September 13, 2023

Ms. Mariya Chiger
Department of Natural Resources and
Environmental Control
Remediation Section
391 Lukens Drive
New Castle, DE 19720

Re: Project No. 16530
Supplemental Soil Sampling Report
Rodney Reservoir Site – P00074
1500 W Ninth Street
Wilmington, Delaware

Dear Ms. Chiger:

Verdantas LLC (Verdantas) submits this report on behalf of our client, [D'Huy Engineering], to document test pit excavation and supplemental soil sampling activities conducted at the above-referenced site (the "Property" or "Site"). The Site is located at 1500 West Ninth Street in Wilmington, Delaware, and is identified by the State of Delaware, Department of Natural Resources and Environmental Control – Remediation Section (DNREC-RS) as P00074 (Figure 1). The sampling was completed in accordance with Verdantas' [date of work plan not the date of submission], "Work Plan for Additional Soil Sampling" (Work Plan) as approved by DNREC-RS.

Sampling was performed to assess the suitability of the earthen materials for reuse following demolition of the reservoir. In November and December of 2022, Verdantas sampled shallow soil from within the earthen berm that surrounds the former reservoir. Shallow refusal was encountered at depths between 1.5-2 feet below ground surface (bgs) due to the presence of 2–4-inch sized stone. Samples were submitted to a laboratory and analytical results indicated that no volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, or polychlorinated biphenyls (PCBs) were reported above the respective DNREC-RS Reporting Levels. Several metals were reported as detected, but only cobalt was reported at concentrations that exceeded the DNREC-RS Reporting Level.

A quantitative risk assessment for cobalt was conducted and the results of the calculation indicated that cobalt concentrations in soils did not pose an unacceptable risk to human health under a residential use scenario, the most conservative of the exposure scenario. Following discussion of the sampling results with Verdantas and D'Huy Engineering, DNREC-RS requested that additional sampling be conducted to evaluate environmental conditions in materials beneath the stone fill.

Supplemental sampling activities were completed in June 2023 and are summarized below:

A. FIELD ACTIVITIES

1. Test Pit Excavation

On June 13, 2023, Verdantas oversaw the excavation of six test pits by the City of Wilmington's contractor, Allen Meyers (Figure 2).

The field assessment conformed to the Work Plan with the exception of the proposed test pit location on the northern side of the berm, adjacent to the pump house. Review of the site prior to commencing with field activities indicated that the northern side of the berm was not accessible due to the steep incline of the berm. After on-site consultation with DNREC-RS, the location of the Test Pit 6 (TP-6) was moved to the center of the southern berm, between test pits TP-2 and TP-3.

Six test pits were excavated to a depth of approximately six feet below the ground surface (bgs), the limit of the reach of the excavation equipment. During field activities, excavated soils were reviewed by Verdantas personnel for indications of environmental impact using visual and olfactory observations along with a photoionization detector (PID) to screen for VOCs. VOCs were not detected by the PID and no indications of environmental impact (e.g., odors, staining, debris) were observed.

Soil samples were collected from the test pits as described in the next section. Following soil sample collection, the test pits were backfilled with excavated materials and tamped down using the excavator bucket. No other restorative effort was taken. The excavator bucket was decontaminated before excavation of the initial test pit, before each subsequent test pit, and prior to leaving the Site.

Soils encountered generally consisted of topsoil from the surface to 0.5 feet bgs, underlain by reddish-brown sandy silt with gravel. Approximately 2–4-inch sized stone was observed generally between 2 to 3 feet bgs in all the test pits. Stone as large as 10-12 inches in diameter was observed in TP-6. Soils beneath the stone layer generally consisted of brown sand with little clay.

2. Soil Sample Collection

A total of 12 soil samples were collected, comprised of one shallow soil sample and one deep soil sample from each of the six test pits. The shallow soil samples were collected from the surface to 2 feet bgs. The deep soil samples were collected from 5-6 feet bgs.

Soil samples were collected in general accordance with the Standard Operating Procedures for Chemical Analytical Programs (SOPCAP) under the Hazardous Substance Cleanup Act (HSCA). Quality Assurance/Quality Control (QA/QC) samples included the collection of one blind duplicate, one matrix spike, one

matrix spike duplicate, one field blank, and two equipment blanks. One equipment blank was collected from the excavator bucket prior to excavation of the first test pit and a second equipment blank was collected from the excavator bucket following completion of the last test pit.

Following collection, the soil samples were transported to DNREC-RS' laboratory for screening for VOCs, SVOCs, pesticides, PCBs, and metals.

B. ENVIRONMENTAL DATA SUMMARY

1. DNREC-RS Screening Results & Confirmatory Sample Selection

The findings of the soil screening completed by DNREC-RS indicated that VOCs, pesticides, and PCBs were not present in the 12 soil samples. Several soil samples were reported with the presence of polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), tentatively identified compounds (TICs), and metals. A copy of DNREC-RS' Soil Screening Report is included as Attachment A.

Following review of the soil screening results and based on the selection criteria presented in the Work Plan, Verdantas and DNREC-RS selected the samples for analysis as presented in Table A, below, by a HSCA-certified laboratory.

Table A: Confirmatory Soil Sample Selection

Sample ID	Sample Depth	Confirmation Analyses				
		TAL Metals	TCL VOCs	TCL SVOCs	TCL Pesticides	PCB Homologs
TP-1S	Shallow	X		X		
TP-1D	Deep	X		X		
TP-2S	Shallow	X	X	X	X	
TP-2D	Deep	X		X		
TP-3S	Shallow	X		X		
TP-3D	Deep	X	X	X	X	X
TP-DUP	Deep	X	X	X	X	
TP-4S	Shallow	X		X		
TP-4D	Deep	X		X		
TP-5S	Shallow	X	X	X	X	X
TP-5D	Deep	X		X		
TP-6S	Shallow	X		X		
TP-6D	Deep	X	X	X	X	
EB-1	Equipment Blank	X	X	X	X	
EB-2	Equipment Blank	X	X	X	X	
FB	Field Blank	X	X	X	X	
TB	Trip Blank		X			

2. Analytical Results

Soil samples were submitted to Eurofins Testing America (Eurofins) for confirmatory laboratory analysis of the parameters listed in Table A, above. Results of the analyses are detailed below and provided in Tables 1, 2, and 3. A copy of Eurofins analytical report is included as Attachment B.

a. TAL Metals, Mercury, and Cyanide

Twenty metals and mercury were reported as detected in the soil samples. Aluminum, chromium, cobalt, iron, mercury, thallium, and vanadium were reported in several samples at concentrations that exceeded the respective DNREC-RS Screening Levels. Chromium, cobalt, and iron were reported at concentrations that also exceeded respective DNREC-RS Reporting Levels in several samples.

b. TCL SVOCs

Twenty-one SVOCs were reported as detected in the soil samples. However, only one soil sample, the shallow soil sample collected from TP-3, was reported by the laboratory with SVOCs at concentrations exceeding the DNREC-RS Screening and/or Reporting Levels. Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-c,d)pyrene were reported in shallow soil sample TP-3S at concentrations exceeding the respective DNREC-RS Screening Levels. Only benzo(a)pyrene in shallow soil sample TP-3S also exceeded the DNREC-RS Reporting Level.

c. TCL VOCs

Four VOCs were reported as detected in the soil samples, however, none of the reported concentrations exceeded the DNREC-RS Screening or Reporting Levels.

d. TCL Pesticides

No pesticides were detected in the analyzed samples.

e. PCB Homologs

No PCB homologs were detected in the analyzed samples.

The locations of shallow soil exceedances are depicted on Figure 3 and locations of deep soil exceedances are depicted on Figure 4.

C. RISK CALCULATION

Due to the reported DNREC-RS Screening Level exceedances, Verdantas utilized the Delaware Risk Assessment Calculator (DERAC) Program to perform a human health risk assessment (HHRA) in general accordance with DNREC's "Guidance for Human Health Risk Assessment under the Hazardous Substance Cleanup Act" (HHRA Guidance), July 2020. Although future residential use of the Site is not anticipated, Verdantas considered the residential land use exposure scenario due to the HHRA Guidance requirement that potential commercial exposure to sensitive receptors (i.e. playgrounds or potential exposed soil) be evaluated under a child residential risk. Other exposure scenarios were

considered and included the excavator, outdoor worker, and recreator scenarios. Selection of exposure pathways are detailed on Table 4.

Substances identified at concentrations that exceeded DNREC-RS Screening Levels were considered Contaminants of Potential Concern (COPCs) for exposures to shallow soil and combined shallow and deep soil (combined soil). Selected COPC are summarized on Tables 5 and 6. Following DNREC's policy for the calculation of Exposure Point Concentrations (EPCs), and using all data collected to date (e.g., November and December 2022, and June 2023),, a 95% Upper Confidence Limit (UCL) was calculated for each COPC under the shallow and combined soil scenarios using the USEPA-developed statistical software ProUCL 5.1 (ProUCL) (Table 6 and Attachment C). Based on the ProUCL outputs, the recommended 95% UCL for several analytes were below the respective DNREC-RS Screening Level. Therefore, those analytes were not retained for further evaluation. The analytes that were retained as COPCs include:

- Shallow Soil COPCs – cobalt, thallium, vanadium, benzo(a)pyrene, benz(a)anthracene, and benzo(b)fluoranthene.
- Combined Soil COPCs – cobalt, thallium, and benzo(a)pyrene.

Using the COPCs identified above, Verdantas input the EPCs for each analyte into the DERAC, a program developed by DNREC for use in human health risk assessments to provide quantitative assessment of cancer and non-cancer risks. The risk calculations were compared to the Hazardous Substance Cleanup Act target cancer risk value and target non-cancer (hazard index) risk value of $1x10^{-5}$ and 1, respectively.

Future risk calculations for exposure to soil are included on Tables 7-14 and tabulated as follows:

Shallow Soil

Scenario	Total Risk	Total Hazard Index	Child Hazard Index
Resident	NA	NA	2
Outdoor Worker	2×10^{-6}	0.1	NA
Excavator	2×10^{-8}	0.01	NA
Recreator	7×10^{-6}	0.2	1

Note: *Bold* = Risk scenario exceeds comparative regulatory values of 1 or 1×10^{-5}.

NA = Not Applicable.

Combined Shallow and Deep Soil

Scenario	Total Risk	Total Hazard Index	Child Hazard Index
Resident	NA	NA	2
Outdoor Worker	3 x 10^{-7}	0.1	NA
Excavator	3 x 10^{-9}	0.004	NA
Recreator	1 x 10^{-6}	0.1	0.4

Note: *Bold* = Risk scenario exceeds comparative regulatory value of 1 or 1 x 10^{-5}.

NA = Not Applicable

The results indicate that:

- Regulated substances in shallow and combined shallow and deep soil are present at an unacceptable non-cancer risk under the Resident Child HI scenario; and
- Regulated substances in shallow and combined shallow and deep soil are present at an acceptable cancer and non-cancer risk under the outdoor worker, excavator, and recreator scenarios.

Copies of the DERAC Outputs are included as Attachment D. The unacceptable non-cancer risk under the Child HI scenario for shallow and combined soil is driven by the calculated EPC value for cobalt .

D. CONCLUSIONS

Verdantas collected soil samples from the earthen berm surrounding the Rodney Reservoir in November and December 2022, and in June 2023. Analytical results for the samples were compared to DNREC-RS Screening Levels. No VOCs, pesticides, or PCBs were reported at concentrations that were above the DNREC-RS Screening Levels. Several SVOCs were reported above DNREC-RS Screening Levels in one shallow soil sample identified as TP-3S. Several metals, including cobalt, were reported in both shallow and deep soil samples at concentrations exceeding DNREC-RS Screening Levels.

A risk assessment was performed using the calculated 95% UCL concentrations of COPCs identified in shallow soil and combined soil. The results of the calculation indicated that regulated substances in shallow and combined soil pose an unacceptable non-cancer risk under the Resident Child HI scenario. This result was driven by cobalt concentrations reported for the soil samples. Under the outdoor worker, excavator, and recreator scenarios, regulated substances in shallow and combined soil are present at an acceptable cancer and non-cancer risk.

At your convenience we would like to request a meeting to discuss the findings of this assessment and next steps for addressing soil management at the Site. Should you have any questions, concerns, or comments regarding this report, please feel free to contact our office at 302-239-6634.

Sincerely,

VERDANTAS LLC

Emaad Fayaz
Staff Engineer II

Robert B. Smagala Jr.
Environmental Project Manager

MEF/RBS:acj
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Attachments

Tables

- Table 1: Analytical Soil Results
- Table 2: Aqueous Blanks
- Table 3: Solid Blanks

Figures

- Figure 1: Site Location Map
- Figure 2: Site Features Sketch
- Figure 3: Shallow Soil Exceedance Sketch
- Figure 4: Deep Soil Exceedance Sketch

Attachments

- Attachment A – DNREC Soil Screening Results
- Attachment B – Eurofins Analytical Report (Attachment Sent Separately)
- Attachment C – ProUCL Inputs/Outputs
- Attachment D – DERAC Outputs

TABLES

Table 1 - Analytical Soil Results
Rodney Reservoir Site
July 2023

Station Name	Units	DNREC HSCA Soil Reporting Level (Feb 2022)	DNREC HSCA Soil Screening Level (April 2023)	TP-1		TP-1		TP-2		TP-2		TP-3		TP-3		TP-3		TP-3		TP-4		TP-4		TP-5		TP-5		TP-6		TP-6	
Field Sample				TP-1D		TP-1S		TP-2D		TP-2S		TP-3D		TP-DUP		TP-3D AVG		TP-3S		TP-4D		TP-4S		TP-5D		TP-5S		TP-6D		TP-6S		
Sample Date				6/13/2023		6/13/2023		6/13/2023		6/13/2023		6/13/2023		6/13/2023		6/13/2023		6/13/2023		6/13/2023		6/13/2023		6/13/2023		6/13/2023		6/13/2023		6/13/2023		6/13/2023	
Delivery Group				460-282595-1		460-282595-1		460-282595-1		460-282595-1		460-282595-1		460-282595-1		460-282595-1		460-282595-1		460-282595-1		460-282595-1		460-282595-1		460-282595-1		460-282595-1		460-282595-1		460-282595-1	
Matrix				Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
				Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
Metals																																	
Aluminum	mg/kg	77000	51200	20700		42600		56000		37200		54800		59300		57050		63300		40900		44900		37300		51600		22400		32100		
Antimony	mg/kg	31	3.1	0.18	J	0.33	J	0.38	J	0.22	J F1	0.24	J	0.28	J	0.26		0.26	J	0.3	J	0.33	J	0.39	J	0.31	J	0.46	J	0.6	J		
Arsenic	mg/kg	11	11	4.6		5.8		5.7		5	F1	5		5.3	J	5.15		4.6		5.8		5.3		5.6		5.2		6.8		5.7			
Barium	mg/kg	15000	1500	85		134		174		138		150		190		170		167		121		136		120		167		97.7		121			
Beryllium	mg/kg	NS	16	0.6		0.89		0.93		0.97		0.86		1		0.93		0.98		1.1		1		1		1.1		0.92		0.87			
Cadmium	mg/kg	7.1	0.71	0.87	U	0.84	U	0.96	U	1.2	U	0.86	U	0.9	U	0.88		0.84	U	0.84	U	1	U	0.92	U	0.96	U	0.16	J	0.18	J		
Calcium	mg/kg	NS	NS	640		1040		1090		765	F1	730		963		846.5		854		963		814		921		850		1720		2360			
Chromium	mg/kg	214	214	53.6		130		303		161		191		578		384.5		76		175		177		163		60.5		63.1		88.6			
Cobalt	mg/kg	34	34	12.2		24.3		45.2		34.6		27.7		74.4		51.05		59.5		32.7		94.5		21.9		34.4		12.3		20.3			
Copper	mg/kg	3100	310	12.9		54.2		101		44.2		48.6		137		92.8		53.9		41.9		57		33.4		50.2		17.7		32.8			
Iron	mg/kg	74767	74767	21600		50000		59600		51600		48000		90400		69200		54700		59000		49900		56100		54000		30100		34000			
Lead	mg/kg	400	400	8.5		27.2		12.1		22.6	F1	24.7		8.4		16.55		17.8		25.3		24.9		31.3		25.8		23.2		60.8			
Magnesium	mg/kg	NS	NS	1380		1050		1150		902	F1	981		990		985.5		853		1140		999		1050		877		1140		1080			
Manganese	mg/kg	2100	2100	310		499		657		726		579		816		697.5		902		811		1160		560		693		465		521			
Mercury	mg/kg	11	1.1	0.023		2.6		0.062		0.084		0.056		0.055		0.0555		0.094		0.065		0.084		0.12		0.14		0.074		0.08			
Nickel	mg/kg	1500	150	16.6		41.7		85.8		36.1		57.1		106		81.55		44.3		36.1		45.8		33.9		27.2		17.1		25.8			
Potassium	mg/kg	NS	NS	673		709		528		407		579		418	J	498.5		523		648		574		587		541		689		558			
Selenium	mg/kg	390	39	0.34	J	0.61	J	6	U	0.51	J F1	0.61	J	11.3	U	5.955		0.59	J	0.78	J	0.73	J	0.62	J	0.61	J	0.45	J	0.5	J		
Thallium	mg/kg	0.78	0.078	0.14	J	0.16	J	0.17	J	0.18	J	0.15	J	0.14	J	0.145		0.14	J	0.17	J	0.19	J	0.16	J	0.13	J	0.2	J	0.17	J		
Vanadium	mg/kg	390	134	45.7		111		149		104		115		209		162		163		119		137		167		163		64		81.6			
Zinc	mg/kg	23000	2300	23.3		39.2		30.3	J	26.9		35.3		28.2	J	31.75		45.1		39.3		37.5	J	41.7		50.7		106		105			
VOCs																																	
1,1-Biphenyl	mg/kg	47	4.7	0.37	U	0.37	U	0.41	U	0.39	U	0.36	U	0.4	U	0.38		0.37	U	0.38	U	0.41	U	0.39	U	0.015	J	0.38	U	0.4	U		
Benzaldehyde	mg/kg	1700	170	0.37	U	0.37	U	0.41	U	0.39	U	0.36	U	0.4	U	0.38		0.37	U	0.38	U	0.41	U	0.39	U	0.42	U	0.38	U	0.6			
Methyl Acetate	mg/kg	78000	7800	NT		NT		NT		0.35	J F1	1.6	U	1.4	U	1.5		NT		NT		NT		NT		0.25	J	1.3	U	NT			
Methylene Chloride	mg/kg	350	35	NT		NT		NT		0.2	J	0.1	J	0.28	U	0.19		NT		NT		NT		NT		0.092	J	0.17	J	NT			
SVOCs																																	
2-Methylnaphthalene	mg/kg	240	24	0.37	U	0.37	U	0.41	U	0.39	U	0.011	J	0.4	U	0.2055		0.37	U	0.38	U	0.41	U	0.39	U	0.072	J	0.38	U	0.4	U		
Acenaphthene	mg/kg	3600	360	0.37	U	0.37	U	0.41	U	0.39	U	0.36	U	0.4	U	0.38		0.063	J	0.38	U	0.41	U	0.39	U	0.072	J	0.38	U	0.4	U		
Acenaphthylene	mg/kg	NS	NS	0.37	U	0.37	U	0.012	J	0.39	U	0.01	J	0.4	U	0.205		0.25	J	0.38	U	0.41	U	0.39	U	0.042	J	0.011	J	0.033	J		
Anthracene	mg/kg	18000	1800	0.37	U	0.37	U	0.41	U	0.39	U	0.36	U	0.4	U	0.38		0.45		0.38	U	0.41	U	0.39	U	0.046	J	0.38	U	0.031	J		
Benzo(a)anthracene	mg/kg	11	1.1	0.037	U	0.061		0.038	J	0.039	U	0.045		0.04	U	0.0425		3		0.059		0.04	J	0.039	U	0.072		0.13		0.12			
Benzo(a)pyrene	mg/kg	1.1	0.24	0.037	U	0.058		0.031	J	0.018	J	0.04		0.015	J	0.0275		3.1		0.059		0.026	J	0.021	J	0.07		0.15		0.11			
Benzo(b)fluoranthene	mg/kg	11	1.1	0.037	U	0.077		0.041		0.033	J	0.052		0.019	J	0.0355		3.8		0.081		0.04	J	0.03	J	0.062		0.2		0.15			
Benzo(g,h,i)perylene	mg/kg	NS	NS	0.093	J	0.04	J	0.038	J	0.022	J	0.025	J	0.4	U	0.2125		1.8		0.034	J	0.016	J	0.013	J	0.028	J	0.09	J	0.097	J		
Benzo(k)fluoranthene	mg/kg	110	11	0.037	U	0.029	J	0.021	J	0.017	J	0.028	J	0.0087	J	0.01835		1.5		0.037	J	0.015	J	0.015	J	0.026	J	0.07		0.088			
Bis(2-ethylhexyl) Phthalate	mg/kg	390	39	0.37	U	0.37	U	0.41	U	0.39	U	0.36	U	0.4	U	0.38		0.37	U	0.38	U	0.41	U	0.39	U	0.42	U	0.38	U	0.13	J		
Butyl Benzyl Phthalate	mg/kg	2900	290	0.37	U	0.37	U	0.41	U	0.39	U	0.36	U	0.4	U	0.38		0.37	U	0.38	U	0.41	U	0.39	U	0.42	U	0.38	U	0.02	J		
Carbazole	mg/kg	NS	NS	0.37	U	0.37	U	0.41	U	0.39	U	0.36	U	0.4	U	0.38		0.057	J	0.38	U	0.41	U	0.39	U	0.42	U	0.38	U	0.4	U		
Chrysene	mg/kg	1100	110	0.37	U	0.083	J	0.037	J	0.024	J	0.043	J	0.4	U	0.2215		2.5		0.065	J	0.038	J	0.027	J	0.069	J	0.12	J	0.12	J		
Dibenz(a,h)anthracene	mg/kg	1.1	0.17	0.038		0.037	U	0.041	U	0.039	U	0.036	U	0.04	U	0.038		0.5		0.038	U	0.041	U	0.039	U	0.042	U	0.038	U	0.017	J		
Dibenzofuran	mg/kg	78	7.8	0.37	U	0.37	U	0.41	U	0.39	U	0.36	U	0.4	U	0.38		0.024	J	0.38	U	0.41	U	0.39	U	0.42	U	0.38	U	0.4	U		
Fluoranthene	mg/kg	2400	240	0.37	U	0.11	J	0.056	J	0.029	J	0.069	J	0.02	J	0.0445		6		0.11	J	0.06	J	0.041	J	0.1	J	0.24	J	0.22	J		
Fluorene	mg/kg	2400	240	0.37	U	0.37	U	0.41	U	0.39	U	0.36	U	0.4	U	0.38		0.056	J	0.38	U	0.41	U	0.39	U	0.044	J	0.38	U	0.4	U		
Indeno(1,2,3-c,d)pyrene	mg/kg	11	1.3	0.067		0.042		0.035	J	0.019	J	0.03	J	0.04	U	0.035		2.3		0.044		0.02	J	0.016	J	0.041	J	0.1		0.1			
Naphthalene	mg/kg	20	2	0.37	U	0.37	U	0.41	U	0.39	U	0.0079	J	0.4	U	0.20395		0.037	J	0.38	U	0.41	U	0.39	U	0.11	J	0.0083	J	0.4	U		
Phenanthrene	mg/kg	1800	180	0.37	U	0.055	J	0.021	J	0.39	U	0.022	J	0.4	U	0.211		1.2		0.045	J	0.025	J	0.016	J	0.17	J	0.061	J	0.074	J		
Pyrene	mg/kg	1800	180	0.37	U	0.1	J	0.073	J	0.026	J	0.064	J	0.02	J	0.042		5.3		0.092	J	0.054	J	0.037	J	0.13	J	0.22	J	0.19	J		
Inorganics																																	
Cyanide	mg/kg	23	2.3	0.27	U F1	0.24	U	0.27	U	0.23	J F1	0.24	U	0.24	U	0.24		0.26	U	0.25	U	0.27	U	0.26	U	0.31	U	0.27	U	0.29	U		
Other																																	
Total Tetrachlorobiphenyls	mg/kg	NS	NS	NT		NT		NT		NT		0.0074	U	NT		0.0074		NT		NT		NT		NT		0.0048	J	NT		NT			

