.22	1.062280758
F4	ST_Shrew	6309.050288	6309.050288	Red Fox	0.45	0.22	624.5959786
F4	Meadow Vole	248.7114955	248.7114955	Red Fox	0.45	0.22	24.62243806
F4	Water_PF	0.23	0.23	Red Fox	0.38	1	0.0874
F4	Deer_Mouse	2435.475349	2435.475349	Red Fox	0.45	0.22	241.1120595
F2	Deer_Mouse	0.634829567	0.634829567	Red-Tailed Hawk	0.0987	0.24	0.015037843
F2	Robin	7.432489705	3.716244853	Red-Tailed Hawk	0.0987	0.1	0.036679337
F2	Water_PF	0.3	0.3	Red-Tailed Hawk	0.0672	1	0.02016
F2	ST_Shrew	1.741359441	1.741359441	Red-Tailed Hawk	0.0987	0.24	0.041249322
F2	Snowshoe Hare	1.44016886	1.305153029	Red-Tailed Hawk	0.0987	0.26	0.033492837
F2	Soil_P	143.4	143.4	Red-Tailed Hawk	1.8	1	258.12
F3	Soil_P	15457	15457	Red-Tailed Hawk	1.8	1	27822.6
F3	Water_PF	0.55	0.55	Red-Tailed Hawk	0.0672	1	0.03696
F3	Deer_Mouse	140.1999943	140.1999943	Red-Tailed Hawk	0.0987	0.24	3.321057465
F3	Mallard	247.6098052	4.952196104	Red-Tailed Hawk	0.0987	0.16	0.078205081
F3	ST_Shrew	377.1305955	377.1305955	Red-Tailed Hawk	0.0987	0.24	8.933469546
F3	Snowshoe Hare	120.4101825	109.1217279	Red-Tailed Hawk	0.0987	0.26	2.800281782
F3	Robin	1700.919235	850.4596176	Red-Tailed Hawk	0.0987	0.1	8.394036426
F4	Soil_P	1680	1680	Red-Tailed Hawk	1.8	1	3024
F4	Water_PF	0.23	0.23	Red-Tailed Hawk	0.0672	1	0.015456
F4	Deer_Mouse	2435.475349	2435.475349	Red-Tailed Hawk	0.0987	0.24	57.69154006
F4	Robin	29584.47703	14792.23851	Red-Tailed Hawk	0.0987	0.1	145.9993941
F4	Mallard	52172.06599	1043.44132	Red-Tailed Hawk	0.0987	0.16	16.47802532
F4	ST_Shrew	6309.050288	6309.050288	Red-Tailed Hawk	0.0987	0.24	149.4487832
F4	Snowshoe Hare	11.8401199	10.73010866	Red-Tailed Hawk	0.0987	0.26	0.275356049

Calculation of Hazard Quotients for Predators - PHCs

Chemical_ID	Chemical	Predator	Sum of Exposure - Predator (mg/d)	Time On Site (proportion)	Total Ingestion - Predator (mg/d)	Total Intake - Predator (mg/kg-d)	Receptor_Type	TRV_value (mg/kg-d)	Hazard Quotient - Predator
79	Aluminum	Arctic Fox	95.751526	0.029	2.776794254	1.110717702	Mammal	19.3	0.05755014
79	Aluminum	Grey Wolf	262.2485387	0.000312	0.081821544	0.001902827	Mammal	19.3	9.85921E-05
79	Aluminum	Red-Tailed Hawk	8419.927153	0.010357	87.20518552	77.17273055	Bird	1100	0.070157028
79	Aluminum	Mink	0.329835948	0.5	0.164917974	0.164917974	Mammal	19.3	0.008544973
39	Anthracene	Mink	0.012656339	0.5	0.00632817	0.00632817	Mammal	1000	6.32817E-06
6	Barium	Red-Tailed Hawk	0.252556794	0.010357	0.002615731	0.002314806	Bird	41.7	5.55109E-05
6	Barium	Mink	99.01838623	0.5	49.50919312	49.50919312	Mammal	19.8	2.500464299
67	Bromoform	Grey Wolf	0.012668707	0.000312	3.95264E-06	9.19218E-08	Mammal	50	1.83844E-09
67	Bromoform	Mink	3.27262E-05	0.5	1.63631E-05	1.63631E-05	Mammal	50	3.27262E-07
67	Bromoform	Arctic Fox	0.028470924	0.029	0.000825657	0.000330263	Mammal	50	6.60525E-06
9	Cadmium	Grey Wolf	0.202481099	0.000312	6.31741E-05	1.46917E-06	Mammal	10	1.46917E-07
9	Cadmium	Arctic Fox	0.270017264	0.029	0.007830501	0.0031322	Mammal	10	0.00031322
9	Cadmium	Mink	0.130242565	0.5	0.065121282	0.065121282	Mammal	10	0.006512128
9	Cadmium	Red-Tailed Hawk	5.001062917	0.010357	0.051796009	0.045837176	Bird	20	0.002291859
11	Chromium 6+	Grey Wolf	0.011420936	0.000312	3.56333E-06	8.28682E-08	Mammal	27400	3.02439E-12
11	Chromium 6+	Arctic Fox	0.0023051	0.029	6.68479E-05	2.67392E-05	Mammal	27400	9.75882E-10
11	Chromium 6+	Red-Tailed Hawk	0.000279756	0.010357	2.89743E-06	2.5641E-06	Bird	5	5.1282E-07
11	Chromium 6+	Mink	0.000131761	0.5	6.58805E-05	6.58805E-05	Mammal	27400	2.4044E-09
58	cis-1,2-Dichloroethene	Mink	0.007504136	0.5	0.003752068	0.003752068	Mammal	452	8.30103E-06
13	Copper	Red-Tailed Hawk	0.000281969	0.010357	2.92036E-06	2.58439E-06	Bird	61.7	4.18863E-08
13	Copper	Mink	0.578773498	0.5	0.289386749	0.289386749	Mammal	15.4	0.018791347
13	Copper	Grey Wolf	0.012346958	0.000312	3.85225E-06	8.95872E-08	Mammal	15.4	5.81735E-09
13	Copper	Arctic Fox	0.002492	0.029	0.000072268	2.89072E-05	Mammal	15.4	1.87709E-06
73	DDT total	Mink	0.005591626	0.5	0.002795813	0.002795813	Mammal	4	0.000698953
73	DDT total	Red-Tailed Hawk	9.4752E-11	0.010357	9.81346E-13	8.68448E-13	Bird	280	3.1016E-15
74	Endrin	Red-Tailed Hawk	3.79008E-09	0.010357	3.92539E-11	3.47379E-11	Bird	0.1	3.47379E-10
74	Endrin	Mink	0.206218062	0.5	0.103109031	0.103109031	Mammal	0.92	0.112075034
14	Lead	Red-Tailed Hawk	0.000396301	0.010357	4.10449E-06	3.63229E-06	Bird	11.3	3.21442E-07
14	Lead	Mink	0.02003253	0.5	0.010016265	0.010016265	Mammal	80	0.000125203
72	Lindane (gamma HCH)	Red-Tailed Hawk	9.4752E-10	0.010357	9.81346E-12	8.68448E-12	Bird	20	4.34224E-13
72	Lindane (gamma HCH)	Mink	0.006728658	0.5	0.003364329	0.003364329	Mammal	80	4.20541E-05
71	Manganese	Red-Tailed Hawk	1.97084E-06	0.010357	2.0412E-08	1.80637E-08	Bird	9770	1.8489E-12
71	Manganese	Mink	0.000273424	0.5	0.000136712	0.000136712	Mammal	284	4.81381E-07
15	Mercury	Red-Tailed Hawk	1.89504E-09	0.010357	1.96269E-11	1.7369E-11	Bird	0.9	1.92988E-11
15	Mercury	Mink	0.050482087	0.5	0.025241043	0.025241043	Mammal	10	0.002524104
69	PCBs	Red-Tailed Hawk	2.90983E-06	0.010357	3.01371E-08	2.667E-08	Bird	1.8	1.48167E-08
69	PCBs	Mink	2.34535121	0.5	1.172675605	1.172675605	Mammal	0.1	11.72675605
53	Pyrene	Mink	0.029245267	0.5	0.014622634	0.014622634	Mammal	750	1.94968E-05
75	Toxaphene	Red-Tailed Hawk	7.04691E-05	0.010357	7.29849E-07	6.45884E-07	Bird	10	6.45884E-08
75	Toxaphene	Arctic Fox	0.000623	0.029	0.000018067	7.2268E-06	Mammal	80	9.0335E-08
75	Toxaphene	Grey Wolf	0.00308674	0.000312	9.63063E-07	2.23968E-08	Mammal	80	2.7996E-10
75	Toxaphene	Mink	0.14586997	0.5	0.072934985	0.072934985	Mammal	80	0.000911687
78	Trichloroethene	Mink	0.106068387	0.5	0.053034194	0.053034194	Mammal	7	0.007576313
22	Vanadium	Red-Tailed Hawk	0.589423427	0.010357	0.006104658	0.005402353	Bird	114	4.73891E-05
23	Zinc	Grey Wolf	6.916613855	0.000312	0.002157984	5.01857E-05	Mammal	320	1.5683E-07
23	Zinc	Arctic Fox	2.849623	0.029	0.082639067	0.033055627	Mammal	320	0.000103299
23	Zinc	Mink	0.00850388	0.5	0.00425194	0.00425194	Mammal	320	1.32873E-05
23	Zinc	Red-Tailed Hawk	220.5884164	0.010357	2.284634229	2.021800202	Bird	130.9	0.01544538

Calculation of Hazard Quotients for Predators - PHCs

ID	PHC fraction	Receptor_Name	Sum Of Exposure - Predator (mg/d)	Time On Site (proportion)	Total Ingestion - Predator (mg/d)	Intake - Predator (mg/kg-d)	Receptor_Type	TRV_value	Risk Quotient - Predator
2	F2	Grey Wolf	9.473402197	0.000312	0.002955701	6.87372E-05	Mammal	460	1.49429E-07
2	F2	Mink	0.014226168	0.5	0.007113084	0.007113084	Mammal	460	1.54632E-05
2	F2	Arctic Fox	7.398950805	0.029	0.214569573	0.085827829	Mammal	460	0.000186582
3	F3	Grey Wolf	880.9459526	0.000312	0.274855137	0.00639198	Mammal	1625	3.93353E-06
3	F3	Mink	1.429862074	0.5	0.714931037	0.714931037	Mammal	1625	0.000439958
3	F3	Arctic Fox	910.3392503	0.029	26.39983826	10.5599353	Mammal	1625	0.006498422
4	F4	Grey Wolf	94.53454861	0.000312	0.029494779	0.000685925	Mammal	20000	3.42963E-08
4	F4	Mink	36.84996842	0.5	18.42498421	18.42498421	Mammal	20000	0.000921249
4	F4	Arctic Fox	10094.07097	0.029	292.7280581	117.0912232	Mammal	20000	0.005854561

Calculation of Hazard Quotients - Prey Species (PHCs)

ID	PHC_fraction	Prey_Item	Sum Of Exposure - Prey (mg/d)	Time On Site (proportion)	Total Ingestion - Prey (mg/d)	Total Intake - Prey (mg/kg-d)	Receptor Type	TRV_value (mg/kg-d)	Hazard Quotient - Prey
2	F2	Meadow Vole	0.135261995	1	0.135261995	3.074136254	Mammal	460	0.006682905
2	F2	Caribou	37.73368234	0.00029	0.010942768	0.000104217	Mammal	460	2.26558E-07
2	F2	ST_Shrew	1.741359441	1	1.741359441	116.0906294	Mammal	460	0.252370933
2	F2	Snowshoe Hare	1.44016886	0.90625	1.305153029	0.932252164	Mammal	460	0.002026635
2	F2	Deer_Mouse	0.634829567	1	0.634829567	28.85588942	Mammal	460	0.062730194
3	F3	Snowshoe Hare	120.4101825	0.90625	109.1217279	77.94409138	Mammal	1625	0.047965595
3	F3	Deer_Mouse	140.1999943	1	140.1999943	6372.727014	Mammal	1625	3.921678162
3	F3	Meadow Vole	17.66350741	1	17.66350741	401.4433503	Mammal	1625	0.247042062
3	F3	ST_Shrew	377.1305955	1	377.1305955	25142.0397	Mammal	1625	15.47202443
3	F3	Muscrat	8.553041363	1	8.553041363	7.127534469	Mammal	1625	0.004386175
3	F3	Caribou	3730.832308	0.00029	1.081941369	0.010304204	Mammal	1625	6.34105E-06
4	F4	Muscrat	1163.27981	1	1163.27981	969.3998415	Mammal	20000	0.048469992
4	F4	Deer_Mouse	2435.475349	1	2435.475349	110703.4249	Mammal	20000	5.535171247
4	F4	Meadow Vole	248.7114955	1	248.7114955	5652.533989	Mammal	20000	0.282626699
4	F4	Caribou	405.6780143	0.00029	0.117646624	0.001120444	Mammal	20000	5.60222E-08
4	F4	ST_Shrew	6309.050288	1	6309.050288	420603.3526	Mammal	20000	21.03016763
4	F4	Snowshoe Hare	11.8401199	0.90625	10.73010866	7.664363331	Mammal	20000	0.000383218

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Sediment (Brackish)	Barium			NA	20.21	Aquatic Vegetation	633	12792.93	Aq_Veg_P	1	1	12792.93
Iqaluit Landfill	0.01	Sediment (Brackish)	Chromium 6+			NA	0.8	Aquatic Vegetation	0.0075	0.006	Aq_Veg_P	1	1	0.006
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	201.6	Aquatic Vegetation	0.000317	0.0639072	Aq_Veg_P	1	1	0.0639072
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	50.4	Aquatic Vegetation	0.145	7.308	Aq_Veg_P	1	1	7.308
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	86.4	Aquatic Vegetation	5.55E-08	4.7952E-06	Aq_Veg_P	1	1	4.7952E-06
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	21.6	Aquatic Vegetation	0.0437	0.94392	Aq_Veg_P	1	1	0.94392
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	376	Aquatic Vegetation	1	376	Aq_Veg_P	1	1	376
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	94	Aquatic Vegetation	1	94	Aq_Veg_P	1	1	94
Iqaluit Landfill	0.01	Sediment (Brackish)	Iron			NA	29778	Aquatic Vegetation	0.4	11911.2	Aq_Veg_P	1	1	11911.2
Iqaluit Landfill	0.01	Sediment (Brackish)	Lead			NA	25.83	Aquatic Vegetation	0.09	2.3247	Aq_Veg_P	1	1	2.3247
Iqaluit Landfill	0.01	Sediment (Brackish)	PCBs	6.29	309000	NA	0.09	Aquatic Vegetation	0.01	0.0009	Aq_Veg_P	1	1	0.0009
Iqaluit Landfill	0.01	Sediment (Brackish)	Vanadium			NA	47.12	Aquatic Vegetation	633	29826.96	Aq_Veg_P	1	1	29826.96
Iqaluit Landfill	0.01	Sediment (Brackish)	Barium			NA	20.21	Benthic Invertebrates	0.0097	0.196037	Benthos_P	1	1	0.196037
Iqaluit Landfill	0.01	Sediment (Brackish)	Chromium 6+			NA	0.8	Benthic Invertebrates	0.39	0.312	Benthos_P	1	1	0.312
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	201.6	Benthic Invertebrates	0.448621432	90.44208077	Benthos_P	1	1	90.44208077
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	50.4	Benthic Invertebrates	1.777780556	89.60014003	Benthos_P	1	1	89.60014003
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	86.4	Benthic Invertebrates	12.79027898	1105.080104	Benthos_P	1	1	1105.080104
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	21.6	Benthic Invertebrates	1.357933288	29.33135902	Benthos_P	1	1	29.33135902
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	376	Benthic Invertebrates	736.005216	276737.9612	Benthos_P	1	1	276737.9612
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	94	Benthic Invertebrates	14.38401468	1352.097379	Benthos_P	1	1	1352.097379
Iqaluit Landfill	0.01	Sediment (Brackish)	Iron			NA	29778	Benthic Invertebrates	0.9	26800.2	Benthos_P	1	1	26800.2
Iqaluit Landfill	0.01	Sediment (Brackish)	Lead			NA	25.83	Benthic Invertebrates	0.22	5.6826	Benthos_P	1	1	5.6826
Iqaluit Landfill	0.01	Sediment (Brackish)	PCBs	6.29	309000	NA	0.09	Benthic Invertebrates	0.53	0.0477	Benthos_P	1	1	0.0477
Iqaluit Landfill	0.01	Sediment (Brackish)	Vanadium			NA	47.12	Benthic Invertebrates	0.22	10.3664	Benthos_P	1	1	10.3664
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Browse	0.784	0.0392	Browse_P	1	1	0.0392
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Browse	0.004	18.708	Browse_P	1	1	18.708
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Browse	1.59	0.0795	Browse_P	1	1	0.0795
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Browse	0.364	1.010828	Browse_P	1	1	1.010828
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Browse	0.029295	1.51232508	Browse_P	1	1	1.51232508
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Browse	0.419565	5.41490589	Browse_P	1	1	5.41490589

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Browse	0.005192	0.327594432	Browse_P	1	1	0.327594432
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Browse	0.281	4.432494	Browse_P	1	1	4.432494
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Browse	0.000317	2.74392664	Browse_P	1	1	2.74392664
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Browse	0.145	313.7771	Browse_P	1	1	313.7771
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Browse	5.55E-08	0.000205887	Browse_P	1	1	0.000205887
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Browse	0.0437	40.528254	Browse_P	1	1	40.528254
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Browse	1.3E-12	1.7472E-09	Browse_P	1	1	1.7472E-09
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Browse	0.00157	2.11008	Browse_P	1	1	2.11008
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Browse	0.4	9478.4	Browse_P	1	1	9478.4
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Browse	1.2E-12	1.47E-10	Browse_P	1	1	1.47E-10
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Lichen	0.00001969	9.845E-07	Caribou	7.64	0.984	7.40123E-06
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Browse	0.784	0.0392	Caribou	7.64	0.002	0.000598976
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Forage	0.784	0.0392	Caribou	7.64	0.003	0.000898464
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Soil1	1	0.05	Caribou	0.24	1	0.012
Iqaluit Landfill	0.01	Surface Water (Fresh)	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.001	Water1F	1	0.001	Caribou	9.5	1	0.0095
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Lichen	0.00001969	0.09209013	Caribou	7.64	0.984	0.692311496
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Browse	0.004	18.708	Caribou	7.64	0.002	0.28585824
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Forage	0.004	18.708	Caribou	7.64	0.003	0.42878736
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Soil1	1	4677	Caribou	0.24	1	1122.48
Iqaluit Landfill	0.01	Surface Water (Fresh)	Aluminum			NA	0.119	Water1F	1	0.119	Caribou	9.5	1	1.1305
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Lichen	0.00001969	9.845E-07	Caribou	7.64	0.984	7.40123E-06
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Soil1	1	0.05	Caribou	0.24	1	0.012
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Forage	1.59	0.0795	Caribou	7.64	0.003	0.00182214
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Browse	1.59	0.0795	Caribou	7.64	0.002	0.00121476
Iqaluit Landfill	0.01	Surface Water (Fresh)	Bromoform	2.4	35.04	NA	0.002	Water1F	1	0.002	Caribou	9.5	1	0.019
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Lichen	0.00001969	5.46791E-05	Caribou	7.64	0.984	0.000411065
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Forage	0.364	1.010828	Caribou	7.64	0.003	0.023168178
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Browse	0.364	1.010828	Caribou	7.64	0.002	0.015445452
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Soil1	1	2.777	Caribou	0.24	1	0.66648
Iqaluit Landfill	0.01	Surface Water (Fresh)	Cadmium			NA	0.000129	Water1F	1	0.000129	Caribou	9.5	1	0.0012255
Iqaluit Landfill	0.01	Surface Water (Fresh)	Chromium 6+			NA	0.0037	Water1F	1	0.0037	Caribou	9.5	1	0.03515
Iqaluit Landfill	0.01	Surface Water (Fresh)	Copper			NA	0.004	Water1F	1	0.004	Caribou	9.5	1	0.038
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Lichen	0.00001969	0.001016477	Caribou	7.64	0.984	0.007641627
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Forage	0.029295	1.51232508	Caribou	7.64	0.003	0.034662491
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Browse	0.029295	1.51232508	Caribou	7.64	0.002	0.023108327
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Soil1	1	51.624	Caribou	0.24	1	12.38976
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aliphatic	5.4	251189	F2	0.108	Water1F	1	0.108	Caribou	9.5	1	1.026
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Lichen	0.00001969	0.000254119	Caribou	7.64	0.984	0.001910407
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Forage	0.419565	5.41490589	Caribou	7.64	0.003	0.124109643
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Browse	0.419565	5.41490589	Caribou	7.64	0.002	0.082739762
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Soil1	1	12.906	Caribou	0.24	1	3.09744
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aromatic	3.4	2512	F2	0.027	Water1F	1	0.027	Caribou	9.5	1	0.2565
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Lichen	0.00001969	0.00124236	Caribou	7.64	0.984	0.009339766

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Forage	0.005192	0.327594432	Caribou	7.64	0.003	0.007508464
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Browse	0.005192	0.327594432	Caribou	7.64	0.002	0.005005643
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Soil1	1	63.096	Caribou	0.24	1	15.14304
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aliphatic	6.7	5011872	F2	0.132	Water1F	1	0.132	Caribou	9.5	1	1.254
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Lichen	0.00001969	0.00031059	Caribou	7.64	0.984	0.002334942
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Forage	0.281	4.432494	Caribou	7.64	0.003	0.101592762
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Browse	0.281	4.432494	Caribou	7.64	0.002	0.067728508
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Soil1	1	15.774	Caribou	0.24	1	3.78576
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aromatic	3.7	5012	F2	0.033	Water1F	1	0.033	Caribou	9.5	1	0.3135
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Lichen	0.00001969	0.170435065	Caribou	7.64	0.984	1.281289913
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Forage	0.000317	2.74392664	Caribou	7.64	0.003	0.062890799
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Browse	0.000317	2.74392664	Caribou	7.64	0.002	0.041927199
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Soil1	1	8655.92	Caribou	0.24	1	2077.4208
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aliphatic	8.8	630957344	F3	0.308	Water1F	1	0.308	Caribou	9.5	1	2.926
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Lichen	0.00001969	0.042608766	Caribou	7.64	0.984	0.320322478
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Browse	0.145	313.7771	Caribou	7.64	0.002	4.794514088
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Forage	0.145	313.7771	Caribou	7.64	0.003	7.191771132
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Soil1	1	2163.98	Caribou	0.24	1	519.3552
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aromatic	4.2	15849	F3	0.077	Water1F	1	0.077	Caribou	9.5	1	0.7315
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Forage	5.55E-08	0.000205887	Caribou	7.64	0.003	4.71894E-06
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Browse	5.55E-08	0.000205887	Caribou	7.64	0.002	3.14596E-06
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Lichen	0.00001969	0.073043599	Caribou	7.64	0.984	0.54912424
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Soil1	1	3709.68	Caribou	0.24	1	890.3232
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	0.132	Water1F	1	0.132	Caribou	9.5	1	1.254
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Lichen	0.00001969	0.0182609	Caribou	7.64	0.984	0.137281062
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Forage	0.0437	40.528254	Caribou	7.64	0.003	0.928907582
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Browse	0.0437	40.528254	Caribou	7.64	0.002	0.619271721
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Soil1	1	927.42	Caribou	0.24	1	222.5808
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aromatic	5.1	125893	F3	0.033	Water1F	1	0.033	Caribou	9.5	1	0.3135
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Forage	1.3E-12	1.7472E-09	Caribou	7.64	0.003	4.00458E-11
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Browse	1.3E-12	1.7472E-09	Caribou	7.64	0.002	2.66972E-11
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Lichen	0.00001969	0.02646336	Caribou	7.64	0.984	0.198945189
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Browse	0.00157	2.11008	Caribou	7.64	0.002	0.032242022
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Soil1	1	1344	Caribou	0.24	1	322.56
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	0.184	Water1F	1	0.184	Caribou	9.5	1	1.748
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Lichen	0.00001969	0.00661584	Caribou	7.64	0.984	0.049736297
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Forage	0.00157	0.52752	Caribou	7.64	0.003	0.012090758
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Soil1	1	336	Caribou	0.24	1	80.64
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aromatic	7.6	1778279	F4	0.046	Water1F	1	0.046	Caribou	9.5	1	0.437
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Lichen	0.00001969	0.46657424	Caribou	7.64	0.984	3.507593159
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Forage	0.4	9478.4	Caribou	7.64	0.003	217.244928

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Browse	0.4	9478.4	Caribou	7.64	0.002	144.829952
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Soil1	1	23696	Caribou	0.24	1	5687.04
Iqaluit Landfill	0.01	Surface Water (Fresh)	Iron			NA	3.5	Water1F	1	3.5	Caribou	9.5	1	33.25
Iqaluit Landfill	0.01	Surface Water (Fresh)	Toxaphene	5	100000	NA	0.001	Water1F	1	0.001	Caribou	9.5	1	0.0095
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Browse	1.2E-12	1.47E-10	Caribou	7.64	0.002	2.24616E-12
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Forage	1.2E-12	1.47E-10	Caribou	7.64	0.003	3.36924E-12
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Lichen	0.00001969	0.002412025	Caribou	7.64	0.984	0.018133025
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Soil1	1	122.5	Caribou	0.24	1	29.4
Iqaluit Landfill	0.01	Surface Water (Fresh)	Zinc			NA	0.026	Water1F	1	0.026	Caribou	9.5	1	0.247
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Terrestrial Invertebrates	22.90171669	1.145085834	Deer_Mouse	0.0049	0.5	0.00280546
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Forage	0.784	0.0392	Deer_Mouse	0.0049	0.5	0.00009604
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Soil1	1	0.05	Deer_Mouse	0.000068	1	0.0000034
Iqaluit Landfill	0.01	Surface Water (Fresh)	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.001	Water1F	1	0.001	Deer_Mouse	0.004	1	0.000004
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Forage	0.004	18.708	Deer_Mouse	0.0049	0.5	0.0458346
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Terrestrial Invertebrates	0.22	1028.94	Deer_Mouse	0.0049	0.5	2.520903
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Soil1	1	4677	Deer_Mouse	0.000068	1	0.318036
Iqaluit Landfill	0.01	Surface Water (Fresh)	Aluminum			NA	0.119	Water1F	1	0.119	Deer_Mouse	0.004	1	0.000476
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Terrestrial Invertebrates	21.84318278	1.092159139	Deer_Mouse	0.0049	0.5	0.00267579
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Soil1	1	0.05	Deer_Mouse	0.000068	1	0.0000034
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Forage	1.59	0.0795	Deer_Mouse	0.0049	0.5	0.000194775
Iqaluit Landfill	0.01	Surface Water (Fresh)	Bromoform	2.4	35.04	NA	0.002	Water1F	1	0.002	Deer_Mouse	0.004	1	0.000008
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Forage	0.364	1.010828	Deer_Mouse	0.0049	0.5	0.002476529
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Terrestrial Invertebrates	0.96	2.66592	Deer_Mouse	0.0049	0.5	0.006531504
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Soil1	1	2.777	Deer_Mouse	0.000068	1	0.000188836
Iqaluit Landfill	0.01	Surface Water (Fresh)	Cadmium			NA	0.000129	Water1F	1	0.000129	Deer_Mouse	0.004	1	0.000000516
Iqaluit Landfill	0.01	Surface Water (Fresh)	Chromium 6+			NA	0.0037	Water1F	1	0.0037	Deer_Mouse	0.004	1	0.0000148
Iqaluit Landfill	0.01	Surface Water (Fresh)	Copper			NA	0.004	Water1F	1	0.004	Deer_Mouse	0.004	1	0.000016
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Terrestrial Invertebrates	1.24130756	64.08126147	Deer_Mouse	0.0049	0.5	0.156999091
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Terrestrial Invertebrates	1.24130756	64.08126147	Deer_Mouse	0.0049	0.5	0.156999091
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Forage	0.029295	1.51232508	Deer_Mouse	0.0049	0.5	0.003705196
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Soil1	1	51.624	Deer_Mouse	0.000068	1	0.003510432
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aliphatic	5.4	251189	F2	0.108	Water1F	1	0.108	Deer_Mouse	0.004	1	0.000432
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Terrestrial Invertebrates	2.25870952	29.15090506	Deer_Mouse	0.0049	0.5	0.071419717
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Forage	0.419565	5.41490589	Deer_Mouse	0.0049	0.5	0.013266519
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Soil1	1	12.906	Deer_Mouse	0.000068	1	0.000877608
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aromatic	3.4	2512	F2	0.027	Water1F	1	0.027	Deer_Mouse	0.004	1	0.000108
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Terrestrial Invertebrates	0.841162778	53.07400662	Deer_Mouse	0.0049	0.5	0.130031316
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Forage	0.005192	0.327594432	Deer_Mouse	0.0049	0.5	0.000802606
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Soil1	1	63.096	Deer_Mouse	0.000068	1	0.004290528
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aliphatic	6.7	5011872	F2	0.132	Water1F	1	0.132	Deer_Mouse	0.004	1	0.000528
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Terrestrial Invertebrates	2.064757037	32.56947751	Deer_Mouse	0.0049	0.5	0.07979522

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Forage	0.281	4.432494	Deer_Mouse	0.0049	0.5	0.01085961
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Soil1	1	15.774	Deer_Mouse	0.000068	1	0.001072632
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aromatic	3.7	5012	F2	0.033	Water1F	1	0.033	Deer_Mouse	0.004	1	0.000132
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Terrestrial Invertebrates	0.448621432	3883.231229	Deer_Mouse	0.0049	0.5	9.513916511
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Forage	0.000317	2.74392664	Deer_Mouse	0.0049	0.5	0.00672262
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Soil1	1	8655.92	Deer_Mouse	0.000068	1	0.58860256
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aliphatic	8.8	630957344	F3	0.308	Water1F	1	0.308	Deer_Mouse	0.004	1	0.001232
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Terrestrial Invertebrates	1.777780556	3847.081568	Deer_Mouse	0.0049	0.5	9.425349841
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Forage	0.145	313.7771	Deer_Mouse	0.0049	0.5	0.768753895
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Soil1	1	2163.98	Deer_Mouse	0.000068	1	0.14715064
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aromatic	4.2	15849	F3	0.077	Water1F	1	0.077	Deer_Mouse	0.004	1	0.000308
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Terrestrial Invertebrates	12.79027898	47447.84212	Deer_Mouse	0.0049	0.5	116.2472132
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Forage	5.55E-08	0.000205887	Deer_Mouse	0.0049	0.5	5.04424E-07
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Soil1	1	3709.68	Deer_Mouse	0.000068	1	0.25225824
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	0.132	Water1F	1	0.132	Deer_Mouse	0.004	1	0.000528
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Terrestrial Invertebrates	1.357933288	1259.37449	Deer_Mouse	0.0049	0.5	3.0854675
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Forage	0.0437	40.528254	Deer_Mouse	0.0049	0.5	0.099294222
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Soil1	1	927.42	Deer_Mouse	0.000068	1	0.06306456
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aromatic	5.1	125893	F3	0.033	Water1F	1	0.033	Deer_Mouse	0.004	1	0.000132
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Terrestrial Invertebrates	736.005216	989191.0103	Deer_Mouse	0.0049	0.5	2423.517975
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Forage	1.3E-12	1.7472E-09	Deer_Mouse	0.0049	0.5	4.28064E-12
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Soil1	1	1344	Deer_Mouse	0.000068	1	0.091392
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	0.184	Water1F	1	0.184	Deer_Mouse	0.004	1	0.000736
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Terrestrial Invertebrates	14.38401468	4833.028931	Deer_Mouse	0.0049	0.5	11.84092088
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Forage	0.00157	0.52752	Deer_Mouse	0.0049	0.5	0.001292424
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Soil1	1	336	Deer_Mouse	0.000068	1	0.022848
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aromatic	7.6	1778279	F4	0.046	Water1F	1	0.046	Deer_Mouse	0.004	1	0.000184
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Terrestrial Invertebrates	0.22	5213.12	Deer_Mouse	0.0049	0.5	12.772144
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Forage	0.4	9478.4	Deer_Mouse	0.0049	0.5	23.22208
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Soil1	1	23696	Deer_Mouse	0.000068	1	1.611328
Iqaluit Landfill	0.01	Surface Water (Fresh)	Iron			NA	3.5	Water1F	1	3.5	Deer_Mouse	0.004	1	0.014
Iqaluit Landfill	0.01	Surface Water (Fresh)	Toxaphene	5	100000	NA	0.001	Water1F	1	0.001	Deer_Mouse	0.004	1	0.000004
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Forage	1.2E-12	1.47E-10	Deer_Mouse	0.0049	0.5	3.6015E-13
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Terrestrial Invertebrates	0.56	68.6	Deer_Mouse	0.0049	0.5	0.16807
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Soil1	1	122.5	Deer_Mouse	0.000068	1	0.00833
Iqaluit Landfill	0.01	Surface Water (Fresh)	Zinc			NA	0.026	Water1F	1	0.026	Deer_Mouse	0.004	1	0.000104
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Browse	0.784	0.0392	E_Cotton	0.034	0.8	0.00106624

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Forage	0.784	0.0392	E_Cotton	0.034	0.2	0.00026656
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Soil1	1	0.05	E_Cotton	0.007	1	0.00035
Iqaluit Landfill	0.01	Surface Water (Fresh)	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.001	Water1F	1	0.001	E_Cotton	0.116	1	0.000116
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Forage	0.004	18.708	E_Cotton	0.034	0.2	0.1272144
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Browse	0.004	18.708	E_Cotton	0.034	0.8	0.5088576
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Soil1	1	4677	E_Cotton	0.007	1	32.739
Iqaluit Landfill	0.01	Surface Water (Fresh)	Aluminum			NA	0.119	Water1F	1	0.119	E_Cotton	0.116	1	0.013804
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Soil1	1	0.05	E_Cotton	0.007	1	0.00035
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Forage	1.59	0.0795	E_Cotton	0.034	0.2	0.0005406
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Browse	1.59	0.0795	E_Cotton	0.034	0.8	0.0021624
Iqaluit Landfill	0.01	Surface Water (Fresh)	Bromoform	2.4	35.04	NA	0.002	Water1F	1	0.002	E_Cotton	0.116	1	0.000232
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Forage	0.364	1.010828	E_Cotton	0.034	0.2	0.00687363
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Browse	0.364	1.010828	E_Cotton	0.034	0.8	0.027494522
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Soil1	1	2.777	E_Cotton	0.007	1	0.019439
Iqaluit Landfill	0.01	Surface Water (Fresh)	Cadmium			NA	0.000129	Water1F	1	0.000129	E_Cotton	0.116	1	0.000014964
Iqaluit Landfill	0.01	Surface Water (Fresh)	Chromium 6+			NA	0.0037	Water1F	1	0.0037	E_Cotton	0.116	1	0.0004292
Iqaluit Landfill	0.01	Surface Water (Fresh)	Copper			NA	0.004	Water1F	1	0.004	E_Cotton	0.116	1	0.000464
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Forage	0.029295	1.51232508	E_Cotton	0.034	0.2	0.010283811
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Browse	0.029295	1.51232508	E_Cotton	0.034	0.8	0.041135242
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Soil1	1	51.624	E_Cotton	0.007	1	0.361368
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aliphatic	5.4	251189	F2	0.108	Water1F	1	0.108	E_Cotton	0.116	1	0.012528
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Browse	0.419565	5.41490589	E_Cotton	0.034	0.8	0.14728544
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Forage	0.419565	5.41490589	E_Cotton	0.034	0.2	0.03682136
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Soil1	1	12.906	E_Cotton	0.007	1	0.090342
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aromatic	3.4	2512	F2	0.027	Water1F	1	0.027	E_Cotton	0.116	1	0.003132
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Forage	0.005192	0.327594432	E_Cotton	0.034	0.2	0.002227642
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Browse	0.005192	0.327594432	E_Cotton	0.034	0.8	0.008910569
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Soil1	1	63.096	E_Cotton	0.007	1	0.441672
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aliphatic	6.7	5011872	F2	0.132	Water1F	1	0.132	E_Cotton	0.116	1	0.015312
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Forage	0.281	4.432494	E_Cotton	0.034	0.2	0.030140959
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Browse	0.281	4.432494	E_Cotton	0.034	0.8	0.120563837
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Soil1	1	15.774	E_Cotton	0.007	1	0.110418
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aromatic	3.7	5012	F2	0.033	Water1F	1	0.033	E_Cotton	0.116	1	0.003828
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Forage	0.000317	2.74392664	E_Cotton	0.034	0.2	0.018658701
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Browse	0.000317	2.74392664	E_Cotton	0.034	0.8	0.074634805
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Soil1	1	8655.92	E_Cotton	0.007	1	60.59144
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aliphatic	8.8	630957344	F3	0.308	Water1F	1	0.308	E_Cotton	0.116	1	0.035728
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Forage	0.145	313.7771	E_Cotton	0.034	0.2	2.13368428
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Browse	0.145	313.7771	E_Cotton	0.034	0.8	8.53473712
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Soil1	1	2163.98	E_Cotton	0.007	1	15.14786
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aromatic	4.2	15849	F3	0.077	Water1F	1	0.077	E_Cotton	0.116	1	0.008932