NS - No Standard

NT - Not Tested

concentration is an approximate value.

U : Indicates the analyte was analyzed for but not detected.

J : Indicates an Estimated Value for TICs

N : This flag indicates the presumptive evidence of a compound.

F1 : MS and/or MSD recovery exceeds control limits

Parameter exceeds Standard

Parameter exceeds Standard

Table 2 - Aqueous Blanks
Rodney Reservoir Site
July 2023

Station Name	Units	EB-1		EB-2		FB	
Field Sample		EB-1 Water		EB-2 Water		FB-Water	
Sample Date		6/13/2023		6/13/2023		6/13/2023	
Delivery Group		460-282595-1		460-282595-1		460-282595-1	
Matrix		Water		Water		Water	
		Result	Q	Result	Q	Result	Q
Metals							
Aluminum	ug/l	164		80		40	U
Barium	ug/l	2.9	J	1.3	J	4	U
Calcium	ug/l	222	J	76.6	J	500	U
Iron	ug/l	149		82	J	120	U
Lead	ug/l	1.5		1.2	U	1.2	U
Manganese	ug/l	15.2		6.2	J	8	U

J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

U : Indicates the analyte was analyzed for but not detected.

Table 3 - Solid Blanks
Rodney Reservoir Site
July 2023

Station Name	Units	EB-1		EB-2		FB		TB	
Sample Date		6/13/2023		6/13/2023		6/13/2023		6/13/2023	
Delivery Group		460-282595-1		460-282595-1		460-282595-1		460-282595-1	
Matrix		Soil		Soil		Soil		Soil	
		Result	Q	Result	Q	Result	Q	Result	Q
VOCs									
Methylene Chloride	mg/kg	0.22	U	0.21	U	0.07	J	0.12	U
SVOCs									
Fluoranthene	mg/kg	0.016	J	0.017	J	0.33	U	NT	
Phenanthrene	mg/kg	0.33	U	0.015	J	0.33	U	NT	
Pyrene	mg/kg	0.019	J	0.019	J	0.33	U	NT	

NT - Not Tested

J : Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

U : Indicates the analyte was analyzed for but not detected.

TABLE 4 - Selection of Exposure Pathways
Rodney Reservoir Site - P00074
1500 W Ninth Street
Wilmington, Delaware

Receptor Population	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Age	Exposure Route	Rationale for Selection or Elimination of Exposure Pathway
Resident	Future	Soil	Shallow Soil	Shallow Soil	Child	Ingestion, Dermal, Inhalation	HHRA Guidance requires child residential risk be evaluated for exposure to sensitive recepors.
Resident	Future	Soil	Shallow and Deep Soil	Shallow and Deep Soil	Child	Ingestion, Dermal, Inhalation	HHRA Guidance requires child residential risk be evaluated for exposure to sensitive recepors.
Outdoor Worker	Future	Soil	Shallow Soil	Shallow Soil	Adult	Ingestion, Dermal, Inhalation	Proposed development is likely to have outside workers.
Outdoor Worker	Future	Soil	Shallow and Deep Soil	Shallow and Deep Soil	Adult	Ingestion, Dermal, Inhalation	Proposed development is likely to have outside workers.
Excavation Worker	Future	Soil	Shallow Soil	Shallow Soil	Adult	Ingestion, Dermal, Inhalation	Proposed redevelopment may require shallow soil work.
Excavation Worker	Future	Soil	Shallow and Deep Soil	Shallow and Deep Soil	Adult	Ingestion, Dermal, Inhalation	Proposed redevelopment may require shallow and deep soil work.
Recreator	Future	Soil	Shallow Soil	Shallow Soil	Child/Adult	Ingestion, Dermal, Inhalation	Proposed development may contain recreation use as open space.
Recreator	Future	Soil	Shallow and Deep Soil	Shallow and Deep Soil	Child/Adult	Ingestion, Dermal, Inhalation	Proposed development may contain recreation use as open space.

TABLE 5 - Selection of Contaminants of Potential Concern - Soil

Rodney Reservoir Site - P00074
1500 W Ninth Street
Wilmington, Delaware

Exposure Medium	Chemical	Maximum Concentration	Lab Qualifier	Units	Screening Level (February 2022)	COPC Flag (Y/N)	Comment
Shallow Soil	Benzo[a]pyrene	3.10		mg/kg	0.24	Y	Max exceeds screening level.
	Benzo[b]fluoranthene	3.80		mg/kg	1.1	Y	Max exceeds screening level.
	Dibenz(a,h)anthracene	0.50		mg/kg	0.17	Y	Max exceeds screening level.
	Benz(a)anthracene	3.00		mg/kg	1.1	Y	Max exceeds screening level.
	Indeno(1,2,3-cd)pyrene	2.30		mg/kg	1.3	Y	Max exceeds screening level.
	Cobalt	94.50		mg/kg	34	Y	Max exceeds screening level.
	Aluminum	63300		mg/kg	51200	Y	Max exceeds screening level.
	Thallium	0.19		mg/kg	0.078	Y	Max exceeds screening level.
	Vanadium	163.00		mg/kg	134	Y	Max exceeds screening level.
	Mercury	2.60		mg/kg	1.1	Y	Max exceeds screening level.
Combined Shallow and Deep Soil	Benzo[a]pyrene	3.10		mg/kg	0.24	Y	Max exceeds screening level.
	Benzo[b]fluoranthene	3.80		mg/kg	1.1	Y	Max exceeds screening level.
	Dibenz(a,h)anthracene	0.50		mg/kg	0.17	Y	Max exceeds screening level.
	Benz(a)anthracene	3.00		mg/kg	1.1	Y	Max exceeds screening level.
	Indeno(1,2,3-cd)pyrene	2.30		mg/kg	1.3	Y	Max exceeds screening level.
	Cobalt	94.50		mg/kg	34	Y	Max exceeds screening level.
	Aluminum	63300		mg/kg	51200	Y	Max exceeds screening level.
	Thallium	0.20		mg/kg	0.078	Y	Max exceeds screening level.
	Vanadium	167.00		mg/kg	134	Y	Max exceeds screening level.
	Mercury	2.60		mg/kg	1.1	Y	Max exceeds screening level.
	Chromium	384.50		mg/kg	214	Y	Max exceeds screening level.

TABLE 6 -Selection of Exposure Point Concentrations (EPC)
Rodney Reservoir Site - P00074
1500 W Ninth Street
Wilmington, Delaware

Exposure Medium	Exposure Point	COPC	# of Detects/# of Samples	Mean Detects	95% UCL	Maximum Concentration	Units	Selected EPC	Distribution/Comment
Soil	Shallow Soil	Cobalt	24/25	33.93	39.04	94.50	mg/kg	39.04	95% KM (t) UCL
		Aluminum	10/10	41840.00	48529.00	63300.00	mg/kg	48529.00	95% Student's-t UCL is below the screening value. Therefore, this substance will not be futher evaluated as a COPC for shallow soil.
		Thallium	10/10	0.16	0.17	0.19	mg/kg	0.17	95% Student's-t UCL
		Vanadium	10/10	116.70	134.50	163.00	mg/kg	134.50	95% Student's-t UCL
		Mercury	10/10	0.34	0.80	2.60	mg/kg	0.80	95% Student's-t UCL is below the screening value. Therefore, this substance will not be futher evaluated as a COPC for shallow soil.
		Benzo(a)pyrene	9/10	0.44	6.03	3.10	mg/kg	3.10	Maximum concentration. Suggested 95% UCL exceeds the maximum reported detection.
		Benz(a)anthracene	9/10	0.46	6.00	3.00	mg/kg	3.00	Maximum conentration. Suggested 95% UCL exceeds the maximum reported detection.
		Benzo(b)fluoranthene	10/10	0.50	1.96	3.80	mg/kg	1.96	95% Adjusted Gamma UCL
		Dibenz(a,h)anthracene	4/10	0.15	0.13	0.50	mg/kg	0.13	95% Halls Bootstrap is below the screening value. Therefore, this substance will not be further evaluated as a COPC for shallow soil.
		Indeno(1,2,3-cd)pyrene	9/10	0.31	0.70	2.30	mg/kg	0.70	KM (t) UCL is below the screening value. Therefore, this substance will not be further evaluated as a COCP for shallow soil.
Soil	Shallow & Deep	Cobalt	30/31	32.99	37.49	94.50	mg/kg	37.49	95% KM (t) UCL
		Chromium	16/16	139.90	179.70	384.50	mg/kg	179.70	95% Student's-t UCL is below the screening value. Therefore, this substance will not be futher evaluated as a COPC for combined shallow and deep soil.
		Aluminum	16/16	40797.00	46408.00	63300.00	mg/kg	46408.00	95% Student's-t UCL is below the screening value. Therefore, this substance will not be futher evaluated as a COPC for combined shallow and deep soil.
		Thallium	16/16	0.16	0.17	0.20	mg/kg	0.17	95% Student's-t UCL
		Vanadium	16/16	117.00	133.90	167.00	mg/kg	133.90	95% Student's-t UCL is below the screening value. Therefore, this substance will not be futher evaluated as a COPC for combined shallow and deep soil.
		Mercury	16/16	0.24	0.52	2.60	mg/kg	0.52	95% Student's-t UCL is below the screening value. Therefore, this substance will not be futher evaluated as a COPC for combined shallow and deep soil.
		Benzo(a)pyrene	14/16	0.31	0.59	3.10	mg/kg	0.59	KM H-UCL
		Benz(a)anthracene	13/16	0.34	0.63	3.00	mg/kg	0.63	KM H-UCL is below the screening value. Therefore, this substance will not be further evaluted as a COPC for combined shallow and deep soil.
		Benzo(b)fluoranthene	15/16	0.36	0.78	3.80	mg/kg	0.78	KM H-UCL is below the screening value. Therefore, this substance will not be further evaluted as a COPC for combined shallow and deep soil.
		Dibenz(a,h)anthracene	6/16	0.11	0.11	0.50	mg/kg	0.11	95% KM (t) UCL is below the screening value. Therefore, this substance will not be further evaluated as a COPC for combined shallow and deep soil.
		Indeno(1,2,3-cd)pyrene	15/16	0.21	0.30	2.30	mg/kg	0.30	KM H-UCL is below the screening value. Therefore, this substance will not be further evaluted as a COPC for combined shallow and deep soil.

TABLE 7 - Risk Summary for Receptors - Resident, Shallow Soil
Rodney Reservoir Site
Timeframe: Future

Exposure Media	Exposure Route	DERAC Input Constituent	COPC	EPC	Units	Carcinogenic Risk	Hazard Quotient	Child Hazard Quotient	Target Organ	Comment
Shallow Soil	Ingestion	Benz(a)anthracene	Benz(a)anthracene	3.00	mg/kg	1.96E-06	--	--		
		Benzo(a)pyrene	Benzo(a)pyrene	3.1	mg/kg	2.0E-05	0.04	0.132		
		Benzo(b)fluoranthene	Benzo(b)fluoranthene	1.96	mg/kg	1.28E-06	-	--		
		Cobalt	Cobalt	39.04	mg/kg	--	0.50	1.660		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	0.07	0.217		
		Vanadium and Compounds	Vanadium	134.50	mg/kg	--	0.10	0.341		
	Total for Exposure Route					**2.34E-05**	**0.71**	**2.35**		
	Dermal	Benz(a)anthracene	Benz(a)anthracene	3.00	mg/kg	6.54E-07	--	--		
		Benzo(a)pyrene	Benzo(a)pyrene	3.1	mg/kg	6.8E-06	0.01	0.0408		
		Benzo(b)fluoranthene	Benzo(b)fluoranthene	1.96	mg/kg	4.27E-07	--	--		
		Cobalt	Cobalt	39.04	mg/kg	--	--	--		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--	--		
		Vanadium and Compounds	Vanadium	134.50	mg/kg	--	--	--		
	Total for Exposure Route					**7.83E-06**	**0.015**	**0.041**		
	Inhalation	Benz(a)anthracene	Benz(a)anthracene	3.00	mg/kg	4.04E-08	--	--		
		Benzo(a)pyrene	Benzo(a)pyrene	3.1	mg/kg	1.35E-09	0.00	0.0011		
		Benzo(b)fluoranthene	Benzo(b)fluoranthene	1.96	mg/kg	8.53E-11	--	--		
		Cobalt	Cobalt	39.04	mg/kg	9.21E-08	0.00	0.0046		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--	--		
		Vanadium and Compounds	Vanadium	134.50	mg/kg	-	0.00	0.0009		
	Total for Exposure Route					**1.34E-07**	**0.007**	**0.0066**		
Total for Exposure Media						**3.14E-05**	**0.73**	**2.40**		
Cumulative Carcinogenic Risk (One significant figure)						**3E-05**				
Hazard Index (One significant figure)							**0.7**	**2**		

TABLE 8 - Risk Summary for Receptors - Resident, Combined Soil
Rodney Reservoir Site
Timeframe: Future

Exposure Media	Exposure Route	DERAC Input Constituent	COPC	EPC	Units	Carcinogenic Risk	Hazard Quotient	Child Hazard Quotient	Target Organ	Comment
Combined Shallow & Deep Soil		Benzo(a)pyrene	Benzo(a)pyrene	0.6	mg/kg	3.9E-06	0.01	0.025		
		Cobalt	Cobalt	37.49	mg/kg	--	0.48	1.600		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	0.07	0.217		
	Total for Exposure Route					**3.85E-06**	**0.56**	**1.84**		
		Benzo(a)pyrene	Benzo(a)pyrene	0.6	mg/kg	1.3E-06	0.003	0.0078		
		Cobalt	Cobalt	37.49	mg/kg	--	--	--		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--	--		
	Total for Exposure Route					**1.29E-06**	**0.003**	**0.008**		
		Benzo(a)pyrene	Benzo(a)pyrene	0.6	mg/kg	2.57E-10	0.0002	0.0002		
		Cobalt	Cobalt	37.49	mg/kg	8.84E-08	0.004	0.0044		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--	--		
	Total for Exposure Route					**8.87E-08**	**0.005**	**0.0046**		
Total for Exposure Media						**5.23E-06**	**0.56**	**1.85**		
Cumulative Carcinogenic Risk (One significant figure)						**5E-06**				
Hazard Index (One significant figure)							**0.6**	**2**		

TABLE 9 - Risk Summary for Receptors - Outdoor Worker, Shallow Soil
Rodney Reservoir Site
Timeframe: Future

Exposure Media	Exposure Route	DERAC Input Constituent	COPC	EPC	Units	Carcinogenic Risk	Hazard Quotient	Target Organ	Comment
Shallow Soil	Ingestion	Benz(a)anthracene	Benz(a)anthracene	3.00	mg/kg	5.39E-08	--		
		Benzo(a)pyrene	Benzo(a)pyrene	3.1	mg/kg	8.5E-07	0.01		
		Benzo(b)fluoranthene	Benzo(b)fluoranthene	1.96	mg/kg	8.26E-08	--		
		Cobalt	Cobalt	39.04	mg/kg	--	0.10		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	0.01		
		Vanadium and Compounds	Vanadium	134.50	mg/kg	--	0.02		
	Total for Exposure Route					**9.90E-07**	**0.14**		
	Dermal	Benz(a)anthracene	Benz(a)anthracene	3.00	mg/kg	2.97E-08	--		
		Benzo(a)pyrene	Benzo(a)pyrene	3.1	mg/kg	4.7E-07	0.00		
		Benzo(b)fluoranthene	Benzo(b)fluoranthene	1.96	mg/kg	4.54E-08	--		
		Cobalt	Cobalt	39.04	mg/kg	--	--		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--		
		Vanadium and Compounds	Vanadium	134.50	mg/kg	--	--		
	Total for Exposure Route					**5.44E-07**	**0.004**		
	Inhalation	Benz(a)anthracene	Benz(a)anthracene	3.00	mg/kg	1.96E-09	--		
		Benzo(a)pyrene	Benzo(a)pyrene	3.1	mg/kg	1.00E-10	0.0002		
		Benzo(b)fluoranthene	Benzo(b)fluoranthene	1.96	mg/kg	9.72E-12	--		
		Cobalt	Cobalt	39.04	mg/kg	1.90E-08	0.0010		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--		
		Vanadium and Compounds	Vanadium	134.50	mg/kg	-	0.02		
	Total for Exposure Route					**2.11E-08**	**0.022**		
Total for Exposure Media						**1.55E-06**	**0.17**		
Cumulative Carcinogenic Risk (One significant figure)						**2E-06**			
Hazard Index (One significant figure)							**0.2**		