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Browse	5.55E-08	0.000205887	E_Cotton	0.034	0.8	5.60013E-06
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Forage	5.55E-08	0.000205887	E_Cotton	0.034	0.2	1.40003E-06
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Soil1	1	3709.68	E_Cotton	0.007	1	25.96776
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	0.132	Water1F	1	0.132	E_Cotton	0.116	1	0.015312
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Forage	0.0437	40.528254	E_Cotton	0.034	0.2	0.275592127
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Browse	0.0437	40.528254	E_Cotton	0.034	0.8	1.102368509
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Soil1	1	927.42	E_Cotton	0.007	1	6.49194
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aromatic	5.1	125893	F3	0.033	Water1F	1	0.033	E_Cotton	0.116	1	0.003828
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Forage	1.3E-12	1.7472E-09	E_Cotton	0.034	0.2	1.1881E-11
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Browse	1.3E-12	1.7472E-09	E_Cotton	0.034	0.8	4.75238E-11
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Browse	0.00157	2.11008	E_Cotton	0.034	0.8	0.057394176
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Soil1	1	1344	E_Cotton	0.007	1	9.408
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	0.184	Water1F	1	0.184	E_Cotton	0.116	1	0.021344
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Forage	0.00157	0.52752	E_Cotton	0.034	0.2	0.003587136
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Soil1	1	336	E_Cotton	0.007	1	2.352
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aromatic	7.6	1778279	F4	0.046	Water1F	1	0.046	E_Cotton	0.116	1	0.005336
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Browse	0.4	9478.4	E_Cotton	0.034	0.8	257.81248
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Forage	0.4	9478.4	E_Cotton	0.034	0.2	64.45312
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Soil1	1	23696	E_Cotton	0.007	1	165.872
Iqaluit Landfill	0.01	Surface Water (Fresh)	Iron			NA	3.5	Water1F	1	3.5	E_Cotton	0.116	1	0.406
Iqaluit Landfill	0.01	Surface Water (Fresh)	Toxaphene	5	100000	NA	0.001	Water1F	1	0.001	E_Cotton	0.116	1	0.000116
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Forage	1.2E-12	1.47E-10	E_Cotton	0.034	0.2	9.996E-13
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Browse	1.2E-12	1.47E-10	E_Cotton	0.034	0.8	3.9984E-12
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Soil1	1	122.5	E_Cotton	0.007	1	0.8575
Iqaluit Landfill	0.01	Surface Water (Fresh)	Zinc			NA	0.026	Water1F	1	0.026	E_Cotton	0.116	1	0.003016
Iqaluit Landfill	0.01	Surface Water (Brackish)	Anthracene	4.45	20400	NA	0.00005	Fish	1770	0.0885	Fish_P	1	1	0.0885
Iqaluit Landfill	0.01	Surface Water (Brackish)	Cadmium			NA	0.001	Fish	907	0.907	Fish_P	1	1	0.907
Iqaluit Landfill	0.01	Surface Water (Brackish)	cis-1,2-Dichloroethene	2.09	43.79	NA	0.004	Fish	13.1	0.0524	Fish_P	1	1	0.0524
Iqaluit Landfill	0.01	Surface Water (Brackish)	Copper			NA	0.0057	Fish	710	4.047	Fish_P	1	1	4.047
Iqaluit Landfill	0.01	Surface Water (Brackish)	DDT total	6.91	220000	NA	0.000005	Fish	7820	0.0391	Fish_P	1	1	0.0391
Iqaluit Landfill	0.01	Surface Water (Brackish)	Endrin	5.2	10600	NA	0.0002	Fish	7210	1.442	Fish_P	1	1	1.442
Iqaluit Landfill	0.01	Surface Water (Brackish)	Iron			NA	0.648	Fish	633	410.184	Fish_P	1	1	410.184
Iqaluit Landfill	0.01	Surface Water (Brackish)	Lindane (gamma HCH)	4.14	1120	NA	0.00005	Fish	941	0.04705	Fish_P	1	1	0.04705
Iqaluit Landfill	0.01	Surface Water (Brackish)	Magnesium			NA	248	Fish	633	156984	Fish_P	1	1	156984
Iqaluit Landfill	0.01	Surface Water (Brackish)	Mercury			NA	0.0001	Fish	3530	0.353	Fish_P	1	1	0.353
Iqaluit Landfill	0.01	Surface Water (Brackish)	PCBs	6.29	309000	NA	0.001	Fish	16400	16.4	Fish_P	1	1	16.4
Iqaluit Landfill	0.01	Surface Water (Brackish)	Pyrene	4.88	69400	NA	0.00005	Fish	4090	0.2045	Fish_P	1	1	0.2045
Iqaluit Landfill	0.01	Surface Water (Brackish)	Sodium			NA	2080	Fish	633	1316640	Fish_P	1	1	1316640
Iqaluit Landfill	0.01	Surface Water (Brackish)	Toxaphene	5	100000	NA	0.0002	Fish	5100	1.02	Fish_P	1	1	1.02
Iqaluit Landfill	0.01	Surface Water (Brackish)	Trichloroethene	2.53	117	NA	0.0226	Fish	32.8	0.74128	Fish_P	1	1	0.74128
Iqaluit Landfill	0.01	Surface Water (Brackish)	Vanadium			NA	0.002	Fish	633	1.266	Fish_P	1	1	1.266
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Forage	0.784	0.0392	Forage_P	1	1	0.0392
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Forage	0.004	18.708	Forage_P	1	1	18.708
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Forage	1.59	0.0795	Forage_P	1	1	0.0795
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Forage	0.364	1.010828	Forage_P	1	1	1.010828
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Forage	0.029295	1.51232508	Forage_P	1	1	1.51232508
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Forage	0.419565	5.41490589	Forage_P	1	1	5.41490589
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Forage	0.005192	0.327594432	Forage_P	1	1	0.327594432

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Forage	0.281	4.432494	Forage_P	1	1	4.432494
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Forage	0.000317	2.74392664	Forage_P	1	1	2.74392664
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Forage	0.145	313.7771	Forage_P	1	1	313.7771
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Forage	5.55E-08	0.000205887	Forage_P	1	1	0.000205887
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Forage	0.0437	40.528254	Forage_P	1	1	40.528254
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Forage	1.3E-12	1.7472E-09	Forage_P	1	1	1.7472E-09
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Forage	0.00157	0.52752	Forage_P	1	1	0.52752
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Forage	0.4	9478.4	Forage_P	1	1	9478.4
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Forage	1.2E-12	1.47E-10	Forage_P	1	1	1.47E-10
Iqaluit Landfill	0.01	Surface Water (Brackish)	Anthracene	4.45	20400	NA	0.00005	Water1B	1	0.00005	Mallard	0.06	1	0.000003
Iqaluit Landfill	0.01	Sediment (Brackish)	Barium			NA	20.21	Benthic Invertebrates	0.0097	0.196037	Mallard	0.25	0.75	0.036756938
Iqaluit Landfill	0.01	Sediment (Brackish)	Barium			NA	20.21	Sediment1B	1	20.21	Mallard	0.0017	1	0.034357
Iqaluit Landfill	0.01	Sediment (Brackish)	Barium			NA	20.21	Aquatic Vegetation	633	12792.93	Mallard	0.25	0.25	799.558125
Iqaluit Landfill	0.01	Surface Water (Brackish)	Barium			NA	0.1	Water1B	1	0.1	Mallard	0.06	1	0.006
Iqaluit Landfill	0.01	Surface Water (Brackish)	Cadmium			NA	0.001	Water1B	1	0.001	Mallard	0.06	1	0.00006
Iqaluit Landfill	0.01	Sediment (Brackish)	Chromium 6+			NA	0.8	Aquatic Vegetation	0.0075	0.006	Mallard	0.25	0.25	0.000375
Iqaluit Landfill	0.01	Sediment (Brackish)	Chromium 6+			NA	0.8	Benthic Invertebrates	0.39	0.312	Mallard	0.25	0.75	0.0585
Iqaluit Landfill	0.01	Sediment (Brackish)	Chromium 6+			NA	0.8	Sediment1B	1	0.8	Mallard	0.0017	1	0.00136
Iqaluit Landfill	0.01	Surface Water (Brackish)	Chromium 6+			NA	0.0005	Water1B	1	0.0005	Mallard	0.06	1	0.00003
Iqaluit Landfill	0.01	Surface Water (Brackish)	cis-1,2-Dichloroethene	2.09	43.79	NA	0.004	Water1B	1	0.004	Mallard	0.06	1	0.00024
Iqaluit Landfill	0.01	Surface Water (Brackish)	Copper			NA	0.0057	Water1B	1	0.0057	Mallard	0.06	1	0.000342
Iqaluit Landfill	0.01	Surface Water (Brackish)	DDT total	6.91	220000	NA	0.000005	Water1B	1	0.000005	Mallard	0.06	1	0.0000003
Iqaluit Landfill	0.01	Surface Water (Brackish)	Endrin	5.2	10600	NA	0.0002	Water1B	1	0.0002	Mallard	0.06	1	0.000012
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	201.6	Benthic Invertebrates	0.448621432	90.44208077	Mallard	0.25	0.75	16.95789014
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	201.6	Aquatic Vegetation	0.000317	0.0639072	Mallard	0.25	0.25	0.0039942
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	201.6	Sediment1B	1	201.6	Mallard	0.0017	1	0.34272
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	0.168	Water1B	1	0.168	Mallard	0.06	1	0.01008
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	50.4	Benthic Invertebrates	1.777780556	89.60014003	Mallard	0.25	0.75	16.80002626
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	50.4	Aquatic Vegetation	0.145	7.308	Mallard	0.25	0.25	0.45675
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	50.4	Sediment1B	1	50.4	Mallard	0.0017	1	0.08568
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	0.042	Water1B	1	0.042	Mallard	0.06	1	0.00252
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	86.4	Benthic Invertebrates	12.79027898	1105.080104	Mallard	0.25	0.75	207.2025195
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	86.4	Aquatic Vegetation	5.55E-08	4.7952E-06	Mallard	0.25	0.25	2.997E-07
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	86.4	Sediment1B	1	86.4	Mallard	0.0017	1	0.14688
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	0.072	Water1B	1	0.072	Mallard	0.06	1	0.00432
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	21.6	Benthic Invertebrates	1.357933288	29.33135902	Mallard	0.25	0.75	5.499629815
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	21.6	Aquatic Vegetation	0.0437	0.94392	Mallard	0.25	0.25	0.058995

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	21.6	Sediment1B	1	21.6	Mallard	0.0017	1	0.03672
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	0.018	Water1B	1	0.018	Mallard	0.06	1	0.00108
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	376	Benthic Invertebrates	736.005216	276737.9612	Mallard	0.25	0.75	51888.36773
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	376	Sediment1B	1	376	Mallard	0.0017	1	0.6392
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	376	Aquatic Vegetation	1	376	Mallard	0.25	0.25	23.5
Iqaluit Landfill	0.01	Surface Water (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	0.08	Water1B	1	0.08	Mallard	0.06	1	0.0048
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	94	Benthic Invertebrates	14.38401468	1352.097379	Mallard	0.25	0.75	253.5182587
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	94	Sediment1B	1	94	Mallard	0.0017	1	0.1598
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	94	Aquatic Vegetation	1	94	Mallard	0.25	0.25	5.875
Iqaluit Landfill	0.01	Surface Water (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	0.02	Water1B	1	0.02	Mallard	0.06	1	0.0012
Iqaluit Landfill	0.01	Sediment (Brackish)	Iron			NA	29778	Aquatic Vegetation	0.4	11911.2	Mallard	0.25	0.25	744.45
Iqaluit Landfill	0.01	Sediment (Brackish)	Iron			NA	29778	Benthic Invertebrates	0.9	26800.2	Mallard	0.25	0.75	5025.0375
Iqaluit Landfill	0.01	Sediment (Brackish)	Iron			NA	29778	Sediment1B	1	29778	Mallard	0.0017	1	50.6226
Iqaluit Landfill	0.01	Surface Water (Brackish)	Iron			NA	0.648	Water1B	1	0.648	Mallard	0.06	1	0.03888
Iqaluit Landfill	0.01	Sediment (Brackish)	Lead			NA	25.83	Aquatic Vegetation	0.09	2.3247	Mallard	0.25	0.25	0.14529375
Iqaluit Landfill	0.01	Sediment (Brackish)	Lead			NA	25.83	Benthic Invertebrates	0.22	5.6826	Mallard	0.25	0.75	1.0654875
Iqaluit Landfill	0.01	Sediment (Brackish)	Lead			NA	25.83	Sediment1B	1	25.83	Mallard	0.0017	1	0.043911
Iqaluit Landfill	0.01	Surface Water (Brackish)	Lead			NA	0.001	Water1B	1	0.001	Mallard	0.06	1	0.00006
Iqaluit Landfill	0.01	Surface Water (Brackish)	Lindane (gamma HCH)	4.14	1120	NA	0.00005	Water1B	1	0.00005	Mallard	0.06	1	0.000003
Iqaluit Landfill	0.01	Surface Water (Brackish)	Magnesium			NA	248	Water1B	1	248	Mallard	0.06	1	14.88
Iqaluit Landfill	0.01	Surface Water (Brackish)	Manganese			NA	0.104	Water1B	1	0.104	Mallard	0.06	1	0.00624
Iqaluit Landfill	0.01	Surface Water (Brackish)	Mercury			NA	0.0001	Water1B	1	0.0001	Mallard	0.06	1	0.000006
Iqaluit Landfill	0.01	Sediment (Brackish)	PCBs	6.29	309000	NA	0.09	Aquatic Vegetation	0.01	0.0009	Mallard	0.25	0.25	0.00005625
Iqaluit Landfill	0.01	Sediment (Brackish)	PCBs	6.29	309000	NA	0.09	Benthic Invertebrates	0.53	0.0477	Mallard	0.25	0.75	0.00894375
Iqaluit Landfill	0.01	Sediment (Brackish)	PCBs	6.29	309000	NA	0.09	Sediment1B	1	0.09	Mallard	0.0017	1	0.000153
Iqaluit Landfill	0.01	Surface Water (Brackish)	PCBs	6.29	309000	NA	0.001	Water1B	1	0.001	Mallard	0.06	1	0.00006
Iqaluit Landfill	0.01	Surface Water (Brackish)	Pyrene	4.88	69400	NA	0.00005	Water1B	1	0.00005	Mallard	0.06	1	0.000003
Iqaluit Landfill	0.01	Surface Water (Brackish)	Sodium			NA	2080	Water1B	1	2080	Mallard	0.06	1	124.8
Iqaluit Landfill	0.01	Surface Water (Brackish)	Toxaphene	5	100000	NA	0.0002	Water1B	1	0.0002	Mallard	0.06	1	0.000012
Iqaluit Landfill	0.01	Surface Water (Brackish)	Trichloroethene	2.53	117	NA	0.0226	Water1B	1	0.0226	Mallard	0.06	1	0.001356
Iqaluit Landfill	0.01	Sediment (Brackish)	Vanadium			NA	47.12	Benthic Invertebrates	0.22	10.3664	Mallard	0.25	0.75	1.9437
Iqaluit Landfill	0.01	Sediment (Brackish)	Vanadium			NA	47.12	Sediment1B	1	47.12	Mallard	0.0017	1	0.080104
Iqaluit Landfill	0.01	Sediment (Brackish)	Vanadium			NA	47.12	Aquatic Vegetation	633	29826.96	Mallard	0.25	0.25	1864.185
Iqaluit Landfill	0.01	Surface Water (Brackish)	Vanadium			NA	0.002	Water1B	1	0.002	Mallard	0.06	1	0.00012
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Terrestrial Invertebrates	22.90171669	1.145085834	Meadow Vole	0.005	0.05	0.000286271
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Forage	0.784	0.0392	Meadow Vole	0.005	0.95	0.0001862
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Soil1	1	0.05	Meadow Vole	0.00012	1	0.000006

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Surface Water (Fresh)	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.001	Water1F	1	0.001	Meadow Vole	0.006	1	0.000006
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Forage	0.004	18.708	Meadow Vole	0.005	0.95	0.088863
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Terrestrial Invertebrates	0.22	1028.94	Meadow Vole	0.005	0.05	0.257235
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Soil1	1	4677	Meadow Vole	0.00012	1	0.56124
Iqaluit Landfill	0.01	Surface Water (Fresh)	Aluminum			NA	0.119	Water1F	1	0.119	Meadow Vole	0.006	1	0.000714
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Terrestrial Invertebrates	21.84318278	1.092159139	Meadow Vole	0.005	0.05	0.00027304
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Soil1	1	0.05	Meadow Vole	0.00012	1	0.000006
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Forage	1.59	0.0795	Meadow Vole	0.005	0.95	0.000377625
Iqaluit Landfill	0.01	Surface Water (Fresh)	Bromoform	2.4	35.04	NA	0.002	Water1F	1	0.002	Meadow Vole	0.006	1	0.000012
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Forage	0.364	1.010828	Meadow Vole	0.005	0.95	0.004801433
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Terrestrial Invertebrates	0.96	2.66592	Meadow Vole	0.005	0.05	0.00066648
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Soil1	1	2.777	Meadow Vole	0.00012	1	0.00033324
Iqaluit Landfill	0.01	Surface Water (Fresh)	Cadmium			NA	0.000129	Water1F	1	0.000129	Meadow Vole	0.006	1	0.000000774
Iqaluit Landfill	0.01	Surface Water (Fresh)	Chromium 6+			NA	0.0037	Water1F	1	0.0037	Meadow Vole	0.006	1	0.0000222
Iqaluit Landfill	0.01	Surface Water (Fresh)	Copper			NA	0.004	Water1F	1	0.004	Meadow Vole	0.006	1	0.000024
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Terrestrial Invertebrates	1.24130756	64.08126147	Meadow Vole	0.005	0.05	0.016020315
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Terrestrial Invertebrates	1.24130756	64.08126147	Meadow Vole	0.005	0.05	0.016020315
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Forage	0.029295	1.51232508	Meadow Vole	0.005	0.95	0.007183544
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Soil1	1	51.624	Meadow Vole	0.00012	1	0.00619488
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aliphatic	5.4	251189	F2	0.108	Water1F	1	0.108	Meadow Vole	0.006	1	0.000648
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Terrestrial Invertebrates	2.25870952	29.15090506	Meadow Vole	0.005	0.05	0.007287726
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Forage	0.419565	5.41490589	Meadow Vole	0.005	0.95	0.025720803
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Soil1	1	12.906	Meadow Vole	0.00012	1	0.00154872
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aromatic	3.4	2512	F2	0.027	Water1F	1	0.027	Meadow Vole	0.006	1	0.000162
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Terrestrial Invertebrates	0.841162778	53.07400662	Meadow Vole	0.005	0.05	0.013268502
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Forage	0.005192	0.327594432	Meadow Vole	0.005	0.95	0.001556074
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Soil1	1	63.096	Meadow Vole	0.00012	1	0.00757152
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aliphatic	6.7	5011872	F2	0.132	Water1F	1	0.132	Meadow Vole	0.006	1	0.000792
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Terrestrial Invertebrates	2.064757037	32.56947751	Meadow Vole	0.005	0.05	0.008142369
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Forage	0.281	4.432494	Meadow Vole	0.005	0.95	0.021054347
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Soil1	1	15.774	Meadow Vole	0.00012	1	0.00189288
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aromatic	3.7	5012	F2	0.033	Water1F	1	0.033	Meadow Vole	0.006	1	0.000198
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Terrestrial Invertebrates	0.448621432	3883.231229	Meadow Vole	0.005	0.05	0.970807807
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Forage	0.000317	2.74392664	Meadow Vole	0.005	0.95	0.013033652
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Soil1	1	8655.92	Meadow Vole	0.00012	1	1.0387104
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aliphatic	8.8	630957344	F3	0.308	Water1F	1	0.308	Meadow Vole	0.006	1	0.001848
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Terrestrial Invertebrates	1.777780556	3847.081568	Meadow Vole	0.005	0.05	0.961770392
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Forage	0.145	313.7771	Meadow Vole	0.005	0.95	1.490441225

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Soil1	1	2163.98	Meadow Vole	0.00012	1	0.2596776
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aromatic	4.2	15849	F3	0.077	Water1F	1	0.077	Meadow Vole	0.006	1	0.000462
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Terrestrial Invertebrates	12.79027898	47447.84212	Meadow Vole	0.005	0.05	11.86196053
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Forage	5.55E-08	0.000205887	Meadow Vole	0.005	0.95	9.77964E-07
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Soil1	1	3709.68	Meadow Vole	0.00012	1	0.4451616
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	0.132	Water1F	1	0.132	Meadow Vole	0.006	1	0.000792
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Terrestrial Invertebrates	1.357933288	1259.37449	Meadow Vole	0.005	0.05	0.314843622
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Forage	0.0437	40.528254	Meadow Vole	0.005	0.95	0.192509207
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Soil1	1	927.42	Meadow Vole	0.00012	1	0.1112904
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aromatic	5.1	125893	F3	0.033	Water1F	1	0.033	Meadow Vole	0.006	1	0.000198
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Terrestrial Invertebrates	736.005216	989191.0103	Meadow Vole	0.005	0.05	247.2977526
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Forage	1.3E-12	1.7472E-09	Meadow Vole	0.005	0.95	8.2992E-12
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Soil1	1	1344	Meadow Vole	0.00012	1	0.16128
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	0.184	Water1F	1	0.184	Meadow Vole	0.006	1	0.001104
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Terrestrial Invertebrates	14.38401468	4833.028931	Meadow Vole	0.005	0.05	1.208257233
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Forage	0.00157	0.52752	Meadow Vole	0.005	0.95	0.00250572
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Soil1	1	336	Meadow Vole	0.00012	1	0.04032
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aromatic	7.6	1778279	F4	0.046	Water1F	1	0.046	Meadow Vole	0.006	1	0.000276
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Terrestrial Invertebrates	0.22	5213.12	Meadow Vole	0.005	0.05	1.30328
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Forage	0.4	9478.4	Meadow Vole	0.005	0.95	45.0224
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Soil1	1	23696	Meadow Vole	0.00012	1	2.84352
Iqaluit Landfill	0.01	Surface Water (Fresh)	Iron			NA	3.5	Water1F	1	3.5	Meadow Vole	0.006	1	0.021
Iqaluit Landfill	0.01	Surface Water (Fresh)	Toxaphene	5	100000	NA	0.001	Water1F	1	0.001	Meadow Vole	0.006	1	0.000006
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Forage	1.2E-12	1.47E-10	Meadow Vole	0.005	0.95	6.9825E-13
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Terrestrial Invertebrates	0.56	68.6	Meadow Vole	0.005	0.05	0.01715
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Soil1	1	122.5	Meadow Vole	0.00012	1	0.0147
Iqaluit Landfill	0.01	Surface Water (Fresh)	Zinc			NA	0.026	Water1F	1	0.026	Meadow Vole	0.006	1	0.000156
Iqaluit Landfill	0.01	Surface Water (Brackish)	Anthracene	4.45	20400	NA	0.00005	Water1B	1	0.00005	Merganser	0.08	1	0.000004
Iqaluit Landfill	0.01	Surface Water (Brackish)	Anthracene	4.45	20400	NA	0.00005	Fish	1770	0.0885	Merganser	0.369	1	0.0326565
Iqaluit Landfill	0.01	Sediment (Brackish)	Barium			NA	20.21	Sediment1B	1	20.21	Merganser	0.0015	1	0.030315
Iqaluit Landfill	0.01	Surface Water (Brackish)	Barium			NA	0.1	Water1B	1	0.1	Merganser	0.08	1	0.008
Iqaluit Landfill	0.01	Surface Water (Brackish)	Cadmium			NA	0.001	Water1B	1	0.001	Merganser	0.08	1	0.00008
Iqaluit Landfill	0.01	Surface Water (Brackish)	Cadmium			NA	0.001	Fish	907	0.907	Merganser	0.369	1	0.334683
Iqaluit Landfill	0.01	Sediment (Brackish)	Chromium 6+			NA	0.8	Sediment1B	1	0.8	Merganser	0.0015	1	0.0012
Iqaluit Landfill	0.01	Surface Water (Brackish)	Chromium 6+			NA	0.0005	Water1B	1	0.0005	Merganser	0.08	1	0.00004
Iqaluit Landfill	0.01	Surface Water (Brackish)	cis-1,2-Dichloroethene	2.09	43.79	NA	0.004	Water1B	1	0.004	Merganser	0.08	1	0.00032
Iqaluit Landfill	0.01	Surface Water (Brackish)	cis-1,2-Dichloroethene	2.09	43.79	NA	0.004	Fish	13.1	0.0524	Merganser	0.369	1	0.0193356
Iqaluit Landfill	0.01	Surface Water (Brackish)	Copper			NA	0.0057	Water1B	1	0.0057	Merganser	0.08	1	0.000456
Iqaluit Landfill	0.01	Surface Water (Brackish)	Copper			NA	0.0057	Fish	710	4.047	Merganser	0.369	1	1.493343
Iqaluit Landfill	0.01	Surface Water (Brackish)	DDT total	6.91	220000	NA	0.000005	Water1B	1	0.000005	Merganser	0.08	1	0.0000004
Iqaluit Landfill	0.01	Surface Water (Brackish)	DDT total	6.91	220000	NA	0.000005	Fish	7820	0.0391	Merganser	0.369	1	0.0144279
Iqaluit Landfill	0.01	Surface Water (Brackish)	Endrin	5.2	10600	NA	0.0002	Water1B	1	0.0002	Merganser	0.08	1	0.000016
Iqaluit Landfill	0.01	Surface Water (Brackish)	Endrin	5.2	10600	NA	0.0002	Fish	7210	1.442	Merganser	0.369	1	0.532098

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	201.6	Sediment1B	1	201.6	Merganser	0.0015	1	0.3024
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	0.168	Water1B	1	0.168	Merganser	0.08	1	0.01344
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	50.4	Sediment1B	1	50.4	Merganser	0.0015	1	0.0756
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	0.042	Water1B	1	0.042	Merganser	0.08	1	0.00336
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	86.4	Sediment1B	1	86.4	Merganser	0.0015	1	0.1296
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	0.072	Water1B	1	0.072	Merganser	0.08	1	0.00576
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	21.6	Sediment1B	1	21.6	Merganser	0.0015	1	0.0324
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	0.018	Water1B	1	0.018	Merganser	0.08	1	0.00144
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	376	Sediment1B	1	376	Merganser	0.0015	1	0.564
Iqaluit Landfill	0.01	Surface Water (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	0.08	Water1B	1	0.08	Merganser	0.08	1	0.0064
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	94	Sediment1B	1	94	Merganser	0.0015	1	0.141
Iqaluit Landfill	0.01	Surface Water (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	0.02	Water1B	1	0.02	Merganser	0.08	1	0.0016
Iqaluit Landfill	0.01	Sediment (Brackish)	Iron			NA	29778	Sediment1B	1	29778	Merganser	0.0015	1	44.667
Iqaluit Landfill	0.01	Surface Water (Brackish)	Iron			NA	0.648	Water1B	1	0.648	Merganser	0.08	1	0.05184
Iqaluit Landfill	0.01	Surface Water (Brackish)	Iron			NA	0.648	Fish	633	410.184	Merganser	0.369	1	151.357896
Iqaluit Landfill	0.01	Sediment (Brackish)	Lead			NA	25.83	Sediment1B	1	25.83	Merganser	0.0015	1	0.038745
Iqaluit Landfill	0.01	Surface Water (Brackish)	Lead			NA	0.001	Water1B	1	0.001	Merganser	0.08	1	0.00008
Iqaluit Landfill	0.01	Surface Water (Brackish)	Lindane (gamma HCH)	4.14	1120	NA	0.00005	Water1B	1	0.00005	Merganser	0.08	1	0.000004
Iqaluit Landfill	0.01	Surface Water (Brackish)	Lindane (gamma HCH)	4.14	1120	NA	0.00005	Fish	941	0.04705	Merganser	0.369	1	0.01736145
Iqaluit Landfill	0.01	Surface Water (Brackish)	Magnesium			NA	248	Water1B	1	248	Merganser	0.08	1	19.84
Iqaluit Landfill	0.01	Surface Water (Brackish)	Magnesium			NA	248	Fish	633	156984	Merganser	0.369	1	57927.096
Iqaluit Landfill	0.01	Surface Water (Brackish)	Manganese			NA	0.104	Water1B	1	0.104	Merganser	0.08	1	0.00832
Iqaluit Landfill	0.01	Surface Water (Brackish)	Mercury			NA	0.0001	Water1B	1	0.0001	Merganser	0.08	1	0.000008
Iqaluit Landfill	0.01	Surface Water (Brackish)	Mercury			NA	0.0001	Fish	3530	0.353	Merganser	0.369	1	0.130257
Iqaluit Landfill	0.01	Sediment (Brackish)	PCBs	6.29	309000	NA	0.09	Sediment1B	1	0.09	Merganser	0.0015	1	0.000135
Iqaluit Landfill	0.01	Surface Water (Brackish)	PCBs	6.29	309000	NA	0.001	Water1B	1	0.001	Merganser	0.08	1	0.00008
Iqaluit Landfill	0.01	Surface Water (Brackish)	PCBs	6.29	309000	NA	0.001	Fish	16400	16.4	Merganser	0.369	1	6.0516
Iqaluit Landfill	0.01	Surface Water (Brackish)	Pyrene	4.88	69400	NA	0.00005	Water1B	1	0.00005	Merganser	0.08	1	0.000004
Iqaluit Landfill	0.01	Surface Water (Brackish)	Pyrene	4.88	69400	NA	0.00005	Fish	4090	0.2045	Merganser	0.369	1	0.0754605
Iqaluit Landfill	0.01	Surface Water (Brackish)	Sodium			NA	2080	Water1B	1	2080	Merganser	0.08	1	166.4
Iqaluit Landfill	0.01	Surface Water (Brackish)	Sodium			NA	2080	Fish	633	1316640	Merganser	0.369	1	485840.16
Iqaluit Landfill	0.01	Surface Water (Brackish)	Toxaphene	5	100000	NA	0.0002	Water1B	1	0.0002	Merganser	0.08	1	0.000016
Iqaluit Landfill	0.01	Surface Water (Brackish)	Toxaphene	5	100000	NA	0.0002	Fish	5100	1.02	Merganser	0.369	1	0.37638
Iqaluit Landfill	0.01	Surface Water (Brackish)	Trichloroethene	2.53	117	NA	0.0226	Water1B	1	0.0226	Merganser	0.08	1	0.001808
Iqaluit Landfill	0.01	Surface Water (Brackish)	Trichloroethene	2.53	117	NA	0.0226	Fish	32.8	0.74128	Merganser	0.369	1	0.27353232
Iqaluit Landfill	0.01	Sediment (Brackish)	Vanadium			NA	47.12	Sediment1B	1	47.12	Merganser	0.0015	1	0.07068
Iqaluit Landfill	0.01	Surface Water (Brackish)	Vanadium			NA	0.002	Water1B	1	0.002	Merganser	0.08	1	0.00016
Iqaluit Landfill	0.01	Surface Water (Brackish)	Vanadium			NA	0.002	Fish	633	1.266	Merganser	0.369	1	0.467154
Iqaluit Landfill	0.01	Surface Water (Brackish)	Anthracene	4.45	20400	NA	0.00005	Water1B	1	0.00005	Muscrat	0.12	1	0.000006
Iqaluit Landfill	0.01	Sediment (Brackish)	Barium			NA	20.21	Benthic Invertebrates	0.0097	0.196037	Muscrat	0.358	0.01	0.000701812
Iqaluit Landfill	0.01	Sediment (Brackish)	Barium			NA	20.21	Sediment1B	1	20.21	Muscrat	0.0024	1	0.048504
Iqaluit Landfill	0.01	Sediment (Brackish)	Barium			NA	20.21	Aquatic Vegetation	633	12792.93	Muscrat	0.358	0.99	4534.070251
Iqaluit Landfill	0.01	Surface Water (Brackish)	Barium			NA	0.1	Water1B	1	0.1	Muscrat	0.12	1	0.012
Iqaluit Landfill	0.01	Surface Water (Brackish)	Cadmium			NA	0.001	Water1B	1	0.001	Muscrat	0.12	1	0.00012
Iqaluit Landfill	0.01	Sediment (Brackish)	Chromium 6+			NA	0.8	Aquatic Vegetation	0.0075	0.006	Muscrat	0.358	0.99	0.00212652
Iqaluit Landfill	0.01	Sediment (Brackish)	Chromium 6+			NA	0.8	Benthic Invertebrates	0.39	0.312	Muscrat	0.358	0.01	0.00111696

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Sediment (Brackish)	Chromium 6+			NA	0.8	Sediment1B	1	0.8	Muscrat	0.0024	1	0.00192
Iqaluit Landfill	0.01	Surface Water (Brackish)	Chromium 6+			NA	0.0005	Water1B	1	0.0005	Muscrat	0.12	1	0.00006
Iqaluit Landfill	0.01	Surface Water (Brackish)	cis-1,2-Dichloroethene	2.09	43.79	NA	0.004	Water1B	1	0.004	Muscrat	0.12	1	0.00048
Iqaluit Landfill	0.01	Surface Water (Brackish)	Copper			NA	0.0057	Water1B	1	0.0057	Muscrat	0.12	1	0.000684
Iqaluit Landfill	0.01	Surface Water (Brackish)	DDT total	6.91	220000	NA	0.000005	Water1B	1	0.000005	Muscrat	0.12	1	0.0000006
Iqaluit Landfill	0.01	Surface Water (Brackish)	Endrin	5.2	10600	NA	0.0002	Water1B	1	0.0002	Muscrat	0.12	1	0.000024
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	201.6	Benthic Invertebrates	0.448621432	90.44208077	Muscrat	0.358	0.01	0.323782649
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	201.6	Aquatic Vegetation	0.000317	0.0639072	Muscrat	0.358	0.99	0.02264999
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	201.6	Sediment1B	1	201.6	Muscrat	0.0024	1	0.48384
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	0.168	Water1B	1	0.168	Muscrat	0.12	1	0.02016
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	50.4	Benthic Invertebrates	1.777780556	89.60014003	Muscrat	0.358	0.01	0.320768501
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	50.4	Aquatic Vegetation	0.145	7.308	Muscrat	0.358	0.99	2.59010136
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	50.4	Sediment1B	1	50.4	Muscrat	0.0024	1	0.12096
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	0.042	Water1B	1	0.042	Muscrat	0.12	1	0.00504
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	86.4	Benthic Invertebrates	12.79027898	1105.080104	Muscrat	0.358	0.01	3.956186772
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	86.4	Aquatic Vegetation	5.55E-08	4.7952E-06	Muscrat	0.358	0.99	1.69951E-06
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	86.4	Sediment1B	1	86.4	Muscrat	0.0024	1	0.20736
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	0.072	Water1B	1	0.072	Muscrat	0.12	1	0.00864
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	21.6	Benthic Invertebrates	1.357933288	29.33135902	Muscrat	0.358	0.01	0.105006265
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	21.6	Aquatic Vegetation	0.0437	0.94392	Muscrat	0.358	0.99	0.334544126
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	21.6	Sediment1B	1	21.6	Muscrat	0.0024	1	0.05184
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	0.018	Water1B	1	0.018	Muscrat	0.12	1	0.00216
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	376	Benthic Invertebrates	736.005216	276737.9612	Muscrat	0.358	0.01	990.7219011
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	376	Aquatic Vegetation	1	376	Muscrat	0.358	0.99	133.26192
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	376	Sediment1B	1	376	Muscrat	0.0024	1	0.9024
Iqaluit Landfill	0.01	Surface Water (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	0.08	Water1B	1	0.08	Muscrat	0.12	1	0.0096
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	94	Benthic Invertebrates	14.38401468	1352.097379	Muscrat	0.358	0.01	4.840508619
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	94	Aquatic Vegetation	1	94	Muscrat	0.358	0.99	33.31548
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	94	Sediment1B	1	94	Muscrat	0.0024	1	0.2256
Iqaluit Landfill	0.01	Surface Water (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	0.02	Water1B	1	0.02	Muscrat	0.12	1	0.0024
Iqaluit Landfill	0.01	Sediment (Brackish)	Iron			NA	29778	Aquatic Vegetation	0.4	11911.2	Muscrat	0.358	0.99	4221.567504
Iqaluit Landfill	0.01	Sediment (Brackish)	Iron			NA	29778	Benthic Invertebrates	0.9	26800.2	Muscrat	0.358	0.01	95.944716
Iqaluit Landfill	0.01	Sediment (Brackish)	Iron			NA	29778	Sediment1B	1	29778	Muscrat	0.0024	1	71.4672
Iqaluit Landfill	0.01	Surface Water (Brackish)	Iron			NA	0.648	Water1B	1	0.648	Muscrat	0.12	1	0.07776
Iqaluit Landfill	0.01	Sediment (Brackish)	Lead			NA	25.83	Aquatic Vegetation	0.09	2.3247	Muscrat	0.358	0.99	0.823920174