TABLE 10 - Risk Summary for Receptors - Outdoor Worker, Combined Soil

Rodney Reservoir Site

Timeframe: Future

Exposure Media	Exposure Route	DERAC Input Constituent	COPC	EPC	Units	Carcinogenic Risk	Hazard Quotient	Target Organ	Comment
Combined Shallow & Deep Soil		Benzo(a)pyrene	Benzo(a)pyrene	0.6	mg/kg	1.6E-07	0.00		
		Cobalt	Cobalt	37.49	mg/kg	--	0.10		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	0.01		
	Total for Exposure Route					**1.62E-07**	**0.11**		
		Benzo(a)pyrene	Benzo(a)pyrene	0.6	mg/kg	8.9E-08	0.001		
		Cobalt	Cobalt	37.49	mg/kg	--	--		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--		
	Total for Exposure Route					**8.93E-08**	**0.001**		
		Benzo(a)pyrene	Benzo(a)pyrene	0.6	mg/kg	1.91E-11	0.00004		
		Cobalt	Cobalt	37.49	mg/kg	1.82E-08	0.001		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--		
	Total for Exposure Route					**1.82E-08**	**0.001**		
Total for Exposure Media						**2.70E-07**	**0.11**		
Cumulative Carcinogenic Risk (One significant figure)						**3E-07**			
Hazard Index (One significant figure)							**0.1**		

TABLE 11 - Risk Summary for Receptors - Excavator, Shallow Soil
Rodney Reservoir Site
Timeframe: Future

Exposure Media	Exposure Route	DERAC Input Constituent	COPC	EPC	Units	Carcinogenic Risk	Hazard Quotient	Target Organ	Comment
Shallow Soil	Ingestion	Benz(a)anthracene	Benz(a)anthracene	3.00	mg/kg	6.33E-10	--		
		Benzo(a)pyrene	Benzo(a)pyrene	3.1	mg/kg	1.0E-08	0.002		
		Benzo(b)fluoranthene	Benzo(b)fluoranthene	1.96	mg/kg	9.69E-10	--		
		Cobalt	Cobalt	39.04	mg/kg	--	0.003		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	0.001		
		Vanadium and Compounds	Vanadium	134.50	mg/kg	--	0.003		
	Total for Exposure Route					**1.16E-08**	**0.01**		
	Dermal	Benz(a)anthracene	Benz(a)anthracene	3.00	mg/kg	2.64E-10	--		
		Benzo(a)pyrene	Benzo(a)pyrene	3.1	mg/kg	4.2E-09	0.001		
		Benzo(b)fluoranthene	Benzo(b)fluoranthene	1.96	mg/kg	4.04E-10	--		
		Cobalt	Cobalt	39.04	mg/kg	--	--		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--		
		Vanadium and Compounds	Vanadium	134.50	mg/kg	--	--		
	Total for Exposure Route					**4.84E-09**	**0.001**		
	Inhalation	Benz(a)anthracene	Benz(a)anthracene	3.00	mg/kg	6.98E-12	--		
		Benzo(a)pyrene	Benzo(a)pyrene	3.1	mg/kg	3.57E-13	0.00002		
		Benzo(b)fluoranthene	Benzo(b)fluoranthene	1.96	mg/kg	3.46E-14	--		
		Cobalt	Cobalt	39.04	mg/kg	6.74E-11	--		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--		
		Vanadium and Compounds	Vanadium	134.50	mg/kg	-	--		
	Total for Exposure Route					**7.48E-11**	**0.00002**		
Total for Exposure Media						**1.65E-08**	**0.01**		
Cumulative Carcinogenic Risk (One significant figure)						**2E-08**			
Hazard Index (One significant figure)							**0.01**		

TABLE 12 - Risk Summary for Receptors - Excavator, Combined Soil

Rodney Reservoir Site

Timeframe: Future

Exposure Media	Exposure Route	DERAC Input Constituent	COPC	EPC	Units	Carcinogenic Risk	Hazard Quotient	Target Organ	Comment
Combined Shallow & Deep Soil		Benzo(a)pyrene	Benzo(a)pyrene	0.6	mg/kg	1.9E-09	0.0004		
		Cobalt	Cobalt	37.49	mg/kg	--	0.003		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	0.001		
	Total for Exposure Route					**1.91E-09**	**0.004**		
		Benzo(a)pyrene	Benzo(a)pyrene	0.6	mg/kg	7.9E-10	0.0002		
		Cobalt	Cobalt	37.49	mg/kg	--	--		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--		
	Total for Exposure Route					**7.94E-10**	**0.0002**		
		Benzo(a)pyrene	Benzo(a)pyrene	0.6	mg/kg	6.08E-14	0.000004		
		Cobalt	Cobalt	37.49	mg/kg	6.48E-11	0.00003		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--		
	Total for Exposure Route					**6.49E-11**	**0.00003**		
Total for Exposure Media						**2.77E-09**	**0.004**		
Cumulative Carcinogenic Risk (One significant figure)						**3E-09**			
Hazard Index (One significant figure)							**0.004**		

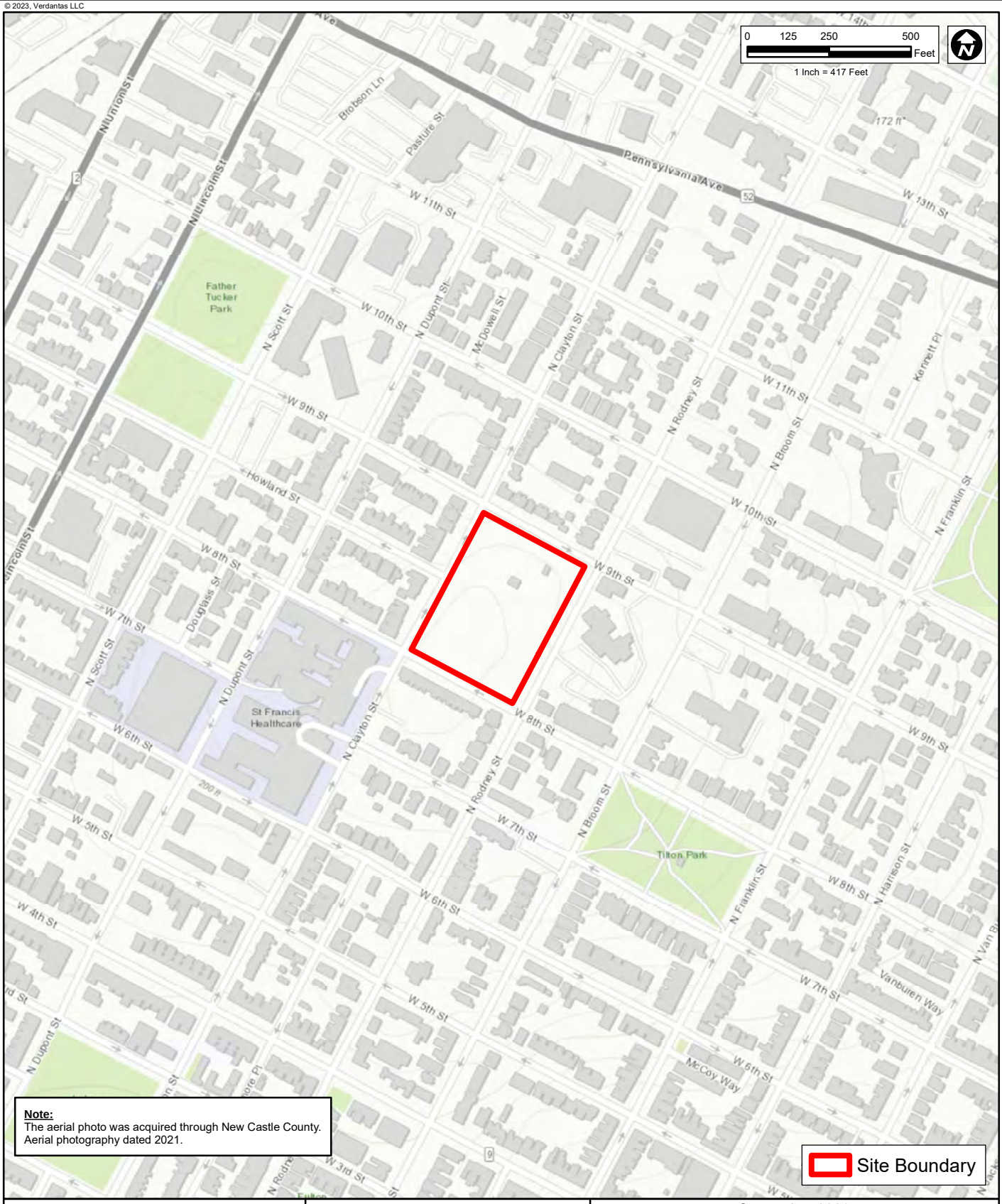
TABLE 13 - Risk Summary for Receptors - Recreator, Shallow Soil
Rodney Reservoir Site
Timeframe: Future

Exposure Media	Exposure Route	DERAC Input Constituent	COPC	EPC	Units	Carcinogenic Risk	Hazard Quotient	Child Hazard Quotient	Target Organ	Comment
Shallow Soil	Ingestion	Benz(a)anthracene	Benz(a)anthracene	3.00	mg/kg	4.20E-07	--	--		
		Benzo(a)pyrene	Benzo(a)pyrene	3.1	mg/kg	4.3E-06	0.01	0.028		
		Benzo(b)fluoranthene	Benzo(b)fluoranthene	1.96	mg/kg	2.74E-07	-	--		
		Cobalt	Cobalt	39.04	mg/kg	--	0.11	0.357		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	0.01	0.047		
		Vanadium and Compounds	Vanadium	134.50	mg/kg	--	0.02	0.073		
	Total for Exposure Route					**5.03E-06**	**0.15**	**0.50**		
	Dermal	Benz(a)anthracene	Benz(a)anthracene	3.00	mg/kg	1.40E-07	--	--		
		Benzo(a)pyrene	Benzo(a)pyrene	3.1	mg/kg	1.5E-06	0.003	0.0087		
		Benzo(b)fluoranthene	Benzo(b)fluoranthene	1.96	mg/kg	9.15E-08	--	--		
		Cobalt	Cobalt	39.04	mg/kg	--	--	--		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--	--		
		Vanadium and Compounds	Vanadium	134.50	mg/kg	--	--	--		
	Total for Exposure Route					**1.68E-06**	**0.003**	**0.009**		
	Inhalation	Benz(a)anthracene	Benz(a)anthracene	3.00	mg/kg	3.61E-10	--	--		
		Benzo(a)pyrene	Benzo(a)pyrene	3.1	mg/kg	1.20E-11	0.00001	0.00001		
		Benzo(b)fluoranthene	Benzo(b)fluoranthene	1.96	mg/kg	7.62E-13	--	--		
		Cobalt	Cobalt	39.04	mg/kg	8.22E-10	0.00004	0.00004		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--	--		
		Vanadium and Compounds	Vanadium	134.50	mg/kg	-	0.00001	0.00001		
	Total for Exposure Route					**1.20E-09**	**0.0001**	**0.0001**		
Total for Exposure Media						**6.72E-06**	**0.16**	**0.51**		
Cumulative Carcinogenic Risk (One significant figure)						**7E-06**				
Hazard Index (One significant figure)							**0.2**	**1**		

TABLE 14 - Risk Summary for Receptors - Recreator, Combined Soil
Rodney Reservoir Site
Timeframe: Future

Exposure Media	Exposure Route	DERAC Input Constituent	COPC	EPC	Units	Carcinogenic Risk	Hazard Quotient	Child Hazard Quotient	Target Organ	Comment
Combined Shallow & Deep Soil		Benzo(a)pyrene	Benzo(a)pyrene	0.6	mg/kg	8.3E-07	0.002	0.005		
		Cobalt	Cobalt	37.49	mg/kg	--	0.10	0.342		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	0.01	0.047		
	Total for Exposure Route					**8.26E-07**	**0.12**	**0.39**		
		Benzo(a)pyrene	Benzo(a)pyrene	0.6	mg/kg	2.8E-07	0.001	0.0017		
		Cobalt	Cobalt	37.49	mg/kg	--	--	--		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--	--		
	Total for Exposure Route					**2.75E-07**	**0.001**	**0.002**		
		Benzo(a)pyrene	Benzo(a)pyrene	0.6	mg/kg	2.29E-12	0.000002	0.000002		
		Cobalt	Cobalt	37.49	mg/kg	7.89E-10	0.00004	0.00004		
		Thallium (Soluble Salts)	Thallium	0.17	mg/kg	--	--	--		
	Total for Exposure Route					**7.91E-10**	**0.00004**	**0.00004**		
Total for Exposure Media						**1.10E-06**	**0.12**	**0.40**		
Cumulative Carcinogenic Risk (One significant figure)						**1E-06**				
Hazard Index (One significant figure)							**0.1**	**0.4**		

FIGURES



Note:
The aerial photo was acquired through New Castle County. Aerial photography dated 2021.

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September 2023

Earthen Berm Soil Sampling
Rodney Reservoir Site

Site Location Map

North Rodney Street & West 9th Street
Wilmington, New Castle County, Delaware

Figure

1

Produced Using Esri's ArcGIS Software

File Location: Z:\GIS\Projects\007\16530_RodneyReservoir\Test Pit Investogation Report 2023\16530_Fig_1 Site Location Map.mxd Edited: 9/6/2023 User: efayaz

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September 2023

Earthen Berm Soil Sampling
Rodney Reservoir Site

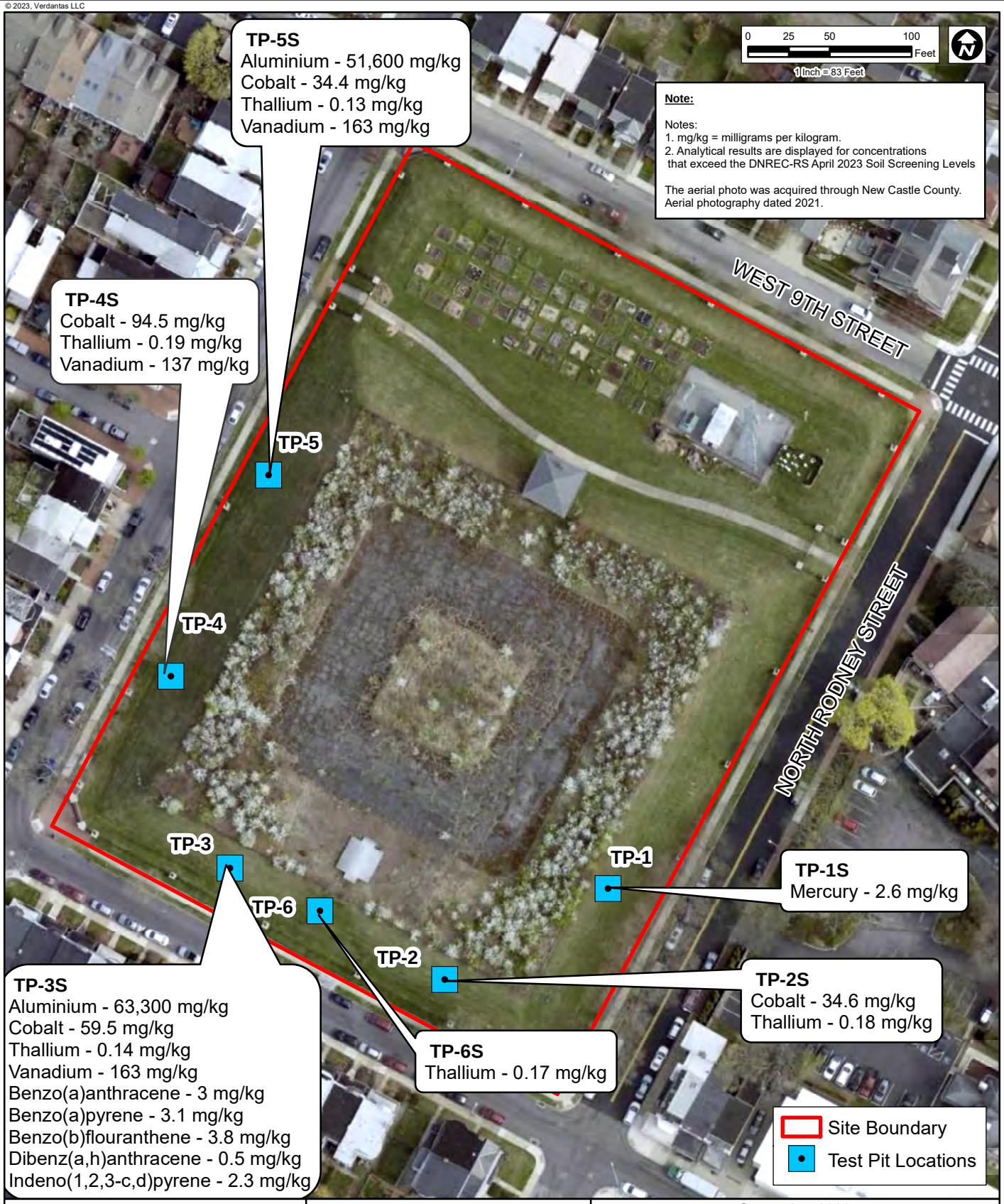
Site Features Sketch

North Rodney Street & West 9th Street
Wilmington, New Castle County, Delaware

Figure
2

Produced Using Esri's ArcGIS Software

File Location: Z:\GIS\Projects\007\16530_RodneyReservoir\Test Pit Investogation Report 2023\16530_Fig2_Site Features Sketch.mxd Edited: 9/6/2023 User: efayaz