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Sediment (Brackish)	Lead			NA	25.83	Benthic Invertebrates	0.22	5.6826	Muscrat	0.358	0.01	0.020343708
Iqaluit Landfill	0.01	Sediment (Brackish)	Lead			NA	25.83	Sediment1B	1	25.83	Muscrat	0.0024	1	0.061992
Iqaluit Landfill	0.01	Surface Water (Brackish)	Lead			NA	0.001	Water1B	1	0.001	Muscrat	0.12	1	0.00012
Iqaluit Landfill	0.01	Surface Water (Brackish)	Lindane (gamma HCH)	4.14	1120	NA	0.00005	Water1B	1	0.00005	Muscrat	0.12	1	0.000006
Iqaluit Landfill	0.01	Surface Water (Brackish)	Magnesium			NA	248	Water1B	1	248	Muscrat	0.12	1	29.76
Iqaluit Landfill	0.01	Surface Water (Brackish)	Manganese			NA	0.104	Water1B	1	0.104	Muscrat	0.12	1	0.01248
Iqaluit Landfill	0.01	Surface Water (Brackish)	Mercury			NA	0.0001	Water1B	1	0.0001	Muscrat	0.12	1	0.000012
Iqaluit Landfill	0.01	Sediment (Brackish)	PCBs	6.29	309000	NA	0.09	Aquatic Vegetation	0.01	0.0009	Muscrat	0.358	0.99	0.000318978
Iqaluit Landfill	0.01	Sediment (Brackish)	PCBs	6.29	309000	NA	0.09	Benthic Invertebrates	0.53	0.0477	Muscrat	0.358	0.01	0.000170766
Iqaluit Landfill	0.01	Sediment (Brackish)	PCBs	6.29	309000	NA	0.09	Sediment1B	1	0.09	Muscrat	0.0024	1	0.000216
Iqaluit Landfill	0.01	Surface Water (Brackish)	PCBs	6.29	309000	NA	0.001	Water1B	1	0.001	Muscrat	0.12	1	0.00012
Iqaluit Landfill	0.01	Surface Water (Brackish)	Pyrene	4.88	69400	NA	0.00005	Water1B	1	0.00005	Muscrat	0.12	1	0.000006
Iqaluit Landfill	0.01	Surface Water (Brackish)	Sodium			NA	2080	Water1B	1	2080	Muscrat	0.12	1	249.6
Iqaluit Landfill	0.01	Surface Water (Brackish)	Toxaphene	5	100000	NA	0.0002	Water1B	1	0.0002	Muscrat	0.12	1	0.000024
Iqaluit Landfill	0.01	Surface Water (Brackish)	Trichloroethene	2.53	117	NA	0.0226	Water1B	1	0.0226	Muscrat	0.12	1	0.002712
Iqaluit Landfill	0.01	Sediment (Brackish)	Vanadium			NA	47.12	Benthic Invertebrates	0.22	10.3664	Muscrat	0.358	0.01	0.037111712
Iqaluit Landfill	0.01	Sediment (Brackish)	Vanadium			NA	47.12	Sediment1B	1	47.12	Muscrat	0.0024	1	0.113088
Iqaluit Landfill	0.01	Sediment (Brackish)	Vanadium			NA	47.12	Aquatic Vegetation	633	29826.96	Muscrat	0.358	0.99	10571.27116
Iqaluit Landfill	0.01	Surface Water (Brackish)	Vanadium			NA	0.002	Water1B	1	0.002	Muscrat	0.12	1	0.00024
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Terrestrial Invertebrates	22.90171669	1.145085834	Robin	0.093	0.32	0.034077754
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Soil1	1	0.05	Robin	0.00138	1	0.000069
Iqaluit Landfill	0.01	Surface Water (Fresh)	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.001	Water1F	1	0.001	Robin	0.014	1	0.000014
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Berries	0.004	18.708	Robin	0.093	0.68	1.18309392
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Terrestrial Invertebrates	0.22	1028.94	Robin	0.093	0.32	30.6212544
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Soil1	1	4677	Robin	0.00138	1	6.45426
Iqaluit Landfill	0.01	Surface Water (Fresh)	Aluminum			NA	0.119	Water1F	1	0.119	Robin	0.014	1	0.001666
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Terrestrial Invertebrates	21.84318278	1.092159139	Robin	0.093	0.32	0.032502656
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Soil1	1	0.05	Robin	0.00138	1	0.000069
Iqaluit Landfill	0.01	Surface Water (Fresh)	Bromoform	2.4	35.04	NA	0.002	Water1F	1	0.002	Robin	0.014	1	0.000028
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Berries	0.038	0.105526	Robin	0.093	0.68	0.006673464
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Terrestrial Invertebrates	0.96	2.66592	Robin	0.093	0.32	0.079337779
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Soil1	1	2.777	Robin	0.00138	1	0.00383226
Iqaluit Landfill	0.01	Surface Water (Fresh)	Cadmium			NA	0.000129	Water1F	1	0.000129	Robin	0.014	1	0.000001806
Iqaluit Landfill	0.01	Surface Water (Fresh)	Chromium 6+			NA	0.0037	Water1F	1	0.0037	Robin	0.014	1	0.0000518
Iqaluit Landfill	0.01	Surface Water (Fresh)	Copper			NA	0.004	Water1F	1	0.004	Robin	0.014	1	0.000056
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Terrestrial Invertebrates	1.24130756	64.08126147	Robin	0.093	0.32	1.907058341
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Terrestrial Invertebrates	1.24130756	64.08126147	Robin	0.093	0.32	1.907058341
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Soil1	1	51.624	Robin	0.00138	1	0.07124112
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aliphatic	5.4	251189	F2	0.108	Water1F	1	0.108	Robin	0.014	1	0.001512
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Terrestrial Invertebrates	2.25870952	29.15090506	Robin	0.093	0.32	0.867530935

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Soil1	1	12.906	Robin	0.00138	1	0.01781028
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aromatic	3.4	2512	F2	0.027	Water1F	1	0.027	Robin	0.014	1	0.000378
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Terrestrial Invertebrates	0.841162778	53.07400662	Robin	0.093	0.32	1.579482437
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Soil1	1	63.096	Robin	0.00138	1	0.08707248
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aliphatic	6.7	5011872	F2	0.132	Water1F	1	0.132	Robin	0.014	1	0.001848
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Terrestrial Invertebrates	2.064757037	32.56947751	Robin	0.093	0.32	0.969267651
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Soil1	1	15.774	Robin	0.00138	1	0.02176812
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aromatic	3.7	5012	F2	0.033	Water1F	1	0.033	Robin	0.014	1	0.000462
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Terrestrial Invertebrates	0.448621432	3883.231229	Robin	0.093	0.32	115.5649614
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Soil1	1	8655.92	Robin	0.00138	1	11.9451696
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aliphatic	8.8	630957344	F3	0.308	Water1F	1	0.308	Robin	0.014	1	0.004312
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Terrestrial Invertebrates	1.777780556	3847.081568	Robin	0.093	0.32	114.4891475
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Soil1	1	2163.98	Robin	0.00138	1	2.9862924
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aromatic	4.2	15849	F3	0.077	Water1F	1	0.077	Robin	0.014	1	0.001078
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Terrestrial Invertebrates	12.79027898	47447.84212	Robin	0.093	0.32	1412.047782
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Soil1	1	3709.68	Robin	0.00138	1	5.1193584
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	0.132	Water1F	1	0.132	Robin	0.014	1	0.001848
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Terrestrial Invertebrates	1.357933288	1259.37449	Robin	0.093	0.32	37.47898481
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Soil1	1	927.42	Robin	0.00138	1	1.2798396
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aromatic	5.1	125893	F3	0.033	Water1F	1	0.033	Robin	0.014	1	0.000462
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Terrestrial Invertebrates	736.005216	989191.0103	Robin	0.093	0.32	29438.32447
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Soil1	1	1344	Robin	0.00138	1	1.85472
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	0.184	Water1F	1	0.184	Robin	0.014	1	0.002576
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Terrestrial Invertebrates	14.38401468	4833.028931	Robin	0.093	0.32	143.830941
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Soil1	1	336	Robin	0.00138	1	0.46368
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aromatic	7.6	1778279	F4	0.046	Water1F	1	0.046	Robin	0.014	1	0.000644
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Berries	0.001	23.696	Robin	0.093	0.68	1.49853504
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Terrestrial Invertebrates	0.22	5213.12	Robin	0.093	0.32	155.1424512
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Soil1	1	23696	Robin	0.00138	1	32.70048
Iqaluit Landfill	0.01	Surface Water (Fresh)	Iron			NA	3.5	Water1F	1	3.5	Robin	0.014	1	0.049
Iqaluit Landfill	0.01	Surface Water (Fresh)	Toxaphene	5	100000	NA	0.001	Water1F	1	0.001	Robin	0.014	1	0.000014
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Terrestrial Invertebrates	0.56	68.6	Robin	0.093	0.32	2.041536
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Berries	0.99	121.275	Robin	0.093	0.68	7.669431
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Soil1	1	122.5	Robin	0.00138	1	0.16905
Iqaluit Landfill	0.01	Surface Water (Fresh)	Zinc			NA	0.026	Water1F	1	0.026	Robin	0.014	1	0.000364
Iqaluit Landfill	0.01	Surface Water (Brackish)	Anthracene	4.45	20400	NA	0.00005	Water1B	1	0.00005	Scaup	0.05	1	0.0000025
Iqaluit Landfill	0.01	Sediment (Brackish)	Barium			NA	20.21	Benthic Invertebrates	0.0097	0.196037	Scaup	0.25	0.91	0.044598418

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Sediment (Brackish)	Barium			NA	20.21	Sediment1B	1	20.21	Scaup	0.0056	1	0.113176
Iqaluit Landfill	0.01	Sediment (Brackish)	Barium			NA	20.21	Aquatic Vegetation	633	12792.93	Scaup	0.25	0.9	2878.40925
Iqaluit Landfill	0.01	Surface Water (Brackish)	Barium			NA	0.1	Water1B	1	0.1	Scaup	0.05	1	0.005
Iqaluit Landfill	0.01	Surface Water (Brackish)	Cadmium			NA	0.001	Water1B	1	0.001	Scaup	0.05	1	0.00005
Iqaluit Landfill	0.01	Sediment (Brackish)	Chromium 6+			NA	0.8	Aquatic Vegetation	0.0075	0.006	Scaup	0.25	0.9	0.00135
Iqaluit Landfill	0.01	Sediment (Brackish)	Chromium 6+			NA	0.8	Benthic Invertebrates	0.39	0.312	Scaup	0.25	0.91	0.07098
Iqaluit Landfill	0.01	Sediment (Brackish)	Chromium 6+			NA	0.8	Sediment1B	1	0.8	Scaup	0.0056	1	0.00448
Iqaluit Landfill	0.01	Surface Water (Brackish)	Chromium 6+			NA	0.0005	Water1B	1	0.0005	Scaup	0.05	1	0.000025
Iqaluit Landfill	0.01	Surface Water (Brackish)	cis-1,2-Dichloroethene	2.09	43.79	NA	0.004	Water1B	1	0.004	Scaup	0.05	1	0.0002
Iqaluit Landfill	0.01	Surface Water (Brackish)	Copper			NA	0.0057	Water1B	1	0.0057	Scaup	0.05	1	0.000285
Iqaluit Landfill	0.01	Surface Water (Brackish)	DDT total	6.91	220000	NA	0.000005	Water1B	1	0.000005	Scaup	0.05	1	0.00000025
Iqaluit Landfill	0.01	Surface Water (Brackish)	Endrin	5.2	10600	NA	0.0002	Water1B	1	0.0002	Scaup	0.05	1	0.00001
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	201.6	Benthic Invertebrates	0.448621432	90.44208077	Scaup	0.25	0.91	20.57557337
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	201.6	Aquatic Vegetation	0.000317	0.0639072	Scaup	0.25	0.9	0.01437912
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	201.6	Sediment1B	1	201.6	Scaup	0.0056	1	1.12896
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	0.168	Water1B	1	0.168	Scaup	0.05	1	0.0084
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	50.4	Benthic Invertebrates	1.777780556	89.60014003	Scaup	0.25	0.91	20.38403186
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	50.4	Aquatic Vegetation	0.145	7.308	Scaup	0.25	0.9	1.6443
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	50.4	Sediment1B	1	50.4	Scaup	0.0056	1	0.28224
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	0.042	Water1B	1	0.042	Scaup	0.05	1	0.0021
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	86.4	Benthic Invertebrates	12.79027898	1105.080104	Scaup	0.25	0.91	251.4057236
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	86.4	Aquatic Vegetation	5.55E-08	4.7952E-06	Scaup	0.25	0.9	1.07892E-06
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	86.4	Sediment1B	1	86.4	Scaup	0.0056	1	0.48384
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	0.072	Water1B	1	0.072	Scaup	0.05	1	0.0036
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	21.6	Benthic Invertebrates	1.357933288	29.33135902	Scaup	0.25	0.91	6.672884176
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	21.6	Aquatic Vegetation	0.0437	0.94392	Scaup	0.25	0.9	0.212382
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	21.6	Sediment1B	1	21.6	Scaup	0.0056	1	0.12096
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	0.018	Water1B	1	0.018	Scaup	0.05	1	0.0009
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	376	Benthic Invertebrates	736.005216	276737.9612	Scaup	0.25	0.91	62957.88618
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	376	Aquatic Vegetation	1	376	Scaup	0.25	0.9	84.6
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	376	Sediment1B	1	376	Scaup	0.0056	1	2.1056
Iqaluit Landfill	0.01	Surface Water (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	0.08	Water1B	1	0.08	Scaup	0.05	1	0.004
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	94	Benthic Invertebrates	14.38401468	1352.097379	Scaup	0.25	0.91	307.6021538
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	94	Aquatic Vegetation	1	94	Scaup	0.25	0.9	21.15
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	94	Sediment1B	1	94	Scaup	0.0056	1	0.5264
Iqaluit Landfill	0.01	Surface Water (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	0.02	Water1B	1	0.02	Scaup	0.05	1	0.001

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Sediment (Brackish)	Iron			NA	29778	Aquatic Vegetation	0.4	11911.2	Scaup	0.25	0.9	2680.02
Iqaluit Landfill	0.01	Sediment (Brackish)	Iron			NA	29778	Benthic Invertebrates	0.9	26800.2	Scaup	0.25	0.91	6097.0455
Iqaluit Landfill	0.01	Sediment (Brackish)	Iron			NA	29778	Sediment1B	1	29778	Scaup	0.0056	1	166.7568
Iqaluit Landfill	0.01	Surface Water (Brackish)	Iron			NA	0.648	Water1B	1	0.648	Scaup	0.05	1	0.0324
Iqaluit Landfill	0.01	Sediment (Brackish)	Lead			NA	25.83	Aquatic Vegetation	0.09	2.3247	Scaup	0.25	0.9	0.5230575
Iqaluit Landfill	0.01	Sediment (Brackish)	Lead			NA	25.83	Benthic Invertebrates	0.22	5.6826	Scaup	0.25	0.91	1.2927915
Iqaluit Landfill	0.01	Sediment (Brackish)	Lead			NA	25.83	Sediment1B	1	25.83	Scaup	0.0056	1	0.144648
Iqaluit Landfill	0.01	Surface Water (Brackish)	Lead			NA	0.001	Water1B	1	0.001	Scaup	0.05	1	0.00005
Iqaluit Landfill	0.01	Surface Water (Brackish)	Lindane (gamma HCH)	4.14	1120	NA	0.00005	Water1B	1	0.00005	Scaup	0.05	1	0.0000025
Iqaluit Landfill	0.01	Surface Water (Brackish)	Magnesium			NA	248	Water1B	1	248	Scaup	0.05	1	12.4
Iqaluit Landfill	0.01	Surface Water (Brackish)	Manganese			NA	0.104	Water1B	1	0.104	Scaup	0.05	1	0.0052
Iqaluit Landfill	0.01	Surface Water (Brackish)	Mercury			NA	0.0001	Water1B	1	0.0001	Scaup	0.05	1	0.000005
Iqaluit Landfill	0.01	Sediment (Brackish)	PCBs	6.29	309000	NA	0.09	Aquatic Vegetation	0.01	0.0009	Scaup	0.25	0.9	0.0002025
Iqaluit Landfill	0.01	Sediment (Brackish)	PCBs	6.29	309000	NA	0.09	Benthic Invertebrates	0.53	0.0477	Scaup	0.25	0.91	0.01085175
Iqaluit Landfill	0.01	Sediment (Brackish)	PCBs	6.29	309000	NA	0.09	Sediment1B	1	0.09	Scaup	0.0056	1	0.000504
Iqaluit Landfill	0.01	Surface Water (Brackish)	PCBs	6.29	309000	NA	0.001	Water1B	1	0.001	Scaup	0.05	1	0.00005
Iqaluit Landfill	0.01	Surface Water (Brackish)	Pyrene	4.88	69400	NA	0.00005	Water1B	1	0.00005	Scaup	0.05	1	0.0000025
Iqaluit Landfill	0.01	Surface Water (Brackish)	Sodium			NA	2080	Water1B	1	2080	Scaup	0.05	1	104
Iqaluit Landfill	0.01	Surface Water (Brackish)	Toxaphene	5	100000	NA	0.0002	Water1B	1	0.0002	Scaup	0.05	1	0.00001
Iqaluit Landfill	0.01	Surface Water (Brackish)	Trichloroethene	2.53	117	NA	0.0226	Water1B	1	0.0226	Scaup	0.05	1	0.00113
Iqaluit Landfill	0.01	Sediment (Brackish)	Vanadium			NA	47.12	Benthic Invertebrates	0.22	10.3664	Scaup	0.25	0.91	2.358356
Iqaluit Landfill	0.01	Sediment (Brackish)	Vanadium			NA	47.12	Sediment1B	1	47.12	Scaup	0.0056	1	0.263872
Iqaluit Landfill	0.01	Sediment (Brackish)	Vanadium			NA	47.12	Aquatic Vegetation	633	29826.96	Scaup	0.25	0.9	6711.066
Iqaluit Landfill	0.01	Surface Water (Brackish)	Vanadium			NA	0.002	Water1B	1	0.002	Scaup	0.05	1	0.0001
Iqaluit Landfill	0.01	Sediment (Brackish)	Barium			NA	20.21	Sediment1B	1	20.21	Sediment_PB	1	1	20.21
Iqaluit Landfill	0.01	Sediment (Brackish)	Chromium 6+			NA	0.8	Sediment1B	1	0.8	Sediment_PB	1	1	0.8
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	201.6	Sediment1B	1	201.6	Sediment_PB	1	1	201.6
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	50.4	Sediment1B	1	50.4	Sediment_PB	1	1	50.4
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	86.4	Sediment1B	1	86.4	Sediment_PB	1	1	86.4
Iqaluit Landfill	0.01	Sediment (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	21.6	Sediment1B	1	21.6	Sediment_PB	1	1	21.6
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	376	Sediment1B	1	376	Sediment_PB	1	1	376
Iqaluit Landfill	0.01	Sediment (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	94	Sediment1B	1	94	Sediment_PB	1	1	94
Iqaluit Landfill	0.01	Sediment (Brackish)	Iron			NA	29778	Sediment1B	1	29778	Sediment_PB	1	1	29778
Iqaluit Landfill	0.01	Sediment (Brackish)	Lead			NA	25.83	Sediment1B	1	25.83	Sediment_PB	1	1	25.83
Iqaluit Landfill	0.01	Sediment (Brackish)	PCBs	6.29	309000	NA	0.09	Sediment1B	1	0.09	Sediment_PB	1	1	0.09
Iqaluit Landfill	0.01	Sediment (Brackish)	Vanadium			NA	47.12	Sediment1B	1	47.12	Sediment_PB	1	1	47.12
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Browse	0.784	0.0392	Snowshoe Hare	0.034	0.6	0.00079968
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Forage	0.784	0.0392	Snowshoe Hare	0.034	0.4	0.00053312
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Soil1	1	0.05	Snowshoe Hare	0.007	1	0.00035
Iqaluit Landfill	0.01	Surface Water (Fresh)	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.001	Water1F	1	0.001	Snowshoe Hare	0.13	1	0.00013
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Forage	0.004	18.708	Snowshoe Hare	0.034	0.4	0.2544288

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Browse	0.004	18.708	Snowshoe Hare	0.034	0.6	0.3816432
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Soil1	1	4677	Snowshoe Hare	0.007	1	32.739
Iqaluit Landfill	0.01	Surface Water (Fresh)	Aluminum			NA	0.119	Water1F	1	0.119	Snowshoe Hare	0.13	1	0.01547
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Soil1	1	0.05	Snowshoe Hare	0.007	1	0.00035
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Browse	1.59	0.0795	Snowshoe Hare	0.034	0.6	0.0016218
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Forage	1.59	0.0795	Snowshoe Hare	0.034	0.4	0.0010812
Iqaluit Landfill	0.01	Surface Water (Fresh)	Bromoform	2.4	35.04	NA	0.002	Water1F	1	0.002	Snowshoe Hare	0.13	1	0.00026
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Forage	0.364	1.010828	Snowshoe Hare	0.034	0.4	0.013747261
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Browse	0.364	1.010828	Snowshoe Hare	0.034	0.6	0.020620891
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Soil1	1	2.777	Snowshoe Hare	0.007	1	0.019439
Iqaluit Landfill	0.01	Surface Water (Fresh)	Cadmium			NA	0.000129	Water1F	1	0.000129	Snowshoe Hare	0.13	1	0.00001677
Iqaluit Landfill	0.01	Surface Water (Fresh)	Chromium 6+			NA	0.0037	Water1F	1	0.0037	Snowshoe Hare	0.13	1	0.000481
Iqaluit Landfill	0.01	Surface Water (Fresh)	Copper			NA	0.004	Water1F	1	0.004	Snowshoe Hare	0.13	1	0.00052
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Browse	0.029295	1.51232508	Snowshoe Hare	0.034	0.6	0.030851432
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Forage	0.029295	1.51232508	Snowshoe Hare	0.034	0.4	0.020567621
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Soil1	1	51.624	Snowshoe Hare	0.007	1	0.361368
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aliphatic	5.4	251189	F2	0.108	Water1F	1	0.108	Snowshoe Hare	0.13	1	0.01404
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Browse	0.419565	5.41490589	Snowshoe Hare	0.034	0.6	0.11046408
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Forage	0.419565	5.41490589	Snowshoe Hare	0.034	0.4	0.07364272
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Soil1	1	12.906	Snowshoe Hare	0.007	1	0.090342
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aromatic	3.4	2512	F2	0.027	Water1F	1	0.027	Snowshoe Hare	0.13	1	0.00351
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Browse	0.005192	0.327594432	Snowshoe Hare	0.034	0.6	0.006682926
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Forage	0.005192	0.327594432	Snowshoe Hare	0.034	0.4	0.004455284
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Soil1	1	63.096	Snowshoe Hare	0.007	1	0.441672
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aliphatic	6.7	5011872	F2	0.132	Water1F	1	0.132	Snowshoe Hare	0.13	1	0.01716
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Browse	0.281	4.432494	Snowshoe Hare	0.034	0.6	0.090422878
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Forage	0.281	4.432494	Snowshoe Hare	0.034	0.4	0.060281918
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Soil1	1	15.774	Snowshoe Hare	0.007	1	0.110418
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aromatic	3.7	5012	F2	0.033	Water1F	1	0.033	Snowshoe Hare	0.13	1	0.00429
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Browse	0.000317	2.74392664	Snowshoe Hare	0.034	0.6	0.055976103
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Forage	0.000317	2.74392664	Snowshoe Hare	0.034	0.4	0.037317402
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Soil1	1	8655.92	Snowshoe Hare	0.007	1	60.59144
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aliphatic	8.8	630957344	F3	0.308	Water1F	1	0.308	Snowshoe Hare	0.13	1	0.04004
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Browse	0.145	313.7771	Snowshoe Hare	0.034	0.6	6.40105284
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Forage	0.145	313.7771	Snowshoe Hare	0.034	0.4	4.26736856
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Soil1	1	2163.98	Snowshoe Hare	0.007	1	15.14786
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aromatic	4.2	15849	F3	0.077	Water1F	1	0.077	Snowshoe Hare	0.13	1	0.01001
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Browse	5.55E-08	0.000205887	Snowshoe Hare	0.034	0.6	4.2001E-06
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Forage	5.55E-08	0.000205887	Snowshoe Hare	0.034	0.4	2.80007E-06
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Soil1	1	3709.68	Snowshoe Hare	0.007	1	25.96776
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	0.132	Water1F	1	0.132	Snowshoe Hare	0.13	1	0.01716
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Browse	0.0437	40.528254	Snowshoe Hare	0.034	0.6	0.826776382

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Forage	0.0437	40.528254	Snowshoe Hare	0.034	0.4	0.551184254
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Soil1	1	927.42	Snowshoe Hare	0.007	1	6.49194
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aromatic	5.1	125893	F3	0.033	Water1F	1	0.033	Snowshoe Hare	0.13	1	0.00429
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Browse	1.3E-12	1.7472E-09	Snowshoe Hare	0.034	0.6	3.56429E-11
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Forage	1.3E-12	1.7472E-09	Snowshoe Hare	0.034	0.4	2.37619E-11
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Browse	0.00157	2.11008	Snowshoe Hare	0.034	0.6	0.043045632
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Soil1	1	1344	Snowshoe Hare	0.007	1	9.408
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	0.184	Water1F	1	0.184	Snowshoe Hare	0.13	1	0.02392
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Forage	0.00157	0.52752	Snowshoe Hare	0.034	0.4	0.007174272
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Soil1	1	336	Snowshoe Hare	0.007	1	2.352
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aromatic	7.6	1778279	F4	0.046	Water1F	1	0.046	Snowshoe Hare	0.13	1	0.00598
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Browse	0.4	9478.4	Snowshoe Hare	0.034	0.6	193.35936
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Forage	0.4	9478.4	Snowshoe Hare	0.034	0.4	128.90624
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Soil1	1	23696	Snowshoe Hare	0.007	1	165.872
Iqaluit Landfill	0.01	Surface Water (Fresh)	Iron			NA	3.5	Water1F	1	3.5	Snowshoe Hare	0.13	1	0.455
Iqaluit Landfill	0.01	Surface Water (Fresh)	Toxaphene	5	100000	NA	0.001	Water1F	1	0.001	Snowshoe Hare	0.13	1	0.00013
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Forage	1.2E-12	1.47E-10	Snowshoe Hare	0.034	0.4	1.9992E-12
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Browse	1.2E-12	1.47E-10	Snowshoe Hare	0.034	0.6	2.9988E-12
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Soil1	1	122.5	Snowshoe Hare	0.007	1	0.8575
Iqaluit Landfill	0.01	Surface Water (Fresh)	Zinc			NA	0.026	Water1F	1	0.026	Snowshoe Hare	0.13	1	0.00338
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Soil1	1	0.05	Soil_P	1	1	0.05
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Soil1	1	4677	Soil_P	1	1	4677
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Soil1	1	0.05	Soil_P	1	1	0.05
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Soil1	1	2.777	Soil_P	1	1	2.777
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Soil1	1	51.624	Soil_P	1	1	51.624
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Soil1	1	12.906	Soil_P	1	1	12.906
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Soil1	1	63.096	Soil_P	1	1	63.096
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Soil1	1	15.774	Soil_P	1	1	15.774
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Soil1	1	8655.92	Soil_P	1	1	8655.92
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Soil1	1	2163.98	Soil_P	1	1	2163.98
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Soil1	1	3709.68	Soil_P	1	1	3709.68
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Soil1	1	927.42	Soil_P	1	1	927.42
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Soil1	1	1344	Soil_P	1	1	1344
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Soil1	1	336	Soil_P	1	1	336
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Soil1	1	23696	Soil_P	1	1	23696
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Soil1	1	122.5	Soil_P	1	1	122.5
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Terrestrial Invertebrates	22.90171669	1.145085834	ST_Shrew	0.009	0.705	0.00726557
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Forage	0.784	0.0392	ST_Shrew	0.009	0.295	0.000104076
Iqaluit Landfill	0.01	Soil	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.05	Soil1	1	0.05	ST_Shrew	0.00117	1	0.0000585
Iqaluit Landfill	0.01	Surface Water (Fresh)	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.001	Water1F	1	0.001	ST_Shrew	0.0033	1	0.0000033
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Forage	0.004	18.708	ST_Shrew	0.009	0.295	0.04966974
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Terrestrial Invertebrates	0.22	1028.94	ST_Shrew	0.009	0.705	6.5286243
Iqaluit Landfill	0.01	Soil	Aluminum			NA	4677	Soil1	1	4677	ST_Shrew	0.00117	1	5.47209

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Surface Water (Fresh)	Aluminum			NA	0.119	Water1F	1	0.119	ST_Shrew	0.0033	1	0.0003927
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Terrestrial Invertebrates	21.84318278	1.092159139	ST_Shrew	0.009	0.705	0.00692975
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Soil1	1	0.05	ST_Shrew	0.00117	1	0.0000585
Iqaluit Landfill	0.01	Soil	Bromoform	2.4	35.04	NA	0.05	Forage	1.59	0.0795	ST_Shrew	0.009	0.295	0.000211073
Iqaluit Landfill	0.01	Surface Water (Fresh)	Bromoform	2.4	35.04	NA	0.002	Water1F	1	0.002	ST_Shrew	0.0033	1	0.0000066
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Forage	0.364	1.010828	ST_Shrew	0.009	0.295	0.002683748
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Terrestrial Invertebrates	0.96	2.66592	ST_Shrew	0.009	0.705	0.016915262
Iqaluit Landfill	0.01	Soil	Cadmium			NA	2.777	Soil1	1	2.777	ST_Shrew	0.00117	1	0.00324909
Iqaluit Landfill	0.01	Surface Water (Fresh)	Cadmium			NA	0.000129	Water1F	1	0.000129	ST_Shrew	0.0033	1	4.257E-07
Iqaluit Landfill	0.01	Surface Water (Fresh)	Chromium 6+			NA	0.0037	Water1F	1	0.0037	ST_Shrew	0.0033	1	0.00001221
Iqaluit Landfill	0.01	Surface Water (Fresh)	Copper			NA	0.004	Water1F	1	0.004	ST_Shrew	0.0033	1	0.0000132
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Terrestrial Invertebrates	1.24130756	64.08126147	ST_Shrew	0.009	0.705	0.406595604
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Terrestrial Invertebrates	1.24130756	64.08126147	ST_Shrew	0.009	0.705	0.406595604
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Forage	0.029295	1.51232508	ST_Shrew	0.009	0.295	0.004015223
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aliphatic	5.4	251189	F2	51.624	Soil1	1	51.624	ST_Shrew	0.00117	1	0.06040008
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aliphatic	5.4	251189	F2	0.108	Water1F	1	0.108	ST_Shrew	0.0033	1	0.0003564
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Terrestrial Invertebrates	2.25870952	29.15090506	ST_Shrew	0.009	0.705	0.184962493
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Forage	0.419565	5.41490589	ST_Shrew	0.009	0.295	0.014376575
Iqaluit Landfill	0.01	Soil	F2 - C>10-12 aromatic	3.4	2512	F2	12.906	Soil1	1	12.906	ST_Shrew	0.00117	1	0.01510002
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aromatic	3.4	2512	F2	0.027	Water1F	1	0.027	ST_Shrew	0.0033	1	0.0000891
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Terrestrial Invertebrates	0.841162778	53.07400662	ST_Shrew	0.009	0.705	0.336754572
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Forage	0.005192	0.327594432	ST_Shrew	0.009	0.295	0.000869763
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aliphatic	6.7	5011872	F2	63.096	Soil1	1	63.096	ST_Shrew	0.00117	1	0.07382232
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aliphatic	6.7	5011872	F2	0.132	Water1F	1	0.132	ST_Shrew	0.0033	1	0.0004356
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Terrestrial Invertebrates	2.064757037	32.56947751	ST_Shrew	0.009	0.705	0.206653335
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Forage	0.281	4.432494	ST_Shrew	0.009	0.295	0.011768272
Iqaluit Landfill	0.01	Soil	F2 - C>12-16 aromatic	3.7	5012	F2	15.774	Soil1	1	15.774	ST_Shrew	0.00117	1	0.01845558
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aromatic	3.7	5012	F2	0.033	Water1F	1	0.033	ST_Shrew	0.0033	1	0.0001089
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Terrestrial Invertebrates	0.448621432	3883.231229	ST_Shrew	0.009	0.705	24.63910215
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Forage	0.000317	2.74392664	ST_Shrew	0.009	0.295	0.007285125
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aliphatic	8.8	630957344	F3	8655.92	Soil1	1	8655.92	ST_Shrew	0.00117	1	10.1274264
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aliphatic	8.8	630957344	F3	0.308	Water1F	1	0.308	ST_Shrew	0.0033	1	0.0010164
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Terrestrial Invertebrates	1.777780556	3847.081568	ST_Shrew	0.009	0.705	24.40973255
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Forage	0.145	313.7771	ST_Shrew	0.009	0.295	0.833078201
Iqaluit Landfill	0.01	Soil	F3 - C>16-21 aromatic	4.2	15849	F3	2163.98	Soil1	1	2163.98	ST_Shrew	0.00117	1	2.5318566
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aromatic	4.2	15849	F3	0.077	Water1F	1	0.077	ST_Shrew	0.0033	1	0.0002541
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Terrestrial Invertebrates	12.79027898	47447.84212	ST_Shrew	0.009	0.705	301.0565583