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September 2023

Earthen Berm Soil Sampling
Rodney Reservoir Site

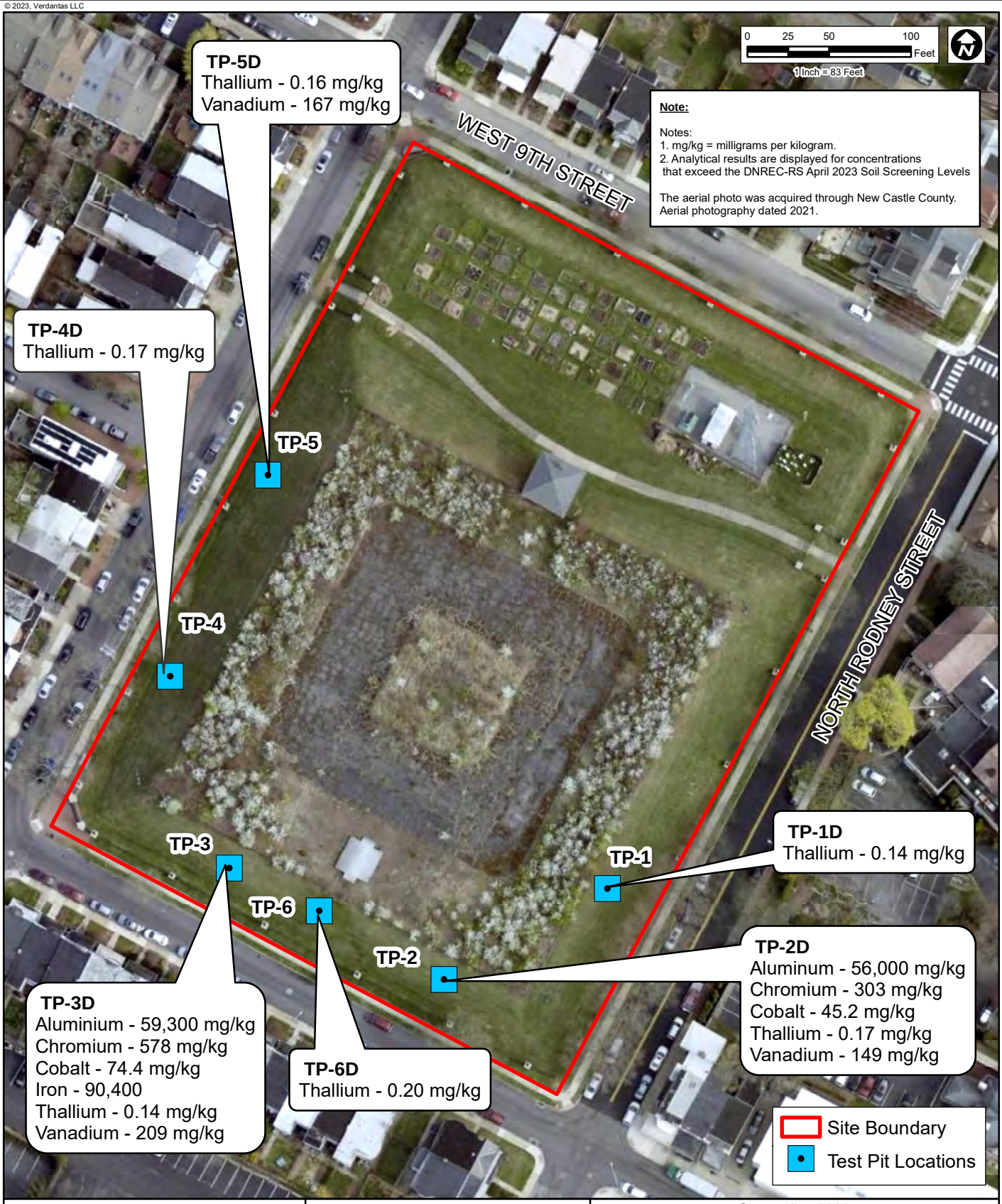
Shallow Soil Exceedance Sketch

North Rodney Street & West 9th Street
Wilmington, New Castle County, Delaware

Figure
3

Produced Using Esri's ArcGIS Software

File Location: Z:\GIS\Projects\007\16530_RodneyReservoir\Test Pit Investogation Report 2023\16530_Fig3_Shallow Soil Exceedance Sketch.mxd Edited: 9/7/2023 User: efayaz



Note:

Notes:
1. mg/kg = milligrams per kilogram.
2. Analytical results are displayed for concentrations that exceed the DNREC-RS April 2023 Soil Screening Levels

The aerial photo was acquired through New Castle County. Aerial photography dated 2021.

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September 2023

Earthen Berm Soil Sampling
Rodney Reservoir Site

Deep Soil Exceedance Sketch

North Rodney Street & West 9th Street
Wilmington, New Castle County, Delaware

Figure 4

Produced Using Esri's ArcGIS Software

File Location: Z:\GIS\Projects\007\16530_RodneyReservoir\Test Pit Investogation Report 2023\16530_Fig4_Deep Soil Exceedance Sketch.mxd Edited: 9/7/2023 User: efayaz

September 8, 2023
Ms. Mariya Chiger
Project Number: 16530

ATTACHMENT A

DNREC SOIL SCREENING REPORT

FIELD SCREENING ANALYSIS SUMMARY

Site Name: RODNEY RESERVOIR **Site ID:** DE —

Estimated PQL
1PPM

Sample name	VOC's	Pest PCB	Screening Date	Semi's
TP 1S	ND	ND	6/13-15/23	TRACE PAH, TICS
1D				ND
2S				TRACE PAH
2D				ND
3S				ND
3D				TRACE PAH
4S				LOW PAH, LOW TPH
4D				LOW PAH, LOW TPH
5S				LOW PAH, LOW TPH
5D				PAH, LOW TPH
6S				PAH
6D				PAH, TPH

EDXRF Analysis Report

Thermo Fisher Scientific Inc., Madison, Wisconsin, USA

Sample List: 2023/06/14 15:18
Analysis Technique: Fundamental Parameters (Alphas)
Method File: C:\...\QUANT'X\Methods\Metals Full List Original.MTH

Analyzed: 06/14/23 19:29:06
Last Calibrated: 07/12/22 13:22:38
Software version: 7.2 (Build 134)

Conditions

Low Zc

Voltage	12 kV	Current	Auto
Livetime	200 seconds	Counts Limit	0
Filter	Aluminum	Atmosphere	Air
Maximum Energy	40 keV	Count Rate	Medium
Warmup time	10 seconds		

High Zb

Voltage	50 kV	Current	Auto
Livetime	200 seconds	Counts Limit	0
Filter	Cu Thick	Atmosphere	Air
Maximum Energy	40 keV	Count Rate	Medium
Warmup time	10 seconds		

Mid Zc

Voltage	28 kV	Current	Auto
Livetime	200 seconds	Counts Limit	0
Filter	Pd Thick	Atmosphere	Air
Maximum Energy	40 keV	Count Rate	Medium
Warmup time	10 seconds		

Results

Element	Concentration	Peak (cps/mA)	Background (cps/mA)
tp1s			
Ca	2806 ppm	117	37
V	174.7 ppm	29	151
Cr	159.4 ppm	53	77
Mn	842.3 ppm	333	61
Fe	42894 ppm	21267	2124
Ti	5000 ppm	558	150
Ag	0 ppm	0	3
Cd	[1.0] ppm	1	6
Ba	268 ppm	76	239
Sb	[0.3] ppm	0	17
Co	35.30 ppm	88	279
Ni	71.2 ppm	21	-5
Cu	39.1 ppm	5	12
Zn	35.6 ppm	6	13
As	3.27 ppm	8	11
Se	0.82 ppm	1	8
Hg	[0.6] ppm	0	9
Tl	0 ppm	0	12
Pb	26.1 ppm	7	17
SiO5	94.764 % Diff		
tp1d			
Ca	2076 ppm	86	34
V	104.4 ppm	17	151
Cr	69.7 ppm	23	52
Mn	577.3 ppm	236	55
Fe	26189 ppm	13593	1431
Ti	5494 ppm	614	130
Ag	0 ppm	0	4
Cd	0 ppm	0	8
Ba	375 ppm	119	286
Sb	0 ppm	0	21
Co	20.34 ppm	52	164
Ni	38.3 ppm	13	-0
Cu	14.6 ppm	2	11
Zn	31.3 ppm	7	11
As	1.69 ppm	5	11

Se	[0.42] ppm	1	10
Hg	0 ppm	0	10
Tl	0 ppm	0	12
Pb	8.3 ppm	2	15
SiO5	96.5 % Diff		

tp2s

Ca	2494 ppm	105	44
V	201 ppm	33	171
Cr	230.5 ppm	76	96
Mn	1014.8 ppm	384	80
Fe	66293 ppm	30969	2953
Ti	5114 ppm	572	181
Ag	[0.8] ppm	0	3
Cd	[0.2] ppm	0	6
Ba	324 ppm	79	220
Sb	[1.6] ppm	1	17
Co	50.36 ppm	121	411
Ni	108.6 ppm	27	-10
Cu	43.2 ppm	5	13
Zn	50.0 ppm	8	11
As	2.76 ppm	6	9
Se	[0.22] ppm	0	9
Hg	[0.2] ppm	0	9
Tl	0 ppm	0	11
Pb	7.3 ppm	2	19
SiO5	92.406 % Diff		

tp2d

Ca	2540 ppm	107	44
V	272 ppm	44	145
Cr	443.2 ppm	147	113
Mn	1731 ppm	642	88
Fe	82149 ppm	37135	3502
Ti	3431 ppm	384	185
Ag	0 ppm	0	3
Cd	[0.7] ppm	0	6
Ba	321 ppm	72	215
Sb	0 ppm	0	16
Co	65.07 ppm	154	525
Ni	162.8 ppm	37	-15
Cu	112.0 ppm	12	13
Zn	41.0 ppm	6	11
As	2.19 ppm	4	8
Se	0 ppm	0	8
Hg	[1.6] ppm	0	8
Tl	[0.6] ppm	0	9
Pb	0 ppm	0	20
SiO5	90.873 % Diff		

tp3s

Ca	2979 ppm	125	43
V	236 ppm	39	152
Cr	93.4 ppm	31	88
Mn	1294.4 ppm	495	64
Fe	61285 ppm	29027	2782
Ti	4495 ppm	501	169
Ag	[0.6] ppm	0	4
Cd	[1.0] ppm	0	6
Ba	299 ppm	75	236
Sb	0 ppm	0	18
Co	50.04 ppm	121	402
Ni	90.5 ppm	23	-8
Cu	69.0 ppm	8	11
Zn	58.3 ppm	9	12
As	2.53 ppm	5	9
Se	[0.10] ppm	0	9
Hg	[1.6] ppm	0	8
Tl	[0.5] ppm	0	10
Pb	[5.5] ppm	1	20
SiO5	92.904 % Diff		

tp3d

Ca	2515 ppm	105	39
V	200 ppm	33	158
Cr	163.4 ppm	54	82
Mn	1239.3 ppm	483	69
Fe	51608 ppm	25028	2486

Ti	4999 ppm	559	163
Ag	0 ppm	0	3
Cd	[1.5] ppm	1	6
Ba	280 ppm	74	243
Sb	[2.2] ppm	1	18
Co	42.10 ppm	103	315
Ni	79.6 ppm	22	-7
Cu	40.2 ppm	5	12
Zn	52.0 ppm	9	11
As	2.73 ppm	6	10
Se	0 ppm	0	9
Hg	[0.9] ppm	0	9
Tl	0 ppm	0	10
Pb	14.9 ppm	4	17
SiO5	93.876 % Diff		

tp4s

Ca	4524 ppm	190	49
V	220 ppm	36	151
Cr	239.4 ppm	78	95
Mn	1292.1 ppm	492	72
Fe	60721 ppm	28611	2769
Ti	4415 ppm	489	166
Ag	[0.3] ppm	0	3
Cd	0 ppm	0	5
Ba	204 ppm	51	175
Sb	[1.2] ppm	0	13
Co	49.68 ppm	120	402
Ni	97.1 ppm	25	-9
Cu	55.9 ppm	7	11
Zn	55.7 ppm	9	11
As	4.25 ppm	9	9
Se	0.68 ppm	1	8
Hg	3.3 ppm	1	7
Tl	0 ppm	0	11
Pb	21.9 ppm	5	21
SiO5	92.809 % Diff		

tp4d

Ca	2563 ppm	107	42
V	195 ppm	32	167
Cr	135.5 ppm	45	87
Mn	1558.7 ppm	605	60
Fe	52044 ppm	25132	2486
Ti	5368 ppm	599	166
Ag	3.8 ppm	1	3
Cd	0 ppm	0	7
Ba	314 ppm	83	283
Sb	0 ppm	0	20
Co	42.89 ppm	105	312
Ni	78.8 ppm	22	-6
Cu	46.8 ppm	6	11
Zn	47.7 ppm	8	12
As	4.21 ppm	9	11
Se	0 ppm	0	9
Hg	[2.3] ppm	1	8
Tl	[0.1] ppm	0	11
Pb	31.7 ppm	7	19
SiO5	93.756 % Diff		

tp5s

Ca	2130 ppm	89	36
V	169.0 ppm	28	152
Cr	84.5 ppm	28	74
Mn	950.7 ppm	376	62
Fe	46110 ppm	22788	2257
Ti	4799 ppm	537	155
Ag	0 ppm	0	3
Cd	[0.4] ppm	0	5
Ba	222 ppm	61	194
Sb	[1.9] ppm	1	15
Co	37.49 ppm	93	292
Ni	66.3 ppm	19	-5
Cu	30.4 ppm	4	12
Zn	62.1 ppm	11	12
As	3.48 ppm	8	11
Se	0 ppm	0	9
Hg	2.3 ppm	1	8

Tl	0 ppm	0	11
Pb	21.5 ppm	5	19
SiO5	94.531 % Diff		

tp5d

Ca	2140 ppm	90	36
V	229 ppm	38	158
Cr	126.7 ppm	42	93
Mn	1055.5 ppm	401	75
Fe	67049 ppm	31441	2998
Ti	4493 ppm	503	176
Ag	0 ppm	0	3
Cd	0 ppm	0	7
Ba	288 ppm	70	240
Sb	[2.6] ppm	1	17
Co	50.16 ppm	121	418
Ni	99.4 ppm	25	-10
Cu	60.3 ppm	7	12
Zn	55.5 ppm	9	11
As	3.18 ppm	7	9
Se	[0.16] ppm	0	8
Hg	0 ppm	0	9
Tl	0 ppm	0	11
Pb	[5.6] ppm	1	21
SiO5	92.434 % Diff		

tp6s

Ca	3243 ppm	135	35
V	98.2 ppm	16	116
Cr	54.7 ppm	18	56
Mn	764.6 ppm	312	49
Fe	29587 ppm	15303	1625
Ti	3628 ppm	404	111
Ag	[0.7] ppm	0	4
Cd	[0.2] ppm	0	7
Ba	256 ppm	79	270
Sb	[2.1] ppm	1	20
Co	27.69 ppm	71	214
Ni	48.4 ppm	16	-2
Cu	35.1 ppm	5	12
Zn	70.5 ppm	14	14
As	6.88 ppm	19	13
Se	[0.28] ppm	0	10
Hg	[1.9] ppm	1	9
Tl	0 ppm	0	15
Pb	58.7 ppm	17	22
SiO5	96.212 % Diff		

tp6d

Ca	2826 ppm	118	38
V	145.2 ppm	24	138
Cr	112.3 ppm	37	65
Mn	1099.3 ppm	440	51
Fe	38520 ppm	19363	1959
Ti	4491 ppm	501	139
Ag	0 ppm	0	4
Cd	0 ppm	0	7
Ba	308 ppm	89	264
Sb	[1.2] ppm	0	19
Co	34.97 ppm	87	282
Ni	63.5 ppm	19	-5
Cu	26.0 ppm	4	11
Zn	56.2 ppm	11	12
As	3.84 ppm	10	10
Se	[0.11] ppm	0	9
Hg	0 ppm	0	9
Tl	0 ppm	0	12
Pb	25.2 ppm	7	17
SiO5	95.229 % Diff		

2710

Ca	10977 ppm	442	89
V	52.4 ppm	8	109
Cr	76.8 ppm	24	52
Mn	9692 ppm	3608	224
Fe	31864 ppm	14944	2126
Ti	2606 ppm	270	106
Ag	46.9 ppm	10	5

Cd	21.0 ppm	10	8
Ba	645 ppm	149	258
Sb	46.6 ppm	14	19
Co	24.26 ppm	56	162
Ni	51.9 ppm	15	-2
Cu	2479 ppm	338	70
Zn	5656 ppm	1023	241
As	535.3 ppm	1170	274
Se	10.05 ppm	13	24
Hg	23.6 ppm	7	21
Tl	0 ppm	0	298
Pb	4752 ppm	1070	459
SiO5	93.044 % Diff		

Chain of Custody Record

664168

eurofins | Environment Testing America

Address: _____

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

TAL-8210

Client Contact	Project Manager: Robert Smagala Jr	Site Contact: Robert Smagala	Date:	COC No: 1
Company Name: Verdantas LLC	Tel/Email: RSmagala@verdantas.com	Lab Contact: Omayra Perez	Carrier:	1 of 2 COCs
Address: 5400 Limestone Rd	Analysis Turnaround Time			Sampler: Omayra Perez (MEC)
City/State/Zip: Wilmington DE 19808	☒ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
Phone: 302 239 6634	TAT if different from Below _____			Walk-in Client:
Fax:	☒ 2 weeks			Lab Sampling:
Project Name: Rodney Reservoir	☐ 1 week			
Site: Rodney Reservoir	☐ 2 days			Job / SDG No.:
PO# 16530	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	DNREC Screen VOCs	DNREC Screening SVOCs	DNREC Screening Pesticides	DNREC Screening PCBs	DNREC Screening Metals	DNREC Screening CN	DNREC Screening Moisture	Sample Specific Notes:
TP-1S	6/13/23	1100	G	S	3	N		X	X	X	X	X	X	X	
TP-1D		1115						X	X	X	X	X	X	X	
TP-2S		~~1010~~ 1010						X	X	X	X	X	X	X	
TP-2D		1025						X	X	X	X	X	X	X	
TP-3S		0935						X	X	X	X	X	X	X	
TP-3D		0945						X	X	X	X	X	X	X	
TP-4S		0900						X	X	X	X	X	X	X	
TP-4D		0915						X	X	X	X	X	X	X	
TP-5S		0820						X	X	X	X	X	X	X	
TP-5D		0840						X	X	X	X	X	X	X	
TP-6S		1140						X	X	X	X	X	X	X	
TP-6D	↓	1150	↓	↓	↓	↓		X	X	X	X	X	X	X	

Preservation Used: 1= Ice, 2= HCl; 3= H_2SO_4; 4=HNO_3; 5=NaOH; 6= Other NaOH

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ | Therm ID No.:_____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
[signature]	Verdantas	6/13/23 1445	[signature]	DNREC-DS	6/13/23 1445
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

Chain of Custody Record

664169 eurofins | Environment Testing America

Address: _____

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other: TAL-8210

Client Contact	Project Manager: Robert Smagala Jr	Site Contact: Robert Smagala	Date:	COC No: 2
Company Name: Verdantas LLC	Tel/Email: rsmagala@verdantas.com	Lab Contact: Amanda Penny	Carrier:	2 of 2 COCs
Address: 5400 Limestone Rd	Analysis Turnaround Time			Sampler: Emmanuel Tenpet (MEF)
City/State/Zip: Wilmington DE 19808	☑ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
Phone: 302 735 6634	TAT if different from Below _____			Walk-in Client:
Fax: ___	☑ 2 weeks			Lab Sampling:
Project Name: Rodney Reservoir	☐ 1 week			
Site: Rodney Reservoir	☐ 2 days			Job / SDG No.:
PO # 16530	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y/N)	Perform MS / MSD (Y/N)	Direct Screening VOCs	Direct Screening SVOCs	Direct Screening Pesticides	Direct Screening PCBs	Direct Screening Metals	Direct Screening CN	Moisture	Sample Specific Notes:
TP-DUP	6/13/23	0800	G	S	3			X	X	X	X	X	X	X	
TP-2S-MS/MSD		1010		S	6			X	X	X	X	X	X	X	
EB-1		0800		S/AQ	4			X	X	X	X	X	X		
EB-2		1200		S/AQ	4			X	X	X	X	X	X		
FB		1215		S/AQ	4			X	X	X	X	X	X		
TB	6/13/23	1215	-	AQ	1			X							
Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other MeOH								6	1	1	1	4	1		

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.

☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)

☐ Return to Client ☐ Disposal by Lab ☐ Archive for _____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd: _____ Corr'd: _____ | Therm ID No.: _____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Emmanuel Tenpet	Verdantas	6/13/23 1445		DHEC-BS	6/13/23 1445
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

ATTACHMENT B

EUROFINS LABORATORY REPORT (ATTACHMENT SENT SEPARATELY)

ATTACHMENT C

PROUCL INPUTS AND OUTPUTS

SHALLOW SOIL PRO-UCL INPUT/OUTPUT

Project Number 16530
Verdantas LLC

	A	B	C	D	E	F	G	H	I	J	K	L
1	Cobalt	D_Cobalt	Aluminum	D_Aluminun	Thallium	D_Thallium	Vanadium	D_Vanadiur	Mercury	D_Mercury	Benzo(a)pyr	D_Benzo(a)
2	24.3	1	42600	1	0.16	1	111	1	2.6	1	0.058	1
3	34.6	1	33300	1	0.18	1	104	1	0.084	1	0.018	1
4	59.5	1	63300	1	0.14	1	163	1	0.094	1	3.1	1
5	94.5	1	44900	1	0.19	1	137	1	0.084	1	0.026	1
6	34.4	1	51600	1	0.13	1	163	1	0.14	1	0.07	1
7	20.3	1	32100	1	0.17	1	81.6	1	0.08	1	0.11	1
8	41.4	1	53600	1	0.14	1	126	1	0.08	1	0.19	1
9	23.3	1	29400	1	0.14	1	79.5	1	0.057	1	0.011	0
10	23.3	1	29200	1	0.16	1	86.7	1	0.12	1	0.026	1
11	59.8	1	38400	1	0.18	1	115	1	0.098	1	0.4	1
12	28.8	1										
13	27	1										
14	23.4	1										
15	38.4	1										
16	19.3	1										
17	26.6	1										
18	53.3	1										
19	27.2	1										
20	18.5	1										
21	24.1	1										
22	39.5	1										
23	32.3	1										
24	31.6	1										
25	9	1										
26	0.18	0										
27												

	M	N	O	P	Q	R	S	T	U	V	W
1	Benz(a)anth	D_Benz(a)a	Benzo(b)fluo	D_Benzo(b)	Dibenz(a,h)a	D_Dibenz(a	Indeno(1,2,3	D_Indendo(1,2,3-cd)pyrene			
2	0.061	1	0.077	1	0.016	0	0.042	1			
3	0.03	0	0.033	1	0.017	0	0.019	1			
4	3	1	3.8	1	0.5	1	2.3	1			
5	0.04	1	0.04	1	0.018	0	0.02	1			
6	0.072	1	0.062	1	0.018	0	0.041	1			
7	0.12	1	0.15	1	0.017	1	0.1	1			
8	0.19	1	0.24	1	0.023	1	0.1	1			
9	0.014	1	0.012	1	0.017	0	0.016	0			
10	0.031	1	0.034	1	0.016	0	0.016	1			
11	0.6	1	0.57	1	0.047	1	0.19	1			
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 7/19/2023 2:18:55 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	25	Number of Distinct Observations	24
Number of Detects	24	Number of Non-Detects	1
Number of Distinct Detects	23	Number of Distinct Non-Detects	1
Minimum Detect	9	Minimum Non-Detect	0.18
Maximum Detect	94.5	Maximum Non-Detect	0.18
Variance Detects	323.5	Percent Non-Detects	4%
Mean Detects	33.93	SD Detects	17.99
Median Detects	28	CV Detects	0.53
Skewness Detects	1.896	Kurtosis Detects	4.69
Mean of Logged Detects	3.413	SD of Logged Detects	0.477

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.827	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.884	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.205	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level

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

KM Mean	32.58	KM Standard Error of Mean	3.775
90KM SD	18.48	95% KM (BCA) UCL	38.95
95% KM (t) UCL	39.04	95% KM (Percentile Bootstrap) UCL	38.82
95% KM (z) UCL	38.79	95% KM Bootstrap t UCL	40.75
90% KM Chebyshev UCL	43.91	95% KM Chebyshev UCL	49.04
97.5% KM Chebyshev UCL	56.16	99% KM Chebyshev UCL	70.14

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.62	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.13	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.178	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.641	k star (bias corrected MLE)	4.089
Theta hat (MLE)	7.311	Theta star (bias corrected MLE)	8.299
nu hat (MLE)	222.8	nu star (bias corrected)	196.3
Mean (detects)	33.93		

51												
52	**Gamma ROS Statistics using Imputed Non-Detects**											
53	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
54	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
55	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
56	This is especially true when the sample size is small.											
57	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
58				Minimum	3.098				Mean	32.7		
59				Maximum	94.5				Median	27.2		
60				SD	18.66				CV	0.571		
61				k hat (MLE)	3.172				k star (bias corrected MLE)	2.818		
62				Theta hat (MLE)	10.31				Theta star (bias corrected MLE)	11.6		
63				nu hat (MLE)	158.6				nu star (bias corrected)	140.9		
64				Adjusted Level of Significance (β)	0.0395							
65				Approximate Chi Square Value (140.90, α)	114.5				Adjusted Chi Square Value (140.90, β)	112.9		
66				95% Gamma Approximate UCL	40.25				95% Gamma Adjusted UCL	40.83		
67												
68	**Estimates of Gamma Parameters using KM Estimates**											
69				Mean (KM)	32.58				SD (KM)	18.48		
70				Variance (KM)	341.4				SE of Mean (KM)	3.775		
71				k hat (KM)	3.11				k star (KM)	2.763		
72				nu hat (KM)	155.5				nu star (KM)	138.2		
73				theta hat (KM)	10.48				theta star (KM)	11.79		
74				80% gamma percentile (KM)	46.93				90% gamma percentile (KM)	58.86		
75				95% gamma percentile (KM)	70.03				99% gamma percentile (KM)	94.36		
76												
77	**Gamma Kaplan-Meier (KM) Statistics**											
78				Approximate Chi Square Value (138.16, α)	112				Adjusted Chi Square Value (138.16, β)	110.4		
79				95% KM Approximate Gamma UCL	40.19				95% KM Adjusted Gamma UCL	40.78		
80												
81	**Lognormal GOF Test on Detected Observations Only**											
82				Shapiro Wilk Test Statistic	0.959				**Shapiro Wilk GOF Test**			
83				10% Shapiro Wilk Critical Value	0.93				Detected Data appear Lognormal at 10% Significance Level			
84				Lilliefors Test Statistic	0.123				**Lilliefors GOF Test**			
85				10% Lilliefors Critical Value	0.162				Detected Data appear Lognormal at 10% Significance Level			
86	**Detected Data appear Lognormal at 10% Significance Level**											
87												
88	**Lognormal ROS Statistics Using Imputed Non-Detects**											
89				Mean in Original Scale	32.96				Mean in Log Scale	3.367		
90				SD in Original Scale	18.27				SD in Log Scale	0.521		
91				95% t UCL (assumes normality of ROS data)	39.21				95% Percentile Bootstrap UCL	39.04		
92				95% BCA Bootstrap UCL	39.98				95% Bootstrap t UCL	41.46		
93				95% H-UCL (Log ROS)	40.95							
94												
95	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
96				KM Mean (logged)	3.208				KM Geo Mean	24.72		
97				KM SD (logged)	1.104				95% Critical H Value (KM-Log)	2.63		
98				KM Standard Error of Mean (logged)	0.226				95% H-UCL (KM -Log)	82.24		
99				KM SD (logged)	1.104				95% Critical H Value (KM-Log)	2.63		
100				KM Standard Error of Mean (logged)	0.226							

101												
102	**DL/2 Statistics**											
103	**DL/2 Normal**						**DL/2 Log-Transformed**					
104					Mean in Original Scale	32.58				Mean in Log Scale	3.18	
105					SD in Original Scale	18.86				SD in Log Scale	1.254	
106					95% t UCL (Assumes normality)	39.03				95% H-Stat UCL	109.1	
107	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
108												
109	**Nonparametric Distribution Free UCL Statistics**											
110	**Detected Data appear Approximate Normal Distributed at 1% Significance Level**											
111												
112	**Suggested UCL to Use**											
113					95% KM (t) UCL	39.04						
114												
115	When a data set follows an approximate distribution passing only one of the GOF tests,											
116	it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL											
117												
118	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
119	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
120	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
121												
122												
123	**Aluminum**											
124												
125	**General Statistics**											
126					Total Number of Observations	10				Number of Distinct Observations	10	
127										Number of Missing Observations	0	
128					Minimum	29200				Mean	41840	
129					Maximum	63300				Median	40500	
130					SD	11538				Std. Error of Mean	3649	
131					Coefficient of Variation	0.276				Skewness	0.627	
132												
133	**Normal GOF Test**											
134					Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk GOF Test**					
135					1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level					
136					Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**					
137					1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level					
138	**Data appear Normal at 1% Significance Level**											
139												
140	**Assuming Normal Distribution**											
141	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
142					95% Student's-t UCL	48529				95% Adjusted-CLT UCL (Chen-1995)	48615	
143										95% Modified-t UCL (Johnson-1978)	48649	
144												
145	**Gamma GOF Test**											
146					A-D Test Statistic	0.3	**Anderson-Darling Gamma GOF Test**					
147					5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level					
148					K-S Test Statistic	0.18	**Kolmogorov-Smirnov Gamma GOF Test**					
149					5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level					
150	**Detected data appear Gamma Distributed at 5% Significance Level**											

151												
152	**Gamma Statistics**											
153					k hat (MLE)	15.24			k star (bias corrected MLE)	10.74		
154					Theta hat (MLE)	2745			Theta star (bias corrected MLE)	3897		
155					nu hat (MLE)	304.8			nu star (bias corrected)	214.7		
156					MLE Mean (bias corrected)	41840			MLE Sd (bias corrected)	12770		
157									Approximate Chi Square Value (0.05)	181.8		
158					Adjusted Level of Significance	0.0267			Adjusted Chi Square Value	176.5		
159												
160	**Assuming Gamma Distribution**											
161					95% Approximate Gamma UCL	49414			95% Adjusted Gamma UCL	50888		
162												
163	**Lognormal GOF Test**											
164					Shapiro Wilk Test Statistic	0.939			**Shapiro Wilk Lognormal GOF Test**			
165					10% Shapiro Wilk Critical Value	0.869			Data appear Lognormal at 10% Significance Level			
166					Lilliefors Test Statistic	0.165			**Lilliefors Lognormal GOF Test**			
167					10% Lilliefors Critical Value	0.241			Data appear Lognormal at 10% Significance Level			
168	**Data appear Lognormal at 10% Significance Level**											
169												
170	**Lognormal Statistics**											
171					Minimum of Logged Data	10.28			Mean of logged Data	10.61		
172					Maximum of Logged Data	11.06			SD of logged Data	0.27		
173												
174	**Assuming Lognormal Distribution**											
175					95% H-UCL	49999			90% Chebyshev (MVUE) UCL	52578		
176					95% Chebyshev (MVUE) UCL	57453			97.5% Chebyshev (MVUE) UCL	64218		
177					99% Chebyshev (MVUE) UCL	77507						
178												
179	**Nonparametric Distribution Free UCL Statistics**											
180	**Data appear to follow a Discernible Distribution**											
181												
182	**Nonparametric Distribution Free UCLs**											
183					95% CLT UCL	47842			95% BCA Bootstrap UCL	47600		
184					95% Standard Bootstrap UCL	47419			95% Bootstrap-t UCL	49705		
185					95% Hall's Bootstrap UCL	48404			95% Percentile Bootstrap UCL	47420		
186					90% Chebyshev(Mean, Sd) UCL	52786			95% Chebyshev(Mean, Sd) UCL	57744		
187					97.5% Chebyshev(Mean, Sd) UCL	64626			99% Chebyshev(Mean, Sd) UCL	78144		
188												
189	**Suggested UCL to Use**											
190					95% Student's-t UCL	48529						
191												
192	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
193	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
194	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
195												
196												
197	**Thallium**											
198												
199	**General Statistics**											
200					Total Number of Observations	10			Number of Distinct Observations	6		

201											Number of Missing Observations	0
202					Minimum	0.13					Mean	0.159
203					Maximum	0.19					Median	0.16
204					SD	0.0208					Std. Error of Mean	0.00657
205					Coefficient of Variation	0.131					Skewness	0.0723
206												
207	**Normal GOF Test**											
208					Shapiro Wilk Test Statistic	0.92	**Shapiro Wilk GOF Test**					
209					1% Shapiro Wilk Critical Value	0.781	Data appear Normal at 1% Significance Level					
210					Lilliefors Test Statistic	0.22	**Lilliefors GOF Test**					
211					1% Lilliefors Critical Value	0.304	Data appear Normal at 1% Significance Level					
212	**Data appear Normal at 1% Significance Level**											
213												
214	**Assuming Normal Distribution**											
215	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
216					95% Student's-t UCL	0.171					95% Adjusted-CLT UCL (Chen-1995)	0.17
217											95% Modified-t UCL (Johnson-1978)	0.171
218												
219	**Gamma GOF Test**											
220					A-D Test Statistic	0.452	**Anderson-Darling Gamma GOF Test**					
221					5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level					
222					K-S Test Statistic	0.232	**Kolmogorov-Smirnov Gamma GOF Test**					
223					5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level					
224	**Detected data appear Gamma Distributed at 5% Significance Level**											
225												
226	**Gamma Statistics**											
227					k hat (MLE)	64.69					k star (bias corrected MLE)	45.35
228					Theta hat (MLE)	0.00246					Theta star (bias corrected MLE)	0.00351
229					nu hat (MLE)	1294					nu star (bias corrected)	906.9
230					MLE Mean (bias corrected)	0.159					MLE Sd (bias corrected)	0.0236
231											Approximate Chi Square Value (0.05)	838
232					Adjusted Level of Significance	0.0267					Adjusted Chi Square Value	826.5
233												
234	**Assuming Gamma Distribution**											
235					95% Approximate Gamma UCL	0.172					95% Adjusted Gamma UCL	0.174
236												
237	**Lognormal GOF Test**											
238					Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk Lognormal GOF Test**					
239					10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level					
240					Lilliefors Test Statistic	0.218	**Lilliefors Lognormal GOF Test**					
241					10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level					
242	**Data appear Lognormal at 10% Significance Level**											
243												
244	**Lognormal Statistics**											
245					Minimum of Logged Data	-2.04					Mean of logged Data	-1.847
246					Maximum of Logged Data	-1.661					SD of logged Data	0.131
247												
248	**Assuming Lognormal Distribution**											
249					95% H-UCL	0.172					90% Chebyshev (MVUE) UCL	0.179
250					95% Chebyshev (MVUE) UCL	0.188					97.5% Chebyshev (MVUE) UCL	0.2

251				99% Chebyshev (MVUE) UCL		0.225						
252												
253	**Nonparametric Distribution Free UCL Statistics**											
254	**Data appear to follow a Discernible Distribution**											
255												
256	**Nonparametric Distribution Free UCLs**											
257				95% CLT UCL		0.17			95% BCA Bootstrap UCL			0.169
258				95% Standard Bootstrap UCL		0.169			95% Bootstrap-t UCL			0.172
259				95% Hall's Bootstrap UCL		0.169			95% Percentile Bootstrap UCL			0.169
260				90% Chebyshev(Mean, Sd) UCL		0.179			95% Chebyshev(Mean, Sd) UCL			0.188
261				97.5% Chebyshev(Mean, Sd) UCL		0.2			99% Chebyshev(Mean, Sd) UCL			0.224
262												
263	**Suggested UCL to Use**											
264				95% Student's-t UCL		0.171						
265												
266	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
267	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
268	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
269												
270												
271	**Vanadium**											
272												
273	**General Statistics**											
274				Total Number of Observations		10			Number of Distinct Observations			9
275									Number of Missing Observations			0
276				Minimum		79.5			Mean			116.7
277				Maximum		163			Median			113
278				SD		30.73			Std. Error of Mean			9.717
279				Coefficient of Variation		0.263			Skewness			0.403
280												
281	**Normal GOF Test**											
282				Shapiro Wilk Test Statistic		0.918			**Shapiro Wilk GOF Test**			
283				1% Shapiro Wilk Critical Value		0.781			Data appear Normal at 1% Significance Level			
284				Lilliefors Test Statistic		0.135			**Lilliefors GOF Test**			
285				1% Lilliefors Critical Value		0.304			Data appear Normal at 1% Significance Level			
286	**Data appear Normal at 1% Significance Level**											
287												
288	**Assuming Normal Distribution**											
289	**95% Normal UCL**								**95% UCLs (Adjusted for Skewness)**			
290				95% Student's-t UCL		134.5			95% Adjusted-CLT UCL (Chen-1995)			134
291									95% Modified-t UCL (Johnson-1978)			134.7
292												
293	**Gamma GOF Test**											
294				A-D Test Statistic		0.293			**Anderson-Darling Gamma GOF Test**			
295				5% A-D Critical Value		0.725			Detected data appear Gamma Distributed at 5% Significance Level			
296				K-S Test Statistic		0.154			**Kolmogorov-Smirnov Gamma GOF Test**			
297				5% K-S Critical Value		0.266			Detected data appear Gamma Distributed at 5% Significance Level			
298	**Detected data appear Gamma Distributed at 5% Significance Level**											
299												
300	**Gamma Statistics**											

301					k hat (MLE)	16.21				k star (bias corrected MLE)		11.41
302					Theta hat (MLE)	7.2				Theta star (bias corrected MLE)		10.23
303					nu hat (MLE)	324.1				nu star (bias corrected)		228.2
304					MLE Mean (bias corrected)	116.7				MLE Sd (bias corrected)		34.54
305										Approximate Chi Square Value (0.05)		194.3
306					Adjusted Level of Significance	0.0267				Adjusted Chi Square Value		188.8
307												
308					**Assuming Gamma Distribution**							
309					95% Approximate Gamma UCL	137.1				95% Adjusted Gamma UCL		141
310												
311					**Lognormal GOF Test**							
312					Shapiro Wilk Test Statistic	0.931				**Shapiro Wilk Lognormal GOF Test**		
313					10% Shapiro Wilk Critical Value	0.869				Data appear Lognormal at 10% Significance Level		
314					Lilliefors Test Statistic	0.143				**Lilliefors Lognormal GOF Test**		
315					10% Lilliefors Critical Value	0.241				Data appear Lognormal at 10% Significance Level		
316					**Data appear Lognormal at 10% Significance Level**							
317												
318					**Lognormal Statistics**							
319					Minimum of Logged Data	4.376				Mean of logged Data		4.728
320					Maximum of Logged Data	5.094				SD of logged Data		0.263
321												
322					**Assuming Lognormal Distribution**							
323					95% H-UCL	138.8				90% Chebyshev (MVUE) UCL		146
324					95% Chebyshev (MVUE) UCL	159.3				97.5% Chebyshev (MVUE) UCL		177.7
325					99% Chebyshev (MVUE) UCL	213.9						
326												
327					**Nonparametric Distribution Free UCL Statistics**							
328					**Data appear to follow a Discernible Distribution**							
329												
330					**Nonparametric Distribution Free UCLs**							
331					95% CLT UCL	132.7				95% BCA Bootstrap UCL		132.1
332					95% Standard Bootstrap UCL	131.5				95% Bootstrap-t UCL		136.4
333					95% Hall's Bootstrap UCL	135.5				95% Percentile Bootstrap UCL		131.6
334					90% Chebyshev(Mean, Sd) UCL	145.8				95% Chebyshev(Mean, Sd) UCL		159
335					97.5% Chebyshev(Mean, Sd) UCL	177.4				99% Chebyshev(Mean, Sd) UCL		213.4
336												
337					**Suggested UCL to Use**							
338					95% Student's-t UCL	134.5						
339												
340					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
341					Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.							
342					However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
343												
344												
345	**Mercury**											
346												
347					**General Statistics**							
348					Total Number of Observations	10				Number of Distinct Observations		8
349										Number of Missing Observations		0
350					Minimum	0.057				Mean		0.344