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Forage	5.55E-08	0.000205887	ST_Shrew	0.009	0.295	5.46631E-07
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aliphatic	15.3	1E+13	F3	3709.68	Soil1	1	3709.68	ST_Shrew	0.00117	1	4.3403256
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	0.132	Water1F	1	0.132	ST_Shrew	0.0033	1	0.0004356
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Terrestrial Invertebrates	1.357933288	1259.37449	ST_Shrew	0.009	0.705	7.990731137
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Forage	0.0437	40.528254	ST_Shrew	0.009	0.295	0.107602514
Iqaluit Landfill	0.01	Soil	F3 - C>21-34 aromatic	5.1	125893	F3	927.42	Soil1	1	927.42	ST_Shrew	0.00117	1	1.0850814
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aromatic	5.1	125893	F3	0.033	Water1F	1	0.033	ST_Shrew	0.0033	1	0.0001089
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Terrestrial Invertebrates	736.005216	989191.0103	ST_Shrew	0.009	0.705	6276.41696
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Forage	1.3E-12	1.7472E-09	ST_Shrew	0.009	0.295	4.63882E-12
Iqaluit Landfill	0.01	Soil	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	1344	Soil1	1	1344	ST_Shrew	0.00117	1	1.57248
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	0.184	Water1F	1	0.184	ST_Shrew	0.0033	1	0.0006072
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Terrestrial Invertebrates	14.38401468	4833.028931	ST_Shrew	0.009	0.705	30.66556857
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Forage	0.00157	0.52752	ST_Shrew	0.009	0.295	0.001400566
Iqaluit Landfill	0.01	Soil	F4 - C>34 aromatic	7.6	1778279	F4	336	Soil1	1	336	ST_Shrew	0.00117	1	0.39312
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aromatic	7.6	1778279	F4	0.046	Water1F	1	0.046	ST_Shrew	0.0033	1	0.0001518
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Terrestrial Invertebrates	0.22	5213.12	ST_Shrew	0.009	0.705	33.0772464
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Forage	0.4	9478.4	ST_Shrew	0.009	0.295	25.165152
Iqaluit Landfill	0.01	Soil	Iron			NA	23696	Soil1	1	23696	ST_Shrew	0.00117	1	27.72432
Iqaluit Landfill	0.01	Surface Water (Fresh)	Iron			NA	3.5	Water1F	1	3.5	ST_Shrew	0.0033	1	0.01155
Iqaluit Landfill	0.01	Surface Water (Fresh)	Toxaphene	5	100000	NA	0.001	Water1F	1	0.001	ST_Shrew	0.0033	1	0.0000033
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Forage	1.2E-12	1.47E-10	ST_Shrew	0.009	0.295	3.90285E-13
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Terrestrial Invertebrates	0.56	68.6	ST_Shrew	0.009	0.705	0.435267
Iqaluit Landfill	0.01	Soil	Zinc			NA	122.5	Soil1	1	122.5	ST_Shrew	0.00117	1	0.143325
Iqaluit Landfill	0.01	Surface Water (Fresh)	Zinc			NA	0.026	Water1F	1	0.026	ST_Shrew	0.0033	1	0.0000858
Iqaluit Landfill	0.01	Surface Water (Brackish)	Anthracene	4.45	20400	NA	0.00005	Water1B	1	0.00005	Water_PB	1	1	0.00005
Iqaluit Landfill	0.01	Surface Water (Brackish)	Barium			NA	0.1	Water1B	1	0.1	Water_PB	1	1	0.1
Iqaluit Landfill	0.01	Surface Water (Brackish)	Cadmium			NA	0.001	Water1B	1	0.001	Water_PB	1	1	0.001
Iqaluit Landfill	0.01	Surface Water (Brackish)	Chromium 6+			NA	0.0005	Water1B	1	0.0005	Water_PB	1	1	0.0005
Iqaluit Landfill	0.01	Surface Water (Brackish)	cis-1,2-Dichloroethene	2.09	43.79	NA	0.004	Water1B	1	0.004	Water_PB	1	1	0.004
Iqaluit Landfill	0.01	Surface Water (Brackish)	Copper			NA	0.0057	Water1B	1	0.0057	Water_PB	1	1	0.0057
Iqaluit Landfill	0.01	Surface Water (Brackish)	DDT total	6.91	220000	NA	0.000005	Water1B	1	0.000005	Water_PB	1	1	0.000005
Iqaluit Landfill	0.01	Surface Water (Brackish)	Endrin	5.2	10600	NA	0.0002	Water1B	1	0.0002	Water_PB	1	1	0.0002
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>16-21 aliphatic	8.8	630957344	F3	0.168	Water1B	1	0.168	Water_PB	1	1	0.168
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>16-21 aromatic	4.2	15849	F3	0.042	Water1B	1	0.042	Water_PB	1	1	0.042
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	0.072	Water1B	1	0.072	Water_PB	1	1	0.072
Iqaluit Landfill	0.01	Surface Water (Brackish)	F3 - C>21-34 aromatic	5.1	125893	F3	0.018	Water1B	1	0.018	Water_PB	1	1	0.018
Iqaluit Landfill	0.01	Surface Water (Brackish)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	0.08	Water1B	1	0.08	Water_PB	1	1	0.08
Iqaluit Landfill	0.01	Surface Water (Brackish)	F4 - C>34 aromatic	7.6	1778279	F4	0.02	Water1B	1	0.02	Water_PB	1	1	0.02
Iqaluit Landfill	0.01	Surface Water (Brackish)	Iron			NA	0.648	Water1B	1	0.648	Water_PB	1	1	0.648
Iqaluit Landfill	0.01	Surface Water (Brackish)	Lead			NA	0.001	Water1B	1	0.001	Water_PB	1	1	0.001
Iqaluit Landfill	0.01	Surface Water (Brackish)	Lindane (gamma HCH)	4.14	1120	NA	0.00005	Water1B	1	0.00005	Water_PB	1	1	0.00005
Iqaluit Landfill	0.01	Surface Water (Brackish)	Magnesium			NA	248	Water1B	1	248	Water_PB	1	1	248
Iqaluit Landfill	0.01	Surface Water (Brackish)	Manganese			NA	0.104	Water1B	1	0.104	Water_PB	1	1	0.104
Iqaluit Landfill	0.01	Surface Water (Brackish)	Mercury			NA	0.0001	Water1B	1	0.0001	Water_PB	1	1	0.0001

Calculation of Exposure - Prey Items (all chemicals)

Site	foc	Medium	Chemical	logKow	Koc	PHC fraction	Concentration in medium	Food Item	Transfer factor applied	Concentration in food item	Prey Item	Total Ingestion Rate (kg/d)	Proportion	Exposure - Prey
Iqaluit Landfill	0.01	Surface Water (Brackish)	PCBs	6.29	309000	NA	0.001	Water1B	1	0.001	Water_PB	1	1	0.001
Iqaluit Landfill	0.01	Surface Water (Brackish)	Pyrene	4.88	69400	NA	0.00005	Water1B	1	0.00005	Water_PB	1	1	0.00005
Iqaluit Landfill	0.01	Surface Water (Brackish)	Sodium			NA	2080	Water1B	1	2080	Water_PB	1	1	2080
Iqaluit Landfill	0.01	Surface Water (Brackish)	Toxaphene	5	100000	NA	0.0002	Water1B	1	0.0002	Water_PB	1	1	0.0002
Iqaluit Landfill	0.01	Surface Water (Brackish)	Trichloroethene	2.53	117	NA	0.0226	Water1B	1	0.0226	Water_PB	1	1	0.0226
Iqaluit Landfill	0.01	Surface Water (Brackish)	Vanadium			NA	0.002	Water1B	1	0.002	Water_PB	1	1	0.002
Iqaluit Landfill	0.01	Surface Water (Fresh)	1,1,1,2-tetrachloroethane	2.93	96.63	NA	0.001	Water1F	1	0.001	Water_PF	1	1	0.001
Iqaluit Landfill	0.01	Surface Water (Fresh)	Aluminum			NA	0.119	Water1F	1	0.119	Water_PF	1	1	0.119
Iqaluit Landfill	0.01	Surface Water (Fresh)	Bromoform	2.4	35.04	NA	0.002	Water1F	1	0.002	Water_PF	1	1	0.002
Iqaluit Landfill	0.01	Surface Water (Fresh)	Cadmium			NA	0.000129	Water1F	1	0.000129	Water_PF	1	1	0.000129
Iqaluit Landfill	0.01	Surface Water (Fresh)	Chromium 6+			NA	0.0037	Water1F	1	0.0037	Water_PF	1	1	0.0037
Iqaluit Landfill	0.01	Surface Water (Fresh)	Copper			NA	0.004	Water1F	1	0.004	Water_PF	1	1	0.004
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aliphatic	5.4	251189	F2	0.108	Water1F	1	0.108	Water_PF	1	1	0.108
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>10-12 aromatic	3.4	2512	F2	0.027	Water1F	1	0.027	Water_PF	1	1	0.027
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aliphatic	6.7	5011872	F2	0.132	Water1F	1	0.132	Water_PF	1	1	0.132
Iqaluit Landfill	0.01	Surface Water (Fresh)	F2 - C>12-16 aromatic	3.7	5012	F2	0.033	Water1F	1	0.033	Water_PF	1	1	0.033
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aliphatic	8.8	630957344	F3	0.308	Water1F	1	0.308	Water_PF	1	1	0.308
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>16-21 aromatic	4.2	15849	F3	0.077	Water1F	1	0.077	Water_PF	1	1	0.077
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aliphatic	15.3	1E+13	F3	0.132	Water1F	1	0.132	Water_PF	1	1	0.132
Iqaluit Landfill	0.01	Surface Water (Fresh)	F3 - C>21-34 aromatic	5.1	125893	F3	0.033	Water1F	1	0.033	Water_PF	1	1	0.033
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aliphatic	23.3	1.58489E+18	F4	0.184	Water1F	1	0.184	Water_PF	1	1	0.184
Iqaluit Landfill	0.01	Surface Water (Fresh)	F4 - C>34 aromatic	7.6	1778279	F4	0.046	Water1F	1	0.046	Water_PF	1	1	0.046
Iqaluit Landfill	0.01	Surface Water (Fresh)	Iron			NA	3.5	Water1F	1	3.5	Water_PF	1	1	3.5
Iqaluit Landfill	0.01	Surface Water (Fresh)	Toxaphene	5	100000	NA	0.001	Water1F	1	0.001	Water_PF	1	1	0.001
Iqaluit Landfill	0.01	Surface Water (Fresh)	Zinc			NA	0.026	Water1F	1	0.026	Water_PF	1	1	0.026

Calculation of Exposure of Predators to COPCs (except PHCs) via Ingestion

Chemical	Prey Item	Sum of Exposure via All Pathways (mg/d)	Total Ingestion - Prey Item (mg/d) * time on site	Predator	Total food or medium (soil, water, sediment) Ingestion Rate	Proportion consumed	Exposure - Predator (mg/d)
Barium	Mallard	799.6352389	15.99270478	Red-Tailed Hawk	0.0987	0.16	0.252556794
Barium	Mallard	799.6352389	15.99270478	Mink	0.218	0.05	0.174320482
Barium	Muscrat	4534.131456	4534.131456	Mink	0.218	0.1	98.84406575
Cadmium	Soil_P	2.777	2.777	Red-Tailed Hawk	1.8	1	4.9986
Cadmium	Soil_P	2.777	2.777	Grey Wolf	0.046	1	0.127742
Cadmium	Soil_P	2.777	2.777	Red Fox	0.0126	1	0.0349902
Cadmium	Soil_P	2.777	2.777	Arctic Fox	0.0126	1	0.0349902
Cadmium	Water_PF	0.000129	0.000129	Red-Tailed Hawk	0.0672	1	8.6688E-06
Cadmium	Water_PF	0.000129	0.000129	Grey Wolf	2.9	1	0.0003741
Cadmium	Water_PF	0.000129	0.000129	Red Fox	0.38	1	0.00004902
Cadmium	Water_PF	0.000129	0.000129	Arctic Fox	0.38	1	0.00004902
Cadmium	Deer_Mouse	0.009197385	0.009197385	Red-Tailed Hawk	0.0987	0.24	0.000217868
Cadmium	Deer_Mouse	0.009197385	0.009197385	Red Fox	0.45	0.22	0.000910541
Cadmium	Meadow Vole	0.005801927	0.005801927	Red Fox	0.45	0.22	0.000574391
Cadmium	Meadow Vole	0.005801927	0.005801927	Arctic Fox	0.45	90	0.234978044
Cadmium	Fish_P	0.907	0.907	Mink	0.218	0.656	0.129708256
Cadmium	Robin	0.089845309	0.044922655	Red-Tailed Hawk	0.0987	0.1	0.000443387
Cadmium	Mallard	0.00006	0.0000012	Red-Tailed Hawk	0.0987	0.16	1.89504E-08
Cadmium	Mallard	0.00006	0.0000012	Mink	0.218	0.05	1.308E-08
Cadmium	Caribou	0.706730194	0.000204952	Grey Wolf	5.456	0.578	0.000646329
Cadmium	ST_Shrew	0.022848526	0.022848526	Red-Tailed Hawk	0.0987	0.24	0.000541236
Cadmium	ST_Shrew	0.022848526	0.022848526	Red Fox	0.45	0.22	0.002262004
Cadmium	Snowshoe Hare	0.053823922	0.048777929	Red-Tailed Hawk	0.0987	0.26	0.001251739
Cadmium	Snowshoe Hare	0.053823922	0.048777929	Grey Wolf	5.456	0.277	0.07371867
Cadmium	Snowshoe Hare	0.053823922	0.048777929	Red Fox	0.45	0.22	0.004829015
Cadmium	Snowshoe Hare	0.053823922	0.048777929	Mink	0.218	0.05	0.000531679
Cadmium	Muscrat	0.00012	0.00012	Mink	0.218	0.1	0.000002616
Chromium 6+	Water_PF	0.0037	0.0037	Red-Tailed Hawk	0.0672	1	0.00024864
Chromium 6+	Water_PF	0.0037	0.0037	Grey Wolf	2.9	1	0.01073
Chromium 6+	Water_PF	0.0037	0.0037	Red Fox	0.38	1	0.001406
Chromium 6+	Water_PF	0.0037	0.0037	Arctic Fox	0.38	1	0.001406
Chromium 6+	Deer_Mouse	0.0000148	0.0000148	Red-Tailed Hawk	0.0987	0.24	3.50582E-07
Chromium 6+	Deer_Mouse	0.0000148	0.0000148	Red Fox	0.45	0.22	1.4652E-06
Chromium 6+	Meadow Vole	0.0000222	0.0000222	Red Fox	0.45	0.22	2.1978E-06
Chromium 6+	Meadow Vole	0.0000222	0.0000222	Arctic Fox	0.45	90	0.0008991
Chromium 6+	Robin	0.0000518	0.0000259	Red-Tailed Hawk	0.0987	0.1	2.55633E-07

Calculation of Exposure of Predators to COPCs (except PHCs) via Ingestion

Chemical	Prey Item	Sum of Exposure via All Pathways (mg/d)	Total Ingestion - Prey Item (mg/d) * time on site	Predator	Total food or medium (soil, water, sediment) Ingestion Rate	Proportion consumed	Exposure - Predator (mg/d)
Chromium 6+	Mallard	0.060265	0.0012053	Red-Tailed Hawk	0.0987	0.16	1.90341E-05
Chromium 6+	Mallard	0.060265	0.0012053	Mink	0.218	0.05	1.31378E-05
Chromium 6+	Caribou	0.03515	1.01935E-05	Grey Wolf	5.456	0.578	3.21459E-05
Chromium 6+	ST_Shrew	0.00001221	0.00001221	Red-Tailed Hawk	0.0987	0.24	2.8923E-07
Chromium 6+	ST_Shrew	0.00001221	0.00001221	Red Fox	0.45	0.22	1.20879E-06
Chromium 6+	Snowshoe Hare	0.000481	0.000435906	Red-Tailed Hawk	0.0987	0.26	1.11862E-05
Chromium 6+	Snowshoe Hare	0.000481	0.000435906	Grey Wolf	5.456	0.277	0.00065879
Chromium 6+	Snowshoe Hare	0.000481	0.000435906	Red Fox	0.45	0.22	4.31547E-05
Chromium 6+	Snowshoe Hare	0.000481	0.000435906	Mink	0.218	0.05	4.75138E-06
Chromium 6+	Muscrat	0.00522348	0.00522348	Mink	0.218	0.1	0.000113872
Copper	Water_PF	0.004	0.004	Red-Tailed Hawk	0.0672	1	0.0002688
Copper	Water_PF	0.004	0.004	Grey Wolf	2.9	1	0.0116
Copper	Water_PF	0.004	0.004	Red Fox	0.38	1	0.00152
Copper	Water_PF	0.004	0.004	Arctic Fox	0.38	1	0.00152
Copper	Deer_Mouse	0.000016	0.000016	Red-Tailed Hawk	0.0987	0.24	3.79008E-07
Copper	Deer_Mouse	0.000016	0.000016	Red Fox	0.45	0.22	0.000001584
Copper	Meadow Vole	0.000024	0.000024	Red Fox	0.45	0.22	0.000002376
Copper	Meadow Vole	0.000024	0.000024	Arctic Fox	0.45	90	0.000972
Copper	Fish_P	4.047	4.047	Mink	0.218	0.656	0.578753376
Copper	Robin	0.000056	0.000028	Red-Tailed Hawk	0.0987	0.1	2.7636E-07
Copper	Mallard	0.000342	0.00000684	Red-Tailed Hawk	0.0987	0.16	1.08017E-07
Copper	Mallard	0.000342	0.00000684	Mink	0.218	0.05	7.4556E-08
Copper	Caribou	0.038	0.00001102	Grey Wolf	5.456	0.578	3.47523E-05
Copper	ST_Shrew	0.0000132	0.0000132	Red-Tailed Hawk	0.0987	0.24	3.12682E-07
Copper	ST_Shrew	0.0000132	0.0000132	Red Fox	0.45	0.22	1.3068E-06
Copper	Snowshoe Hare	0.00052	0.00047125	Red-Tailed Hawk	0.0987	0.26	1.20932E-05
Copper	Snowshoe Hare	0.00052	0.00047125	Grey Wolf	5.456	0.277	0.000712206
Copper	Snowshoe Hare	0.00052	0.00047125	Red Fox	0.45	0.22	4.66538E-05
Copper	Snowshoe Hare	0.00052	0.00047125	Mink	0.218	0.05	5.13663E-06
Copper	Muscrat	0.000684	0.000684	Mink	0.218	0.1	1.49112E-05
Lead	Mallard	1.25475225	0.025095045	Red-Tailed Hawk	0.0987	0.16	0.000396301
Lead	Mallard	1.25475225	0.025095045	Mink	0.218	0.05	0.000273536
Lead	Muscrat	0.906375882	0.906375882	Mink	0.218	0.1	0.019758994
Mercury	Fish_P	0.353	0.353	Mink	0.218	0.656	0.050481824
Mercury	Mallard	0.000006	0.00000012	Red-Tailed Hawk	0.0987	0.16	1.89504E-09
Mercury	Mallard	0.000006	0.00000012	Mink	0.218	0.05	1.308E-09

Calculation of Exposure of Predators to COPCs (except PHCs) via Ingestion

Chemical	Prey Item	Sum of Exposure via All Pathways (mg/d)	Total Ingestion - Prey Item (mg/d) * time on site	Predator	Total food or medium (soil, water, sediment) Ingestion Rate	Proportion consumed	Exposure - Predator (mg/d)
Mercury	Muscrat	0.000012	0.000012	Mink	0.218	0.1	2.616E-07
Vanadium	Fish_P	1.266	1.266	Mink	0.218	0.656	0.181048128
Vanadium	Mallard	1866.208924	37.32417848	Red-Tailed Hawk	0.0987	0.16	0.589423427
Vanadium	Mallard	1866.208924	37.32417848	Mink	0.218	0.05	0.406833545
Vanadium	Muscrat	10571.4216	10571.4216	Mink	0.218	0.1	230.4569909
Zinc	Soil_P	122.5	122.5	Red-Tailed Hawk	1.8	1	220.5
Zinc	Soil_P	122.5	122.5	Grey Wolf	0.046	1	5.635
Zinc	Soil_P	122.5	122.5	Red Fox	0.0126	1	1.5435
Zinc	Soil_P	122.5	122.5	Arctic Fox	0.0126	1	1.5435
Zinc	Water_PF	0.026	0.026	Red-Tailed Hawk	0.0672	1	0.0017472
Zinc	Water_PF	0.026	0.026	Grey Wolf	2.9	1	0.0754
Zinc	Water_PF	0.026	0.026	Red Fox	0.38	1	0.00988
Zinc	Water_PF	0.026	0.026	Arctic Fox	0.38	1	0.00988
Zinc	Deer_Mouse	0.176504	0.176504	Red-Tailed Hawk	0.0987	0.24	0.004181027
Zinc	Deer_Mouse	0.176504	0.176504	Red Fox	0.45	0.22	0.017473896
Zinc	Meadow Vole	0.032006	0.032006	Red Fox	0.45	0.22	0.003168594
Zinc	Meadow Vole	0.032006	0.032006	Arctic Fox	0.45	90	1.296243
Zinc	Robin	9.880381	4.9401905	Red-Tailed Hawk	0.0987	0.1	0.04875968
Zinc	Caribou	29.66513303	0.008602889	Grey Wolf	5.456	0.578	0.027129794
Zinc	ST_Shrew	0.5786778	0.5786778	Red-Tailed Hawk	0.0987	0.24	0.01370772
Zinc	ST_Shrew	0.5786778	0.5786778	Red Fox	0.45	0.22	0.057289102
Zinc	Snowshoe Hare	0.86088	0.7801725	Red-Tailed Hawk	0.0987	0.26	0.020020787
Zinc	Snowshoe Hare	0.86088	0.7801725	Grey Wolf	5.456	0.277	1.179084061
Zinc	Snowshoe Hare	0.86088	0.7801725	Red Fox	0.45	0.22	0.077237078
Zinc	Snowshoe Hare	0.86088	0.7801725	Mink	0.218	0.05	0.00850388
Anthracene	Fish_P	0.0885	0.0885	Mink	0.218	0.656	0.012656208
Anthracene	Mallard	0.000003	0.00000006	Red-Tailed Hawk	0.0987	0.16	9.4752E-10
Anthracene	Mallard	0.000003	0.00000006	Mink	0.218	0.05	6.54E-10
Anthracene	Muscrat	0.000006	0.000006	Mink	0.218	0.1	1.308E-07
Pyrene	Fish_P	0.2045	0.2045	Mink	0.218	0.656	0.029245136
Pyrene	Mallard	0.000003	0.00000006	Red-Tailed Hawk	0.0987	0.16	9.4752E-10
Pyrene	Mallard	0.000003	0.00000006	Mink	0.218	0.05	6.54E-10
Pyrene	Muscrat	0.000006	0.000006	Mink	0.218	0.1	1.308E-07
cis-1,2-Dichloroethene	Fish_P	0.0524	0.0524	Mink	0.218	0.656	0.007493619