351					Maximum	2.6					Median	0.089
352					SD	0.793					Std. Error of Mean	0.251
353					Coefficient of Variation	2.308					Skewness	3.157
354												
355	**Normal GOF Test**											
356					Shapiro Wilk Test Statistic	0.392	**Shapiro Wilk GOF Test**					
357					1% Shapiro Wilk Critical Value	0.781	Data Not Normal at 1% Significance Level					
358					Lilliefors Test Statistic	0.501	**Lilliefors GOF Test**					
359					1% Lilliefors Critical Value	0.304	Data Not Normal at 1% Significance Level					
360	**Data Not Normal at 1% Significance Level**											
361												
362	**Assuming Normal Distribution**											
363	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
364					95% Student's-t UCL	0.803	95% Adjusted-CLT UCL (Chen-1995)					1.024
365							95% Modified-t UCL (Johnson-1978)					0.845
366												
367	**Gamma GOF Test**											
368					A-D Test Statistic	2.576	**Anderson-Darling Gamma GOF Test**					
369					5% A-D Critical Value	0.768	Data Not Gamma Distributed at 5% Significance Level					
370					K-S Test Statistic	0.465	**Kolmogorov-Smirnov Gamma GOF Test**					
371					5% K-S Critical Value	0.279	Data Not Gamma Distributed at 5% Significance Level					
372	**Data Not Gamma Distributed at 5% Significance Level**											
373												
374	**Gamma Statistics**											
375					k hat (MLE)	0.615	k star (bias corrected MLE)					0.497
376					Theta hat (MLE)	0.559	Theta star (bias corrected MLE)					0.691
377					nu hat (MLE)	12.3	nu star (bias corrected)					9.945
378					MLE Mean (bias corrected)	0.344	MLE Sd (bias corrected)					0.487
379							Approximate Chi Square Value (0.05)					3.907
380					Adjusted Level of Significance	0.0267	Adjusted Chi Square Value					3.277
381												
382	**Assuming Gamma Distribution**											
383					95% Approximate Gamma UCL	0.875	95% Adjusted Gamma UCL					1.043
384												
385	**Lognormal GOF Test**											
386					Shapiro Wilk Test Statistic	0.578	**Shapiro Wilk Lognormal GOF Test**					
387					10% Shapiro Wilk Critical Value	0.869	Data Not Lognormal at 10% Significance Level					
388					Lilliefors Test Statistic	0.362	**Lilliefors Lognormal GOF Test**					
389					10% Lilliefors Critical Value	0.241	Data Not Lognormal at 10% Significance Level					
390	**Data Not Lognormal at 10% Significance Level**											
391												
392	**Lognormal Statistics**											
393					Minimum of Logged Data	-2.865	Mean of logged Data					-2.069
394					Maximum of Logged Data	0.956	SD of logged Data					1.09
395												
396	**Assuming Lognormal Distribution**											
397					95% H-UCL	0.757	90% Chebyshev (MVUE) UCL					0.44
398					95% Chebyshev (MVUE) UCL	0.544	97.5% Chebyshev (MVUE) UCL					0.688
399					99% Chebyshev (MVUE) UCL	0.971						
400												

401	**Nonparametric Distribution Free UCL Statistics**											
402	**Data do not follow a Discernible Distribution**											
403												
404	**Nonparametric Distribution Free UCLs**											
405					95% CLT UCL	0.756				95% BCA Bootstrap UCL	1.095	
406					95% Standard Bootstrap UCL	0.735				95% Bootstrap-t UCL	12.91	
407					95% Hall's Bootstrap UCL	6.926				95% Percentile Bootstrap UCL	0.844	
408					90% Chebyshev(Mean, Sd) UCL	1.096				95% Chebyshev(Mean, Sd) UCL	1.437	
409					97.5% Chebyshev(Mean, Sd) UCL	1.91				99% Chebyshev(Mean, Sd) UCL	2.839	
410												
411	**Suggested UCL to Use**											
412					95% Student's-t UCL	0.803						
413												
414	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
415	**Please verify the data were collected from random locations.**											
416	**If the data were collected using judgmental or other non-random methods,**											
417	**then contact a statistician to correctly calculate UCLs.**											
418												
419	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
420	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
421	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
422												
423	**Benzo(a)pyrene**											
424												
425	**General Statistics**											
426					Total Number of Observations	10				Number of Distinct Observations	9	
427					Number of Detects	9				Number of Non-Detects	1	
428					Number of Distinct Detects	8				Number of Distinct Non-Detects	1	
429					Minimum Detect	0.018				Minimum Non-Detect	0.011	
430					Maximum Detect	3.1				Maximum Non-Detect	0.011	
431					Variance Detects	1.007				Percent Non-Detects	10%	
432					Mean Detects	0.444				SD Detects	1.003	
433					Median Detects	0.07				CV Detects	2.258	
434					Skewness Detects	2.92				Kurtosis Detects	8.622	
435					Mean of Logged Detects	-2.275				SD of Logged Detects	1.625	
436												
437	**Normal GOF Test on Detects Only**											
438					Shapiro Wilk Test Statistic	0.484				**Shapiro Wilk GOF Test**		
439					1% Shapiro Wilk Critical Value	0.764				Detected Data Not Normal at 1% Significance Level		
440					Lilliefors Test Statistic	0.406				**Lilliefors GOF Test**		
441					1% Lilliefors Critical Value	0.316				Detected Data Not Normal at 1% Significance Level		
442	**Detected Data Not Normal at 1% Significance Level**											
443												
444	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
445					KM Mean	0.401				KM Standard Error of Mean	0.304	
446					90KM SD	0.907				95% KM (BCA) UCL	0.999	
447					95% KM (t) UCL	0.958				95% KM (Percentile Bootstrap) UCL	0.981	
448					95% KM (z) UCL	0.901				95% KM Bootstrap t UCL	6.026	
449					90% KM Chebyshev UCL	1.313				95% KM Chebyshev UCL	1.727	
450					97.5% KM Chebyshev UCL	2.3				99% KM Chebyshev UCL	3.427	

451												
452	**Gamma GOF Tests on Detected Observations Only**											
453					A-D Test Statistic	0.986	**Anderson-Darling GOF Test**					
454					5% A-D Critical Value	0.781	Detected Data Not Gamma Distributed at 5% Significance Level					
455					K-S Test Statistic	0.267	**Kolmogorov-Smirnov GOF**					
456					5% K-S Critical Value	0.296	Detected data appear Gamma Distributed at 5% Significance Level					
457	**Detected data follow Appr. Gamma Distribution at 5% Significance Level**											
458	**Note GOF tests may be unreliable for small sample sizes**											
459												
460	**Gamma Statistics on Detected Data Only**											
461					k hat (MLE)	0.442	k star (bias corrected MLE)	0.369				
462					Theta hat (MLE)	1.004	Theta star (bias corrected MLE)	1.204				
463					nu hat (MLE)	7.963	nu star (bias corrected)	6.642				
464					Mean (detects)	0.444						
465												
466	**Gamma ROS Statistics using Imputed Non-Detects**											
467	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
468	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
469	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
470	This is especially true when the sample size is small.											
471	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
472					Minimum	0.01	Mean	0.401				
473					Maximum	3.1	Median	0.064				
474					SD	0.956	CV	2.385				
475					k hat (MLE)	0.411	k star (bias corrected MLE)	0.354				
476					Theta hat (MLE)	0.975	Theta star (bias corrected MLE)	1.131				
477					nu hat (MLE)	8.221	nu star (bias corrected)	7.088				
478					Adjusted Level of Significance (β)	0.0267						
479					Approximate Chi Square Value (7.09, α)	2.219	Adjusted Chi Square Value (7.09, β)	1.777				
480					95% Gamma Approximate UCL	1.28	95% Gamma Adjusted UCL	1.599				
481												
482	**Estimates of Gamma Parameters using KM Estimates**											
483					Mean (KM)	0.401	SD (KM)	0.907				
484					Variance (KM)	0.822	SE of Mean (KM)	0.304				
485					k hat (KM)	0.195	k star (KM)	0.204				
486					nu hat (KM)	3.91	nu star (KM)	4.07				
487					theta hat (KM)	2.051	theta star (KM)	1.97				
488					80% gamma percentile (KM)	0.533	90% gamma percentile (KM)	1.213				
489					95% gamma percentile (KM)	2.056	99% gamma percentile (KM)	4.372				
490												
491	**Gamma Kaplan-Meier (KM) Statistics**											
492					Approximate Chi Square Value (4.07, α)	0.75	Adjusted Chi Square Value (4.07, β)	0.541				
493					95% KM Approximate Gamma UCL	2.177	95% KM Adjusted Gamma UCL	3.019				
494												
495	**Lognormal GOF Test on Detected Observations Only**											
496					Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk GOF Test**					
497					10% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 10% Significance Level					
498					Lilliefors Test Statistic	0.15	**Lilliefors GOF Test**					
499					10% Lilliefors Critical Value	0.252	Detected Data appear Lognormal at 10% Significance Level					
500	**Detected Data appear Lognormal at 10% Significance Level**											

	A	B	C	D	E	F	G	H	I	J	K	L
501	**Note GOF tests may be unreliable for small sample sizes**											
502												
503	**Lognormal ROS Statistics Using Imputed Non-Detects**											
504					Mean in Original Scale	0.4				Mean in Log Scale		-2.667
505					SD in Original Scale	0.956				SD in Log Scale		1.971
506				95% t UCL (assumes normality of ROS data)		0.954				95% Percentile Bootstrap UCL		0.983
507					95% BCA Bootstrap UCL	1.3				95% Bootstrap t UCL		6.215
508					95% H-UCL (Log ROS)	16.05						
509												
510	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
511					KM Mean (logged)	-2.499				KM Geo Mean		0.0822
512					KM SD (logged)	1.601				95% Critical H Value (KM-Log)		4.441
513					KM Standard Error of Mean (logged)	0.537				95% H-UCL (KM -Log)		3.163
514					KM SD (logged)	1.601				95% Critical H Value (KM-Log)		4.441
515					KM Standard Error of Mean (logged)	0.537						
516												
517	**DL/2 Statistics**											
518	**DL/2 Normal**						**DL/2 Log-Transformed**					
519					Mean in Original Scale	0.4				Mean in Log Scale		-2.568
520					SD in Original Scale	0.956				SD in Log Scale		1.79
521					95% t UCL (Assumes normality)	0.955				95% H-Stat UCL		7.043
522	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
523												
524	**Nonparametric Distribution Free UCL Statistics**											
525	**Detected Data appear Approximate Gamma Distributed at 5% Significance Level**											
526												
527	**Suggested UCL to Use**											
528					95% KM Bootstrap t UCL	6.026				95% Hall's Bootstrap		3.163
529												
530	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
531	**Please verify the data were collected from random locations.**											
532	**If the data were collected using judgmental or other non-random methods,**											
533	**then contact a statistician to correctly calculate UCLs.**											
534												
535	When a data set follows an approximate distribution passing only one of the GOF tests,											
536	it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL											
537												
538	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
539	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
540	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
541												
542	**Benz(a)anthracene**											
543												
544	**General Statistics**											
545					Total Number of Observations	10				Number of Distinct Observations		10
546					Number of Detects	9				Number of Non-Detects		1
547					Number of Distinct Detects	9				Number of Distinct Non-Detects		1
548					Minimum Detect	0.014				Minimum Non-Detect		0.03
549					Maximum Detect	3				Maximum Non-Detect		0.03
550					Variance Detects	0.941				Percent Non-Detects		10%

551					Mean Detects	0.459					SD Detects	0.97
552					Median Detects	0.072					CV Detects	2.115
553					Skewness Detects	2.816					Kurtosis Detects	8.095
554					Mean of Logged Detects	-2.176					SD of Logged Detects	1.64
555												
556					**Normal GOF Test on Detects Only**							
557					Shapiro Wilk Test Statistic	0.52			**Shapiro Wilk GOF Test**			
558					1% Shapiro Wilk Critical Value	0.764			Detected Data Not Normal at 1% Significance Level			
559					Lilliefors Test Statistic	0.387			**Lilliefors GOF Test**			
560					1% Lilliefors Critical Value	0.316			Detected Data Not Normal at 1% Significance Level			
561					**Detected Data Not Normal at 1% Significance Level**							
562												
563					**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**							
564					KM Mean	0.414			KM Standard Error of Mean			0.294
565					90KM SD	0.878			95% KM (BCA) UCL			0.984
566					95% KM (t) UCL	0.954			95% KM (Percentile Bootstrap) UCL			0.956
567					95% KM (z) UCL	0.899			95% KM Bootstrap t UCL			6.016
568					90% KM Chebyshev UCL	1.298			95% KM Chebyshev UCL			1.698
569					97.5% KM Chebyshev UCL	2.253			99% KM Chebyshev UCL			3.344
570												
571					**Gamma GOF Tests on Detected Observations Only**							
572					A-D Test Statistic	0.86			**Anderson-Darling GOF Test**			
573					5% A-D Critical Value	0.778			Detected Data Not Gamma Distributed at 5% Significance Level			
574					K-S Test Statistic	0.281			**Kolmogorov-Smirnov GOF**			
575					5% K-S Critical Value	0.296			Detected data appear Gamma Distributed at 5% Significance Level			
576					**Detected data follow Appr. Gamma Distribution at 5% Significance Level**							
577					**Note GOF tests may be unreliable for small sample sizes**							
578												
579					**Gamma Statistics on Detected Data Only**							
580					k hat (MLE)	0.461			k star (bias corrected MLE)			0.381
581					Theta hat (MLE)	0.996			Theta star (bias corrected MLE)			1.203
582					nu hat (MLE)	8.293			nu star (bias corrected)			6.862
583					Mean (detects)	0.459						
584												
585					**Gamma ROS Statistics using Imputed Non-Detects**							
586					GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs							
587					GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)							
588					For such situations, GROS method may yield incorrect values of UCLs and BTVs							
589					This is especially true when the sample size is small.							
590					For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates							
591					Minimum	0.01			Mean			0.414
592					Maximum	3			Median			0.0665
593					SD	0.926			CV			2.237
594					k hat (MLE)	0.424			k star (bias corrected MLE)			0.364
595					Theta hat (MLE)	0.975			Theta star (bias corrected MLE)			1.138
596					nu hat (MLE)	8.485			nu star (bias corrected)			7.273
597					Adjusted Level of Significance (β)	0.0267						
598					Approximate Chi Square Value (7.27, α)	2.322			Adjusted Chi Square Value (7.27, β)			1.866
599					95% Gamma Approximate UCL	1.296			95% Gamma Adjusted UCL			1.613
600												

	A	B	C	D	E	F	G	H	I	J	K	L
601	**Estimates of Gamma Parameters using KM Estimates**											
602					Mean (KM)	0.414				SD (KM)		0.878
603					Variance (KM)	0.771				SE of Mean (KM)		0.294
604					k hat (KM)	0.223				k star (KM)		0.222
605					nu hat (KM)	4.452				nu star (KM)		4.45
606					theta hat (KM)	1.861				theta star (KM)		1.862
607					80% gamma percentile (KM)	0.574				90% gamma percentile (KM)		1.251
608					95% gamma percentile (KM)	2.074				99% gamma percentile (KM)		4.301
609												
610	**Gamma Kaplan-Meier (KM) Statistics**											
611					Approximate Chi Square Value (4.45, α)	0.907				Adjusted Chi Square Value (4.45, β)		0.666
612					95% KM Approximate Gamma UCL	2.032				95% KM Adjusted Gamma UCL		2.766
613												
614	**Lognormal GOF Test on Detected Observations Only**											
615					Shapiro Wilk Test Statistic	0.939				**Shapiro Wilk GOF Test**		
616					10% Shapiro Wilk Critical Value	0.859				Detected Data appear Lognormal at 10% Significance Level		
617					Lilliefors Test Statistic	0.165				**Lilliefors GOF Test**		
618					10% Lilliefors Critical Value	0.252				Detected Data appear Lognormal at 10% Significance Level		
619	**Detected Data appear Lognormal at 10% Significance Level**											
620	**Note GOF tests may be unreliable for small sample sizes**											
621												
622	**Lognormal ROS Statistics Using Imputed Non-Detects**											
623					Mean in Original Scale	0.414				Mean in Log Scale		-2.452
624					SD in Original Scale	0.926				SD in Log Scale		1.775
625					95% t UCL (assumes normality of ROS data)	0.95				95% Percentile Bootstrap UCL		0.957
626					95% BCA Bootstrap UCL	1.281				95% Bootstrap t UCL		6.256
627					95% H-UCL (Log ROS)	7.372						
628												
629	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
630					KM Mean (logged)	-2.385				KM Geo Mean		0.0921
631					KM SD (logged)	1.595				95% Critical H Value (KM-Log)		4.429
632					KM Standard Error of Mean (logged)	0.535				95% H-UCL (KM -Log)		3.464
633					KM SD (logged)	1.595				95% Critical H Value (KM-Log)		4.429
634					KM Standard Error of Mean (logged)	0.535						
635												
636	**DL/2 Statistics**											
637	**DL/2 Normal**						**DL/2 Log-Transformed**					
638					Mean in Original Scale	0.414				Mean in Log Scale		-2.378
639					SD in Original Scale	0.925				SD in Log Scale		1.673
640					95% t UCL (Assumes normality)	0.951				95% H-Stat UCL		4.922
641	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
642												
643	**Nonparametric Distribution Free UCL Statistics**											
644	**Detected Data appear Approximate Gamma Distributed at 5% Significance Level**											
645												
646	**Suggested UCL to Use**											
647					95% KM Bootstrap t UCL	6.016				95% Hall's Bootstrap		3.464
648												
649	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
650	**Please verify the data were collected from random locations.**											

651	**If the data were collected using judgmental or other non-random methods,**											
652	**then contact a statistician to correctly calculate UCLs.**											
653												
654	When a data set follows an approximate distribution passing only one of the GOF tests,											
655	it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL											
656												
657	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
658	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
659	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
660												
661												
662	**Benzo(b)fluoranthene**											
663												
664	**General Statistics**											
665	Total Number of Observations			10			Number of Distinct Observations				10	
666							Number of Missing Observations				0	
667	Minimum			0.012			Mean				0.502	
668	Maximum			3.8			Median				0.0695	
669	SD			1.171			Std. Error of Mean				0.37	
670	Coefficient of Variation			2.334			Skewness				3.048	
671												
672	**Normal GOF Test**											
673	Shapiro Wilk Test Statistic			0.47			**Shapiro Wilk GOF Test**					
674	1% Shapiro Wilk Critical Value			0.781			Data Not Normal at 1% Significance Level					
675	Lilliefors Test Statistic			0.388			**Lilliefors GOF Test**					
676	1% Lilliefors Critical Value			0.304			Data Not Normal at 1% Significance Level					
677	**Data Not Normal at 1% Significance Level**											
678												
679	**Assuming Normal Distribution**											
680	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
681	95% Student's-t UCL			1.181			95% Adjusted-CLT UCL (Chen-1995)				1.492	
682							95% Modified-t UCL (Johnson-1978)				1.24	
683												
684	**Gamma GOF Test**											
685	A-D Test Statistic			1.054			**Anderson-Darling Gamma GOF Test**					
686	5% A-D Critical Value			0.791			Data Not Gamma Distributed at 5% Significance Level					
687	K-S Test Statistic			0.258			**Kolmogorov-Smirnov Gamma GOF Test**					
688	5% K-S Critical Value			0.284			Detected data appear Gamma Distributed at 5% Significance Level					
689	**Detected data follow Appr. Gamma Distribution at 5% Significance Level**											
690												
691	**Gamma Statistics**											
692	k hat (MLE)			0.423			k star (bias corrected MLE)				0.362	
693	Theta hat (MLE)			1.187			Theta star (bias corrected MLE)				1.384	
694	nu hat (MLE)			8.452			nu star (bias corrected)				7.25	
695	MLE Mean (bias corrected)			0.502			MLE Sd (bias corrected)				0.833	
696							Approximate Chi Square Value (0.05)				2.309	
697	Adjusted Level of Significance			0.0267			Adjusted Chi Square Value				1.855	
698												
699	**Assuming Gamma Distribution**											
700	95% Approximate Gamma UCL			1.576			95% Adjusted Gamma UCL				1.961	