Calculation of Exposure of Predators to COPCs (except PHCs) via Ingestion

Chemical	Prey Item	Sum of Exposure via All Pathways (mg/d)	Total Ingestion - Prey Item (mg/d) * time on site	Predator	Total food or medium (soil, water, sediment) Ingestion Rate	Proportion consumed	Exposure - Predator (mg/d)
cis-1,2-Dichloroethene	Mallard	0.00024	0.0000048	Red-Tailed Hawk	0.0987	0.16	7.58016E-08
cis-1,2-Dichloroethene	Mallard	0.00024	0.0000048	Mink	0.218	0.05	5.232E-08
cis-1,2-Dichloroethene	Muscrat	0.00048	0.00048	Mink	0.218	0.1	0.000010464
Bromoform	Soil_P	0.05	0.05	Red-Tailed Hawk	1.8	1	0.09
Bromoform	Soil_P	0.05	0.05	Grey Wolf	0.046	1	0.0023
Bromoform	Soil_P	0.05	0.05	Red Fox	0.0126	1	0.00063
Bromoform	Soil_P	0.05	0.05	Arctic Fox	0.0126	1	0.00063
Bromoform	Water_PF	0.002	0.002	Red-Tailed Hawk	0.0672	1	0.0001344
Bromoform	Water_PF	0.002	0.002	Grey Wolf	2.9	1	0.0058
Bromoform	Water_PF	0.002	0.002	Red Fox	0.38	1	0.00076
Bromoform	Water_PF	0.002	0.002	Arctic Fox	0.38	1	0.00076
Bromoform	Deer_Mouse	0.002881965	0.002881965	Red-Tailed Hawk	0.0987	0.24	6.8268E-05
Bromoform	Deer_Mouse	0.002881965	0.002881965	Red Fox	0.45	0.22	0.000285315
Bromoform	Meadow Vole	0.000668665	0.000668665	Red Fox	0.45	0.22	6.61978E-05
Bromoform	Meadow Vole	0.000668665	0.000668665	Arctic Fox	0.45	90	0.027080924
Bromoform	Robin	0.032599656	0.016299828	Red-Tailed Hawk	0.0987	0.1	0.000160879
Bromoform	Caribou	0.034044301	9.87285E-06	Grey Wolf	5.456	0.578	3.11347E-05
Bromoform	ST_Shrew	0.007205922	0.007205922	Red-Tailed Hawk	0.0987	0.24	0.000170694
Bromoform	ST_Shrew	0.007205922	0.007205922	Red Fox	0.45	0.22	0.000713386
Bromoform	Snowshoe Hare	0.003313	0.003002406	Red-Tailed Hawk	0.0987	0.26	7.70477E-05
Bromoform	Snowshoe Hare	0.003313	0.003002406	Grey Wolf	5.456	0.277	0.004537573
Bromoform	Snowshoe Hare	0.003313	0.003002406	Red Fox	0.45	0.22	0.000297238
Bromoform	Snowshoe Hare	0.003313	0.003002406	Mink	0.218	0.05	3.27262E-05
1,1,1,2-tetrachloroethane	Soil_P	0.05	0.05	Red-Tailed Hawk	1.8	1	0.09
1,1,1,2-tetrachloroethane	Soil_P	0.05	0.05	Grey Wolf	0.046	1	0.0023
1,1,1,2-tetrachloroethane	Soil_P	0.05	0.05	Red Fox	0.0126	1	0.00063
1,1,1,2-tetrachloroethane	Soil_P	0.05	0.05	Arctic Fox	0.0126	1	0.00063
1,1,1,2-tetrachloroethane	Water_PF	0.001	0.001	Red-Tailed Hawk	0.0672	1	0.0000672

Calculation of Exposure of Predators to COPCs (except PHCs) via Ingestion

Chemical	Prey Item	Sum of Exposure via All Pathways (mg/d)	Total Ingestion - Prey Item (mg/d) * time on site	Predator	Total food or medium (soil, water, sediment) Ingestion Rate	Proportion consumed	Exposure - Predator (mg/d)
1,1,1,2-tetrachloroethane	Water_PF	0.001	0.001	Grey Wolf	2.9	1	0.0029
1,1,1,2-tetrachloroethane	Water_PF	0.001	0.001	Red Fox	0.38	1	0.00038
1,1,1,2-tetrachloroethane	Water_PF	0.001	0.001	Arctic Fox	0.38	1	0.00038
1,1,1,2-tetrachloroethane	Deer_Mouse	0.0029089	0.0029089	Red-Tailed Hawk	0.0987	0.24	6.8906E-05
1,1,1,2-tetrachloroethane	Deer_Mouse	0.0029089	0.0029089	Red Fox	0.45	0.22	0.000287981
1,1,1,2-tetrachloroethane	Meadow Vole	0.000484471	0.000484471	Red Fox	0.45	0.22	4.79627E-05
1,1,1,2-tetrachloroethane	Meadow Vole	0.000484471	0.000484471	Arctic Fox	0.45	90	0.019621094
1,1,1,2-tetrachloroethane	Robin	0.034160754	0.017080377	Red-Tailed Hawk	0.0987	0.1	0.000168583
1,1,1,2-tetrachloroethane	Caribou	0.023004841	6.6714E-06	Grey Wolf	5.456	0.578	2.10387E-05
1,1,1,2-tetrachloroethane	ST_Shrew	0.007431446	0.007431446	Red-Tailed Hawk	0.0987	0.24	0.000176036
1,1,1,2-tetrachloroethane	ST_Shrew	0.007431446	0.007431446	Red Fox	0.45	0.22	0.000735713
1,1,1,2-tetrachloroethane	Snowshoe Hare	0.0018128	0.00164285	Red-Tailed Hawk	0.0987	0.26	4.21588E-05
1,1,1,2-tetrachloroethane	Snowshoe Hare	0.0018128	0.00164285	Grey Wolf	5.456	0.277	0.002482859
1,1,1,2-tetrachloroethane	Snowshoe Hare	0.0018128	0.00164285	Red Fox	0.45	0.22	0.000162642
1,1,1,2-tetrachloroethane	Snowshoe Hare	0.0018128	0.00164285	Mink	0.218	0.05	1.79071E-05
PCBs	Fish_P	16.4	16.4	Mink	0.218	0.656	2.3453312
PCBs	Mallard	0.009213	0.00018426	Red-Tailed Hawk	0.0987	0.16	2.90983E-06
PCBs	Mallard	0.009213	0.00018426	Mink	0.218	0.05	2.00843E-06
PCBs	Muscrat	0.000825744	0.000825744	Mink	0.218	0.1	1.80012E-05
Manganese	Mallard	0.00624	0.0001248	Red-Tailed Hawk	0.0987	0.16	1.97084E-06
Manganese	Mallard	0.00624	0.0001248	Mink	0.218	0.05	1.36032E-06

Calculation of Exposure of Predators to COPCs (except PHCs) via Ingestion

Chemical	Prey Item	Sum of Exposure via All Pathways (mg/d)	Total Ingestion - Prey Item (mg/d) * time on site	Predator	Total food or medium (soil, water, sediment) Ingestion Rate	Proportion consumed	Exposure - Predator (mg/d)
Manganese	Muscrat	0.01248	0.01248	Mink	0.218	0.1	0.000272064
Lindane (gamma HCH)	Fish_P	0.04705	0.04705	Mink	0.218	0.656	0.006728526
Lindane (gamma HCH)	Mallard	0.000003	0.00000006	Red-Tailed Hawk	0.0987	0.16	9.4752E-10
Lindane (gamma HCH)	Mallard	0.000003	0.00000006	Mink	0.218	0.05	6.54E-10
Lindane (gamma HCH)	Muscrat	0.000006	0.000006	Mink	0.218	0.1	1.308E-07
DDT total	Fish_P	0.0391	0.0391	Mink	0.218	0.656	0.005591613
DDT total	Mallard	0.0000003	0.000000006	Red-Tailed Hawk	0.0987	0.16	9.4752E-11
DDT total	Mallard	0.0000003	0.000000006	Mink	0.218	0.05	6.54E-11
DDT total	Muscrat	0.0000006	0.0000006	Mink	0.218	0.1	1.308E-08
Endrin	Fish_P	1.442	1.442	Mink	0.218	0.656	0.206217536
Endrin	Mallard	0.000012	0.00000024	Red-Tailed Hawk	0.0987	0.16	3.79008E-09
Endrin	Mallard	0.000012	0.00000024	Mink	0.218	0.05	2.616E-09
Endrin	Muscrat	0.000024	0.000024	Mink	0.218	0.1	5.232E-07
Toxaphene	Water_PF	0.001	0.001	Red-Tailed Hawk	0.0672	1	0.0000672
Toxaphene	Water_PF	0.001	0.001	Grey Wolf	2.9	1	0.0029
Toxaphene	Water_PF	0.001	0.001	Red Fox	0.38	1	0.00038
Toxaphene	Water_PF	0.001	0.001	Arctic Fox	0.38	1	0.00038
Toxaphene	Deer_Mouse	0.000004	0.000004	Red-Tailed Hawk	0.0987	0.24	9.4752E-08
Toxaphene	Deer_Mouse	0.000004	0.000004	Red Fox	0.45	0.22	0.000000396

Calculation of Exposure of Predators to COPCs (except PHCs) via Ingestion

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Toxaphene	Meadow Vole	0.000006	0.000006	Red Fox	0.45	0.22	0.000000594
Toxaphene	Meadow Vole	0.000006	0.000006	Arctic Fox	0.45	90	0.000243
Toxaphene	Fish_P	1.02	1.02	Mink	0.218	0.656	0.14586816
Toxaphene	Robin	0.000014	0.000007	Red-Tailed Hawk	0.0987	0.1	6.909E-08
Toxaphene	Mallard	0.000012	0.00000024	Red-Tailed Hawk	0.0987	0.16	3.79008E-09
Toxaphene	Mallard	0.000012	0.00000024	Mink	0.218	0.05	2.616E-09
Toxaphene	Caribou	0.0095	0.000002755	Grey Wolf	5.456	0.578	8.68808E-06
Toxaphene	ST_Shrew	0.0000033	0.0000033	Red-Tailed Hawk	0.0987	0.24	7.81704E-08
Toxaphene	ST_Shrew	0.0000033	0.0000033	Red Fox	0.45	0.22	3.267E-07
Toxaphene	Snowshoe Hare	0.00013	0.000117813	Red-Tailed Hawk	0.0987	0.26	3.0233E-06
Toxaphene	Snowshoe Hare	0.00013	0.000117813	Grey Wolf	5.456	0.277	0.000178051
Toxaphene	Snowshoe Hare	0.00013	0.000117813	Red Fox	0.45	0.22	1.16634E-05
Toxaphene	Snowshoe Hare	0.00013	0.000117813	Mink	0.218	0.05	1.28416E-06
Toxaphene	Muscrat	0.000024	0.000024	Mink	0.218	0.1	5.232E-07
Trichloroethene	Fish_P	0.74128	0.74128	Mink	0.218	0.656	0.10600897
Trichloroethene	Mallard	0.001356	0.00002712	Red-Tailed Hawk	0.0987	0.16	4.28279E-07
Trichloroethene	Mallard	0.001356	0.00002712	Mink	0.218	0.05	2.95608E-07
Trichloroethene	Muscrat	0.002712	0.002712	Mink	0.218	0.1	5.91216E-05
Aluminum	Soil_P	4677	4677	Red-Tailed Hawk	1.8	1	8418.6
Aluminum	Soil_P	4677	4677	Grey Wolf	0.046	1	215.142
Aluminum	Soil_P	4677	4677	Red Fox	0.0126	1	58.9302
Aluminum	Soil_P	4677	4677	Arctic Fox	0.0126	1	58.9302
Aluminum	Water_PF	0.119	0.119	Red-Tailed Hawk	0.0672	1	0.0079968
Aluminum	Water_PF	0.119	0.119	Grey Wolf	2.9	1	0.3451
Aluminum	Water_PF	0.119	0.119	Red Fox	0.38	1	0.04522
Aluminum	Water_PF	0.119	0.119	Arctic Fox	0.38	1	0.04522
Aluminum	Deer_Mouse	2.8852496	2.8852496	Red-Tailed Hawk	0.0987	0.24	0.068345793
Aluminum	Deer_Mouse	2.8852496	2.8852496	Red Fox	0.45	0.22	0.28563971
Aluminum	Meadow Vole	0.908052	0.908052	Red Fox	0.45	0.22	0.089897148
Aluminum	Meadow Vole	0.908052	0.908052	Arctic Fox	0.45	90	36.776106
Aluminum	Robin	38.26027432	19.13013716	Red-Tailed Hawk	0.0987	0.1	0.188814454
Aluminum	Caribou	1125.017457	0.326255063	Grey Wolf	5.456	0.578	1.028867525
Aluminum	ST_Shrew	12.05077674	12.05077674	Red-Tailed Hawk	0.0987	0.24	0.285458799
Aluminum	ST_Shrew	12.05077674	12.05077674	Red Fox	0.45	0.22	1.193026897
Aluminum	Snowshoe Hare	33.390542	30.26017869	Red-Tailed Hawk	0.0987	0.26	0.776536705
Aluminum	Snowshoe Hare	33.390542	30.26017869	Grey Wolf	5.456	0.277	45.73257117

Calculation of Exposure of Predators to COPCs (except PHCs) via Ingestion

Chemical	Prey Item	Sum of Exposure via All Pathways (mg/d)	Total Ingestion - Prey Item (mg/d) * time on site	Predator	Total food or medium (soil, water, sediment) Ingestion Rate	Proportion consumed	Exposure - Predator (mg/d)
Aluminum	Snowshoe Hare	33.390542	30.26017869	Red Fox	0.45	0.22	2.99575769
Aluminum	Snowshoe Hare	33.390542	30.26017869	Mink	0.218	0.05	0.329835948
Magnesium	Fish_P	156984	156984	Mink	0.218	0.656	22449.96787
Magnesium	Mallard	14.88	0.2976	Red-Tailed Hawk	0.0987	0.16	0.004699699
Magnesium	Mallard	14.88	0.2976	Mink	0.218	0.05	0.00324384
Magnesium	Muscrat	29.76	29.76	Mink	0.218	0.1	0.648768
Iron	Soil_P	23696	23696	Red-Tailed Hawk	1.8	1	42652.8
Iron	Soil_P	23696	23696	Grey Wolf	0.046	1	1090.016
Iron	Soil_P	23696	23696	Red Fox	0.0126	1	298.5696
Iron	Soil_P	23696	23696	Arctic Fox	0.0126	1	298.5696
Iron	Water_PF	3.5	3.5	Red-Tailed Hawk	0.0672	1	0.2352
Iron	Water_PF	3.5	3.5	Grey Wolf	2.9	1	10.15
Iron	Water_PF	3.5	3.5	Red Fox	0.38	1	1.33
Iron	Water_PF	3.5	3.5	Arctic Fox	0.38	1	1.33
Iron	Deer_Mouse	37.619552	37.619552	Red-Tailed Hawk	0.0987	0.24	0.891131948
Iron	Deer_Mouse	37.619552	37.619552	Red Fox	0.45	0.22	3.724335648
Iron	Meadow Vole	49.1902	49.1902	Red Fox	0.45	0.22	4.8698298
Iron	Meadow Vole	49.1902	49.1902	Arctic Fox	0.45	90	1992.2031
Iron	Fish_P	410.184	410.184	Mink	0.218	0.656	58.65959347
Iron	Robin	189.3904662	94.69523312	Red-Tailed Hawk	0.0987	0.1	0.934641951
Iron	Mallard	5820.14898	116.4029796	Red-Tailed Hawk	0.0987	0.16	1.838235854
Iron	Mallard	5820.14898	116.4029796	Mink	0.218	0.05	1.268792478
Iron	Caribou	6085.872473	1.764903017	Grey Wolf	5.456	0.578	5.565741678
Iron	ST_Shrew	85.9782684	85.9782684	Red-Tailed Hawk	0.0987	0.24	2.036653222
Iron	ST_Shrew	85.9782684	85.9782684	Red Fox	0.45	0.22	8.511848572
Iron	Snowshoe Hare	488.5926	442.7870438	Red-Tailed Hawk	0.0987	0.26	11.36280112
Iron	Snowshoe Hare	488.5926	442.7870438	Grey Wolf	5.456	0.277	669.1893727
Iron	Snowshoe Hare	488.5926	442.7870438	Red Fox	0.45	0.22	43.83591733
Iron	Snowshoe Hare	488.5926	442.7870438	Mink	0.218	0.05	4.826378777
Iron	Muscrat	4389.05718	4389.05718	Mink	0.218	0.1	95.68144652
Sodium	Fish_P	1316640	1316640	Mink	0.218	0.656	188290.0531
Sodium	Mallard	124.8	2.496	Red-Tailed Hawk	0.0987	0.16	0.039416832
Sodium	Mallard	124.8	2.496	Mink	0.218	0.05	0.0272064
Sodium	Muscrat	249.6	249.6	Mink	0.218	0.1	5.44128