701												
702	**Lognormal GOF Test**											
703					Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk Lognormal GOF Test**					
704					10% Shapiro Wilk Critical Value	0.869	Data appear Lognormal at 10% Significance Level					
705					Lilliefors Test Statistic	0.178	**Lilliefors Lognormal GOF Test**					
706					10% Lilliefors Critical Value	0.241	Data appear Lognormal at 10% Significance Level					
707	**Data appear Lognormal at 10% Significance Level**											
708												
709	**Lognormal Statistics**											
710					Minimum of Logged Data	-4.423	Mean of logged Data	-2.233				
711					Maximum of Logged Data	1.335	SD of logged Data	1.672				
712												
713	**Assuming Lognormal Distribution**											
714					95% H-UCL	5.669	90% Chebyshev (MVUE) UCL	0.896				
715					95% Chebyshev (MVUE) UCL	1.15	97.5% Chebyshev (MVUE) UCL	1.502				
716					99% Chebyshev (MVUE) UCL	2.193						
717												
718	**Nonparametric Distribution Free UCL Statistics**											
719	**Data appear to follow a Discernible Distribution**											
720												
721	**Nonparametric Distribution Free UCLs**											
722					95% CLT UCL	1.111	95% BCA Bootstrap UCL	1.597				
723					95% Standard Bootstrap UCL	1.069	95% Bootstrap-t UCL	7.188				
724					95% Hall's Bootstrap UCL	3.997	95% Percentile Bootstrap UCL	1.208				
725					90% Chebyshev(Mean, Sd) UCL	1.613	95% Chebyshev(Mean, Sd) UCL	2.116				
726					97.5% Chebyshev(Mean, Sd) UCL	2.814	99% Chebyshev(Mean, Sd) UCL	4.186				
727												
728	**Suggested UCL to Use**											
729					95% Adjusted Gamma UCL	1.961						
730												
731	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
732	**Please verify the data were collected from random locations.**											
733	**If the data were collected using judgmental or other non-random methods,**											
734	**then contact a statistician to correctly calculate UCLs.**											
735												
736	When a data set follows an approximate distribution passing only one of the GOF tests,											
737	it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL											
738												
739	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
740	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
741	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
742												
743	**Dibenz(a,h)anthracene**											
744												
745	**General Statistics**											
746					Total Number of Observations	10	Number of Distinct Observations	6				
747					Number of Detects	4	Number of Non-Detects	6				
748					Number of Distinct Detects	4	Number of Distinct Non-Detects	3				
749					Minimum Detect	0.017	Minimum Non-Detect	0.016				
750					Maximum Detect	0.5	Maximum Non-Detect	0.018				

751					Variance Detects	0.0556					Percent Non-Detects	60%
752					Mean Detects	0.147					SD Detects	0.236
753					Median Detects	0.035					CV Detects	1.607
754					Skewness Detects	1.982					Kurtosis Detects	3.938
755					Mean of Logged Detects	-2.899					SD of Logged Detects	1.531
756												
757	**Normal GOF Test on Detects Only**											
758					Shapiro Wilk Test Statistic	0.676	**Shapiro Wilk GOF Test**					
759					1% Shapiro Wilk Critical Value	0.687	Detected Data Not Normal at 1% Significance Level					
760					Lilliefors Test Statistic	0.414	**Lilliefors GOF Test**					
761					1% Lilliefors Critical Value	0.413	Detected Data Not Normal at 1% Significance Level					
762	**Detected Data Not Normal at 1% Significance Level**											
763												
764	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
765					KM Mean	0.0683					KM Standard Error of Mean	0.0526
766					90KM SD	0.144					95% KM (BCA) UCL	N/A
767					95% KM (t) UCL	0.165					95% KM (Percentile Bootstrap) UCL	N/A
768					95% KM (z) UCL	0.155					95% KM Bootstrap t UCL	N/A
769					90% KM Chebyshev UCL	0.226					95% KM Chebyshev UCL	0.298
770					97.5% KM Chebyshev UCL	0.397					99% KM Chebyshev UCL	0.592
771												
772	**Gamma GOF Tests on Detected Observations Only**											
773					A-D Test Statistic	0.596	**Anderson-Darling GOF Test**					
774					5% A-D Critical Value	0.676	Detected data appear Gamma Distributed at 5% Significance Level					
775					K-S Test Statistic	0.372	**Kolmogorov-Smirnov GOF**					
776					5% K-S Critical Value	0.408	Detected data appear Gamma Distributed at 5% Significance Level					
777	**Detected data appear Gamma Distributed at 5% Significance Level**											
778	**Note GOF tests may be unreliable for small sample sizes**											
779												
780	**Gamma Statistics on Detected Data Only**											
781					k hat (MLE)	0.626					k star (bias corrected MLE)	0.323
782					Theta hat (MLE)	0.234					Theta star (bias corrected MLE)	0.454
783					nu hat (MLE)	5.01					nu star (bias corrected)	2.586
784					Mean (detects)	0.147						
785												
786	**Gamma ROS Statistics using Imputed Non-Detects**											
787	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
788	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
789	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
790	This is especially true when the sample size is small.											
791	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
792					Minimum	0.01					Mean	0.0647
793					Maximum	0.5					Median	0.01
794					SD	0.153					CV	2.371
795					k hat (MLE)	0.531					k star (bias corrected MLE)	0.438
796					Theta hat (MLE)	0.122					Theta star (bias corrected MLE)	0.148
797					nu hat (MLE)	10.62					nu star (bias corrected)	8.769
798					Adjusted Level of Significance (β)	0.0267						
799					Approximate Chi Square Value (8.77, α)	3.188					Adjusted Chi Square Value (8.77, β)	2.632
800					95% Gamma Approximate UCL	0.178					95% Gamma Adjusted UCL	N/A

801											
802	**Estimates of Gamma Parameters using KM Estimates**										
803				Mean (KM)	0.0683			SD (KM)	0.144		
804				Variance (KM)	0.0208			SE of Mean (KM)	0.0526		
805				k hat (KM)	0.225			k star (KM)	0.224		
806				nu hat (KM)	4.493			nu star (KM)	4.479		
807				theta hat (KM)	0.304			theta star (KM)	0.305		
808				80% gamma percentile (KM)	0.095			90% gamma percentile (KM)	0.206		
809				95% gamma percentile (KM)	0.342			99% gamma percentile (KM)	0.707		
810											
811	**Gamma Kaplan-Meier (KM) Statistics**										
812				Approximate Chi Square Value (4.48, α)	0.919			Adjusted Chi Square Value (4.48, β)	0.676		
813				95% KM Approximate Gamma UCL	0.333			95% KM Adjusted Gamma UCL	0.453		
814											
815	**Lognormal GOF Test on Detected Observations Only**										
816				Shapiro Wilk Test Statistic	0.849			**Shapiro Wilk GOF Test**			
817				10% Shapiro Wilk Critical Value	0.792			Detected Data appear Lognormal at 10% Significance Level			
818				Lilliefors Test Statistic	0.291			**Lilliefors GOF Test**			
819				10% Lilliefors Critical Value	0.346			Detected Data appear Lognormal at 10% Significance Level			
820	**Detected Data appear Lognormal at 10% Significance Level**										
821	**Note GOF tests may be unreliable for small sample sizes**										
822											
823	**Lognormal ROS Statistics Using Imputed Non-Detects**										
824				Mean in Original Scale	0.0594			Mean in Log Scale	-5.479		
825				SD in Original Scale	0.156			SD in Log Scale	2.509		
826				95% t UCL (assumes normality of ROS data)	0.15			95% Percentile Bootstrap UCL	0.155		
827				95% BCA Bootstrap UCL	0.207			95% Bootstrap t UCL	1.081		
828				95% H-UCL (Log ROS)	25.15						
829											
830	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**										
831				KM Mean (logged)	-3.638			KM Geo Mean	0.0263		
832				KM SD (logged)	1.033			95% Critical H Value (KM-Log)	3.172		
833				KM Standard Error of Mean (logged)	0.377			95% H-UCL (KM -Log)	0.134		
834				KM SD (logged)	1.033			95% Critical H Value (KM-Log)	3.172		
835				KM Standard Error of Mean (logged)	0.377						
836											
837	**DL/2 Statistics**										
838				**DL/2 Normal**				**DL/2 Log-Transformed**			
839				Mean in Original Scale	0.0638			Mean in Log Scale	-4.021		
840				SD in Original Scale	0.154			SD in Log Scale	1.31		
841				95% t UCL (Assumes normality)	0.153			95% H-Stat UCL	0.219		
842	**DL/2 is not a recommended method, provided for comparisons and historical reasons**										
843											
844	**Nonparametric Distribution Free UCL Statistics**										
845	**Detected Data appear Gamma Distributed at 5% Significance Level**										
846											
847	**Suggested UCL to Use**										
848				95% KM Bootstrap t UCL	N/A			95% Hall's Bootstrap	0.134		
849											
850	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**										

	A	B	C	D	E	F	G	H	I	J	K	L
851	**Please verify the data were collected from random locations.**											
852	**If the data were collected using judgmental or other non-random methods,**											
853	**then contact a statistician to correctly calculate UCLs.**											
854												
855	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
856	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
857	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
858												
859	**Indeno(1,2,3-cd)pyrene**											
860												
861	**General Statistics**											
862						Total Number of Observations	10				Number of Distinct Observations	8	
863						Number of Detects	9				Number of Non-Detects	1	
864						Number of Distinct Detects	8				Number of Distinct Non-Detects	1	
865						Minimum Detect	0.016				Minimum Non-Detect	0.016	
866						Maximum Detect	2.3				Maximum Non-Detect	0.016	
867						Variance Detects	0.558				Percent Non-Detects	10%	
868						Mean Detects	0.314				SD Detects	0.747	
869						Median Detects	0.042				CV Detects	2.377	
870						Skewness Detects	2.967				Kurtosis Detects	8.851	
871						Mean of Logged Detects	-2.645				SD of Logged Detects	1.559	
872													
873	**Normal GOF Test on Detects Only**											
874						Shapiro Wilk Test Statistic	0.453				**Shapiro Wilk GOF Test**		
875						1% Shapiro Wilk Critical Value	0.764				Detected Data Not Normal at 1% Significance Level		
876						Lilliefors Test Statistic	0.455				**Lilliefors GOF Test**		
877						1% Lilliefors Critical Value	0.316				Detected Data Not Normal at 1% Significance Level		
878	**Detected Data Not Normal at 1% Significance Level**											
879													
880	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
881						KM Mean	0.284				KM Standard Error of Mean	0.226	
882						90KM SD	0.674				95% KM (BCA) UCL	0.737	
883						95% KM (t) UCL	0.699				95% KM (Percentile Bootstrap) UCL	0.721	
884						95% KM (z) UCL	0.656				95% KM Bootstrap t UCL	4.905	
885						90% KM Chebyshev UCL	0.963				95% KM Chebyshev UCL	1.27	
886						97.5% KM Chebyshev UCL	1.696				99% KM Chebyshev UCL	2.534	
887													
888	**Gamma GOF Tests on Detected Observations Only**											
889						A-D Test Statistic	1.25				**Anderson-Darling GOF Test**		
890						5% A-D Critical Value	0.782				Detected Data Not Gamma Distributed at 5% Significance Level		
891						K-S Test Statistic	0.32				**Kolmogorov-Smirnov GOF**		
892						5% K-S Critical Value	0.296				Detected Data Not Gamma Distributed at 5% Significance Level		
893	**Detected Data Not Gamma Distributed at 5% Significance Level**											
894													
895	**Gamma Statistics on Detected Data Only**											
896						k hat (MLE)	0.436				k star (bias corrected MLE)	0.365	
897						Theta hat (MLE)	0.72				Theta star (bias corrected MLE)	0.861	
898						nu hat (MLE)	7.852				nu star (bias corrected)	6.568	
899						Mean (detects)	0.314						
900													

901	**Gamma ROS Statistics using Imputed Non-Detects**											
902	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
903	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
904	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
905	This is especially true when the sample size is small.											
906	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
907					Minimum	0.01				Mean	0.284	
908					Maximum	2.3				Median	0.0415	
909					SD	0.711				CV	2.504	
910					k hat (MLE)	0.414				k star (bias corrected MLE)	0.356	
911					Theta hat (MLE)	0.686				Theta star (bias corrected MLE)	0.797	
912					nu hat (MLE)	8.275				nu star (bias corrected)	7.126	
913					Adjusted Level of Significance (β)	0.0267						
914					Approximate Chi Square Value (7.13, α)	2.24				Adjusted Chi Square Value (7.13, β)	1.795	
915					95% Gamma Approximate UCL	0.903				95% Gamma Adjusted UCL	1.127	
916												
917	**Estimates of Gamma Parameters using KM Estimates**											
918					Mean (KM)	0.284				SD (KM)	0.674	
919					Variance (KM)	0.454				SE of Mean (KM)	0.226	
920					k hat (KM)	0.178				k star (KM)	0.191	
921					nu hat (KM)	3.562				nu star (KM)	3.826	
922					theta hat (KM)	1.597				theta star (KM)	1.486	
923					80% gamma percentile (KM)	0.366				90% gamma percentile (KM)	0.86	
924					95% gamma percentile (KM)	1.482				99% gamma percentile (KM)	3.209	
925												
926	**Gamma Kaplan-Meier (KM) Statistics**											
927					Approximate Chi Square Value (3.83, α)	0.654				Adjusted Chi Square Value (3.83, β)	0.466	
928					95% KM Approximate Gamma UCL	1.663				95% KM Adjusted Gamma UCL	2.336	
929												
930	**Lognormal GOF Test on Detected Observations Only**											
931					Shapiro Wilk Test Statistic	0.854				**Shapiro Wilk GOF Test**		
932					10% Shapiro Wilk Critical Value	0.859				Detected Data Not Lognormal at 10% Significance Level		
933					Lilliefors Test Statistic	0.191				**Lilliefors GOF Test**		
934					10% Lilliefors Critical Value	0.252				Detected Data appear Lognormal at 10% Significance Level		
935	**Detected Data appear Approximate Lognormal at 10% Significance Level**											
936	**Note GOF tests may be unreliable for small sample sizes**											
937												
938	**Lognormal ROS Statistics Using Imputed Non-Detects**											
939					Mean in Original Scale	0.283				Mean in Log Scale	-3.01	
940					SD in Original Scale	0.711				SD in Log Scale	1.869	
941					95% t UCL (assumes normality of ROS data)	0.695				95% Percentile Bootstrap UCL	0.724	
942					95% BCA Bootstrap UCL	0.952				95% Bootstrap t UCL	5.14	
943					95% H-UCL (Log ROS)	6.69						
944												
945	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
946					KM Mean (logged)	-2.794				KM Geo Mean	0.0612	
947					KM SD (logged)	1.464				95% Critical H Value (KM-Log)	4.124	
948					KM Standard Error of Mean (logged)	0.491				95% H-UCL (KM -Log)	1.337	
949					KM SD (logged)	1.464				95% Critical H Value (KM-Log)	4.124	
950					KM Standard Error of Mean (logged)	0.491						

	A	B	C	D	E	F	G	H	I	J	K	L
951												
952	**DL/2 Statistics**											
953	**DL/2 Normal**						**DL/2 Log-Transformed**					
954	Mean in Original Scale					0.284	Mean in Log Scale					-2.864
955	SD in Original Scale					0.711	SD in Log Scale					1.624
956	95% t UCL (Assumes normality)					0.696	95% H-Stat UCL					2.43
957	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
958												
959	**Nonparametric Distribution Free UCL Statistics**											
960	**Detected Data appear Approximate Lognormal Distributed at 10% Significance Level**											
961												
962	**Suggested UCL to Use**											
963	KM (t) UCL					0.699						
964												
965	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
966	**Please verify the data were collected from random locations.**											
967	**If the data were collected using judgmental or other non-random methods,**											
968	**then contact a statistician to correctly calculate UCLs.**											
969												
970	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
971	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
972	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
973												

COMBINED SOIL PRO-UCL INPUT/OUTPUT

Project Number 16530
Verdantas LLC

	A	B	C	D	E	F	G	H	I	J	K	L
1	Cobalt	D_Cobalt	Chromium	D_Chromiur	Aluminum	D_Aluminur	Thallium	D_Thallium	Vanadium	D_Vanadiur	Mercury	D_Mercury
2	24.3	1	130	1	42600	1	0.16	1	111	1	2.6	1
3	34.6	1	161	1	33300	1	0.18	1	104	1	0.084	1
4	59.5	1	76	1	63300	1	0.14	1	163	1	0.094	1
5	94.5	1	177	1	44900	1	0.19	1	137	1	0.084	1
6	34.4	1	60.5	1	51600	1	0.13	1	163	1	0.14	1
7	20.3	1	88.6	1	32100	1	0.17	1	81.6	1	0.08	1
8	12.2	1	53.6	1	20700	1	0.14	1	45.7	1	0.023	1
9	45.2	1	303	1	56000	1	0.17	1	149	1	0.062	1
10	51.05	1	384.5	1	57050	1	0.15	1	162	1	0.056	1
11	32.7	1	175	1	40900	1	0.17	1	119	1	0.065	1
12	21.9	1	163	1	37300	1	0.16	1	167	1	0.12	1
13	12.3	1	63.1	1	22400	1	0.2	1	64	1	0.074	1
14	41.4	1	82.5	1	53600	1	0.14	1	126	1	0.08	1
15	23.3	1	92.9	1	29400	1	0.14	1	79.5	1	0.057	1
16	23.3	1	108	1	29200	1	0.16	1	86.7	1	0.12	1
17	59.8	1	120	1	38400	1	0.18	1	115	1	0.098	1
18	28.8	1										
19	27	1										
20	23.4	1										
21	38.4	1										
22	19.3	1										
23	26.6	1										
24	53.3	1										
25	27.2	1										
26	18.5	1										
27	24.1	1										
28	39.5	1										
29	32.3	1										
30	31.6	1										
31	9	1										
32	0.18	0										

	M	N	O	P	Q	R	S	T	U	V	W	X
1	Benzo(a)pyr	D_Benzo(a)	Benz(a)anth	D_Benz(a)a	Benzo(b)flu	D_Benzo(b)	Dibenz(a,h)	D_Dibenz(a	Indeno(1,2,3	D_Indeno(1,2,3-cd)pyrene		
2	0.058	1	0.061	1	0.077	1	0.016	0	0.042	1		
3	0.018	1	0.03	0	0.033	1	0.017	0	0.019	1		
4	3.1	1	3	1	3.8	1	0.5	1	2.3	1		
5	0.026	1	0.04	1	0.04	1	0.018	0	0.02	1		
6	0.07	1	0.072	1	0.062	1	0.018	0	0.041	1		
7	0.11	1	0.12	1	0.15	1	0.017	1	0.1	1		
8	0.0099	0	0.028	0	0.0096	0	0.038	1	0.067	1		
9	0.031	1	0.038	1	0.041	1	0.018	0	0.035	1		
10	0.04	1	0.045	1	0.052	1	0.016	1	0.03	1		
11	0.059	1	0.059	1	0.081	1	0.017	0	0.044	1		
12	0.021	1	0.029	0	0.03	1	0.017	0	0.016	1		
13	0.15	1	0.13	1	0.2	1	0.016	0	0.1	1		
14	0.19	1	0.19	1	0.24	1	0.023	1	0.1	1		
15	0.011	0	0.014	1	0.012	1	0.017	0	0.016	0		
16	0.026	1	0.031	1	0.034	1	0.016	0	0.016	1		
17	0.4	1	0.6	1	0.57	1	0.047	1	0.19	1		
18												
19												
20												
21												
22												
23												
24												
25												
26												
27												
28												
29												
30												
31												
32												

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 7/19/2023 3:05:50 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	31	Number of Distinct Observations	30
Number of Detects	30	Number of Non-Detects	1
Number of Distinct Detects	29	Number of Distinct Non-Detects	1
Minimum Detect	9	Minimum Non-Detect	0.18
Maximum Detect	94.5	Maximum Non-Detect	0.18
Variance Detects	307.6	Percent Non-Detects	3.226%
Mean Detects	32.99	SD Detects	17.54
Median Detects	28	CV Detects	0.532
Skewness Detects	1.659	Kurtosis Detects	4.055
Mean of Logged Detects	3.375	SD of Logged Detects	0.504

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.875	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.9	Detected Data Not Normal at 1% Significance Level
Lilliefors Test Statistic	0.163	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.185	Detected Data appear Normal at 1% Significance Level

Detected Data appear Approximate Normal at 1% Significance Level

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

KM Mean	31.93	KM Standard Error of Mean	3.275
90KM SD	17.93	95% KM (BCA) UCL	37.49
95% KM (t) UCL	37.49	95% KM (Percentile Bootstrap) UCL	37.4
95% KM (z) UCL	37.32	95% KM Bootstrap t UCL	38.8
90% KM Chebyshev UCL	41.76	95% KM Chebyshev UCL	46.21
97.5% KM Chebyshev UCL	52.39	99% KM Chebyshev UCL	64.52

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.319	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.749	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0972	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.161	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.268	k star (bias corrected MLE)	3.863
Theta hat (MLE)	7.73	Theta star (bias corrected MLE)	8.54
nu hat (MLE)	256.1	nu star (bias corrected)	231.8
Mean (detects)	32.99		

	A	B	C	D	E	F	G	H	I	J	K	L
51												
52	**Gamma ROS Statistics using Imputed Non-Detects**											
53	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
54	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
55	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
56	This is especially true when the sample size is small.											
57	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
58					Minimum	2.829					Mean	32.02
59					Maximum	94.5					Median	27.2
60					SD	18.08					CV	0.565
61					k hat (MLE)	3.149					k star (bias corrected MLE)	2.866
62					Theta hat (MLE)	10.17					Theta star (bias corrected MLE)	11.17
63					nu hat (MLE)	195.3					nu star (bias corrected)	177.7
64					Adjusted Level of Significance (β)	0.0413						
65					Approximate Chi Square Value (177.70, α)	147.9					Adjusted Chi Square Value (177.70, β)	146.4
66					95% Gamma Approximate UCL	38.48					95% Gamma Adjusted UCL	38.88
67												
68	**Estimates of Gamma Parameters using KM Estimates**											
69					Mean (KM)	31.93					SD (KM)	17.93
70					Variance (KM)	321.4					SE of Mean (KM)	3.275
71					k hat (KM)	3.173					k star (KM)	2.887
72					nu hat (KM)	196.7					nu star (KM)	179
73					theta hat (KM)	10.06					theta star (KM)	11.06
74					80% gamma percentile (KM)	45.76					90% gamma percentile (KM)	57.13
75					95% gamma percentile (KM)	67.76					99% gamma percentile (KM)	90.85
76												
77	**Gamma Kaplan-Meier (KM) Statistics**											
78					Approximate Chi Square Value (179.01, α)	149.1					Adjusted Chi Square Value (179.01, β)	147.5
79					95% KM Approximate Gamma UCL	38.35					95% KM Adjusted Gamma UCL	38.74
80												
81	**Lognormal GOF Test on Detected Observations Only**											
82					Shapiro Wilk Test Statistic	0.984			**Shapiro Wilk GOF Test**			
83					10% Shapiro Wilk Critical Value	0.939			Detected Data appear Lognormal at 10% Significance Level			
84					Lilliefors Test Statistic	0.0935			**Lilliefors GOF Test**			
85					10% Lilliefors Critical Value	0.146			Detected Data appear Lognormal at 10% Significance Level			
86	**Detected Data appear Lognormal at 10% Significance Level**											
87												
88	**Lognormal ROS Statistics Using Imputed Non-Detects**											
89					Mean in Original Scale	32.19					Mean in Log Scale	3.334
90					SD in Original Scale	17.81					SD in Log Scale	0.545
91					95% t UCL (assumes normality of ROS data)	37.62					95% Percentile Bootstrap UCL	37.62
92					95% BCA Bootstrap UCL	38.51					95% Bootstrap t UCL	38.93
93					95% H-UCL (Log ROS)	39.56						
94												
95	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
96					KM Mean (logged)	3.21					KM Geo Mean	24.79
97					KM SD (logged)	1.023					95% Critical H Value (KM-Log)	2.45
98					KM Standard Error of Mean (logged)	0.187					95% H-UCL (KM -Log)	66.09
99					KM SD (logged)	1.023					95% Critical H Value (KM-Log)	2.45
100					KM Standard Error of Mean (logged)	0.187						

101												
102	**DL/2 Statistics**											
103	**DL/2 Normal**						**DL/2 Log-Transformed**					
104					Mean in Original Scale	31.93				Mean in Log Scale	3.188	
105					SD in Original Scale	18.23				SD in Log Scale	1.151	
106					95% t UCL (Assumes normality)	37.49				95% H-Stat UCL	81.28	
107	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
108												
109	**Nonparametric Distribution Free UCL Statistics**											
110	**Detected Data appear Approximate Normal Distributed at 1% Significance Level**											
111												
112	**Suggested UCL to Use**											
113					95% KM (t) UCL	37.49						
114												
115	When a data set follows an approximate distribution passing only one of the GOF tests,											
116	it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL											
117												
118	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
119	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
120	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
121												
122												
123	**Chromium**											
124												
125	**General Statistics**											
126					Total Number of Observations	16				Number of Distinct Observations	16	
127										Number of Missing Observations	0	
128					Minimum	53.6				Mean	139.9	
129					Maximum	384.5				Median	114	
130					SD	90.7				Std. Error of Mean	22.68	
131					Coefficient of Variation	0.648				Skewness	1.711	
132												
133	**Normal GOF Test**											
134					Shapiro Wilk Test Statistic	0.811	**Shapiro Wilk GOF Test**					
135					1% Shapiro Wilk Critical Value	0.844	Data Not Normal at 1% Significance Level					
136					Lilliefors Test Statistic	0.216	**Lilliefors GOF Test**					
137					1% Lilliefors Critical Value	0.248	Data appear Normal at 1% Significance Level					
138	**Data appear Approximate Normal at 1% Significance Level**											
139												
140	**Assuming Normal Distribution**											
141	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
142					95% Student's-t UCL	179.7				95% Adjusted-CLT UCL (Chen-1995)	187.6	
143										95% Modified-t UCL (Johnson-1978)	181.3	
144												
145	**Gamma GOF Test**											
146					A-D Test Statistic	0.449	**Anderson-Darling Gamma GOF Test**					
147					5% A-D Critical Value	0.744	Detected data appear Gamma Distributed at 5% Significance Level					
148					K-S Test Statistic	0.141	**Kolmogorov-Smirnov Gamma GOF Test**					
149					5% K-S Critical Value	0.217	Detected data appear Gamma Distributed at 5% Significance Level					
150	**Detected data appear Gamma Distributed at 5% Significance Level**											

151												
152	**Gamma Statistics**											
153						k hat (MLE)	3.295			k star (bias corrected MLE)		2.719
154						Theta hat (MLE)	42.47			Theta star (bias corrected MLE)		51.47
155						nu hat (MLE)	105.4			nu star (bias corrected)		86.99
156						MLE Mean (bias corrected)	139.9			MLE Sd (bias corrected)		84.86
157										Approximate Chi Square Value (0.05)		66.49
158						Adjusted Level of Significance	0.0335			Adjusted Chi Square Value		64.45
159												
160	**Assuming Gamma Distribution**											
161						95% Approximate Gamma UCL	183.1			95% Adjusted Gamma UCL		188.8
162												
163	**Lognormal GOF Test**											
164						Shapiro Wilk Test Statistic	0.955			**Shapiro Wilk Lognormal GOF Test**		
165						10% Shapiro Wilk Critical Value	0.906			Data appear Lognormal at 10% Significance Level		
166						Lilliefors Test Statistic	0.116			**Lilliefors Lognormal GOF Test**		
167						10% Lilliefors Critical Value	0.196			Data appear Lognormal at 10% Significance Level		
168	**Data appear Lognormal at 10% Significance Level**											
169												
170	**Lognormal Statistics**											
171						Minimum of Logged Data	3.982			Mean of logged Data		4.782
172						Maximum of Logged Data	5.952			SD of logged Data		0.562
173												
174	**Assuming Lognormal Distribution**											
175						95% H-UCL	190			90% Chebyshev (MVUE) UCL		198.7
176						95% Chebyshev (MVUE) UCL	226.2			97.5% Chebyshev (MVUE) UCL		264.2
177						99% Chebyshev (MVUE) UCL	339					
178												
179	**Nonparametric Distribution Free UCL Statistics**											
180	**Data appear to follow a Discernible Distribution**											
181												
182	**Nonparametric Distribution Free UCLs**											
183						95% CLT UCL	177.2			95% BCA Bootstrap UCL		189.9
184						95% Standard Bootstrap UCL	176.5			95% Bootstrap-t UCL		208.8
185						95% Hall's Bootstrap UCL	381.9			95% Percentile Bootstrap UCL		178.4
186						90% Chebyshev(Mean, Sd) UCL	207.9			95% Chebyshev(Mean, Sd) UCL		238.8
187						97.5% Chebyshev(Mean, Sd) UCL	281.5			99% Chebyshev(Mean, Sd) UCL		365.5
188												
189	**Suggested UCL to Use**											
190						95% Student's-t UCL	179.7					
191												
192	When a data set follows an approximate distribution passing only one of the GOF tests,											
193	it is suggested to use a UCL based upon a distribution passing both GOF tests in ProUCL											
194												
195	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
196	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
197	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
198												
199												
200	**Aluminum**											

201												
202	**General Statistics**											
203					Total Number of Observations	16				Number of Distinct Observations		16
204										Number of Missing Observations		0
205					Minimum	20700				Mean		40797
206					Maximum	63300				Median		39650
207					SD	12803				Std. Error of Mean		3201
208					Coefficient of Variation	0.314				Skewness		0.15
209												
210	**Normal GOF Test**											
211					Shapiro Wilk Test Statistic	0.966				**Shapiro Wilk GOF Test**		
212					1% Shapiro Wilk Critical Value	0.844				Data appear Normal at 1% Significance Level		
213					Lilliefors Test Statistic	0.113				**Lilliefors GOF Test**		
214					1% Lilliefors Critical Value	0.248				Data appear Normal at 1% Significance Level		
215	**Data appear Normal at 1% Significance Level**											
216												
217	**Assuming Normal Distribution**											
218					**95% Normal UCL**					**95% UCLs (Adjusted for Skewness)**		
219					95% Student's-t UCL	46408				95% Adjusted-CLT UCL (Chen-1995)		46190
220										95% Modified-t UCL (Johnson-1978)		46428
221												
222	**Gamma GOF Test**											
223					A-D Test Statistic	0.212				**Anderson-Darling Gamma GOF Test**		
224					5% A-D Critical Value	0.739				Detected data appear Gamma Distributed at 5% Significance Level		
225					K-S Test Statistic	0.125				**Kolmogorov-Smirnov Gamma GOF Test**		
226					5% K-S Critical Value	0.215				Detected data appear Gamma Distributed at 5% Significance Level		
227	**Detected data appear Gamma Distributed at 5% Significance Level**											
228												
229	**Gamma Statistics**											
230					k hat (MLE)	10.26				k star (bias corrected MLE)		8.38
231					Theta hat (MLE)	3975				Theta star (bias corrected MLE)		4869
232					nu hat (MLE)	328.4				nu star (bias corrected)		268.2
233					MLE Mean (bias corrected)	40797				MLE Sd (bias corrected)		14093
234										Approximate Chi Square Value (0.05)		231.2
235					Adjusted Level of Significance	0.0335				Adjusted Chi Square Value		227.3
236												
237	**Assuming Gamma Distribution**											
238					95% Approximate Gamma UCL	47311				95% Adjusted Gamma UCL		48123
239												
240	**Lognormal GOF Test**											
241					Shapiro Wilk Test Statistic	0.96				**Shapiro Wilk Lognormal GOF Test**		
242					10% Shapiro Wilk Critical Value	0.906				Data appear Lognormal at 10% Significance Level		
243					Lilliefors Test Statistic	0.116				**Lilliefors Lognormal GOF Test**		
244					10% Lilliefors Critical Value	0.196				Data appear Lognormal at 10% Significance Level		
245	**Data appear Lognormal at 10% Significance Level**											
246												
247	**Lognormal Statistics**											
248					Minimum of Logged Data	9.938				Mean of logged Data		10.57
249					Maximum of Logged Data	11.06				SD of logged Data		0.332
250												

251	**Assuming Lognormal Distribution**											
252					95% H-UCL	48281			90% Chebyshev (MVUE) UCL	51222		
253					95% Chebyshev (MVUE) UCL	55905			97.5% Chebyshev (MVUE) UCL	62405		
254					99% Chebyshev (MVUE) UCL	75173						
255												
256	**Nonparametric Distribution Free UCL Statistics**											
257	**Data appear to follow a Discernible Distribution**											
258												
259	**Nonparametric Distribution Free UCLs**											
260					95% CLT UCL	46062			95% BCA Bootstrap UCL	46288		
261					95% Standard Bootstrap UCL	45862			95% Bootstrap-t UCL	46532		
262					95% Hall's Bootstrap UCL	45982			95% Percentile Bootstrap UCL	45856		
263					90% Chebyshev(Mean, Sd) UCL	50399			95% Chebyshev(Mean, Sd) UCL	54749		
264					97.5% Chebyshev(Mean, Sd) UCL	60786			99% Chebyshev(Mean, Sd) UCL	72645		
265												
266	**Suggested UCL to Use**											
267					95% Student's-t UCL	46408						
268												
269	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
270	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
271	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
272												
273												
274	**Thallium**											
275												
276	**General Statistics**											
277					Total Number of Observations	16			Number of Distinct Observations	8		
278									Number of Missing Observations	0		
279					Minimum	0.13			Mean	0.161		
280					Maximum	0.2			Median	0.16		
281					SD	0.0203			Std. Error of Mean	0.00507		
282					Coefficient of Variation	0.126			Skewness	0.245		
283												
284	**Normal GOF Test**											
285					Shapiro Wilk Test Statistic	0.951			**Shapiro Wilk GOF Test**			
286					1% Shapiro Wilk Critical Value	0.844			Data appear Normal at 1% Significance Level			
287					Lilliefors Test Statistic	0.165			**Lilliefors GOF Test**			
288					1% Lilliefors Critical Value	0.248			Data appear Normal at 1% Significance Level			
289	**Data appear Normal at 1% Significance Level**											
290												
291	**Assuming Normal Distribution**											
292					**95% Normal UCL**				**95% UCLs (Adjusted for Skewness)**			
293					95% Student's-t UCL	0.17			95% Adjusted-CLT UCL (Chen-1995)	0.17		
294									95% Modified-t UCL (Johnson-1978)	0.17		
295												
296	**Gamma GOF Test**											
297					A-D Test Statistic	0.389			**Anderson-Darling Gamma GOF Test**			
298					5% A-D Critical Value	0.736			Detected data appear Gamma Distributed at 5% Significance Level			
299					K-S Test Statistic	0.176			**Kolmogorov-Smirnov Gamma GOF Test**			
300					5% K-S Critical Value	0.214			Detected data appear Gamma Distributed at 5% Significance Level			

	A	B	C	D	E	F	G	H	I	J	K	L
301	**Detected data appear Gamma Distributed at 5% Significance Level**											
302												
303	**Gamma Statistics**											
304					k hat (MLE)	67.74			k star (bias corrected MLE)			55.08
305					Theta hat (MLE)	0.00238			Theta star (bias corrected MLE)			0.00293
306					nu hat (MLE)	2168			nu star (bias corrected)			1763
307					MLE Mean (bias corrected)	0.161			MLE Sd (bias corrected)			0.0217
308									Approximate Chi Square Value (0.05)			1666
309					Adjusted Level of Significance	0.0335			Adjusted Chi Square Value			1655
310												
311	**Assuming Gamma Distribution**											
312					95% Approximate Gamma UCL	0.171			95% Adjusted Gamma UCL			0.172
313												
314	**Lognormal GOF Test**											
315					Shapiro Wilk Test Statistic	0.952			**Shapiro Wilk Lognormal GOF Test**			
316					10% Shapiro Wilk Critical Value	0.906			Data appear Lognormal at 10% Significance Level			
317					Lilliefors Test Statistic	0.169			**Lilliefors Lognormal GOF Test**			
318					10% Lilliefors Critical Value	0.196			Data appear Lognormal at 10% Significance Level			
319	**Data appear Lognormal at 10% Significance Level**											
320												
321	**Lognormal Statistics**											
322					Minimum of Logged Data	-2.04			Mean of logged Data			-1.832
323					Maximum of Logged Data	-1.609			SD of logged Data			0.126
324												
325	**Assuming Lognormal Distribution**											
326					95% H-UCL	0.171			90% Chebyshev (MVUE) UCL			0.176
327					95% Chebyshev (MVUE) UCL	0.183			97.5% Chebyshev (MVUE) UCL			0.193
328					99% Chebyshev (MVUE) UCL	0.212						
329												
330	**Nonparametric Distribution Free UCL Statistics**											
331	**Data appear to follow a Discernible Distribution**											
332												
333	**Nonparametric Distribution Free UCLs**											
334					95% CLT UCL	0.17			95% BCA Bootstrap UCL			0.169
335					95% Standard Bootstrap UCL	0.169			95% Bootstrap-t UCL			0.17
336					95% Hall's Bootstrap UCL	0.169			95% Percentile Bootstrap UCL			0.169
337					90% Chebyshev(Mean, Sd) UCL	0.176			95% Chebyshev(Mean, Sd) UCL			0.183
338					97.5% Chebyshev(Mean, Sd) UCL	0.193			99% Chebyshev(Mean, Sd) UCL			0.212
339												
340	**Suggested UCL to Use**											
341					95% Student's-t UCL	0.17						
342												
343	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
344	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
345	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
346												
347												
348	**Vanadium**											
349												
350	**General Statistics**											

351	Total Number of Observations					16	Number of Distinct Observations					15
352							Number of Missing Observations					0
353	Minimum					45.7	Mean					117.1
354	Maximum					167	Median					117
355	SD					38.25	Std. Error of Mean					9.562
356	Coefficient of Variation					0.327	Skewness					-0.262
357												
358	**Normal GOF Test**											
359	Shapiro Wilk Test Statistic					0.943	**Shapiro Wilk GOF Test**					
360	1% Shapiro Wilk Critical Value					0.844	Data appear Normal at 1% Significance Level					
361	Lilliefors Test Statistic					0.13	**Lilliefors GOF Test**					
362	1% Lilliefors Critical Value					0.248	Data appear Normal at 1% Significance Level					
363	**Data appear Normal at 1% Significance Level**											
364												
365	**Assuming Normal Distribution**											
366	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
367	95% Student's-t UCL					133.9	95% Adjusted-CLT UCL (Chen-1995)					132.2
368							95% Modified-t UCL (Johnson-1978)					133.8
369												
370	**Gamma GOF Test**											
371	A-D Test Statistic					0.389	**Anderson-Darling Gamma GOF Test**					
372	5% A-D Critical Value					0.74	Detected data appear Gamma Distributed at 5% Significance Level					
373	K-S Test Statistic					0.117	**Kolmogorov-Smirnov Gamma GOF Test**					
374	5% K-S Critical Value					0.215	Detected data appear Gamma Distributed at 5% Significance Level					
375	**Detected data appear Gamma Distributed at 5% Significance Level**											
376												
377	**Gamma Statistics**											
378	k hat (MLE)					8.538	k star (bias corrected MLE)					6.978
379	Theta hat (MLE)					13.72	Theta star (bias corrected MLE)					16.78
380	nu hat (MLE)					273.2	nu star (bias corrected)					223.3
381	MLE Mean (bias corrected)					117.1	MLE Sd (bias corrected)					44.33
382							Approximate Chi Square Value (0.05)					189.7
383	Adjusted Level of Significance					0.0335	Adjusted Chi Square Value					186.2
384												
385	**Assuming Gamma Distribution**											
386	95% Approximate Gamma UCL					137.8	95% Adjusted Gamma UCL					140.4
387												
388	**Lognormal GOF Test**											
389	Shapiro Wilk Test Statistic					0.913	**Shapiro Wilk Lognormal GOF Test**					
390	10% Shapiro Wilk Critical Value					0.906	Data appear Lognormal at 10% Significance Level					
391	Lilliefors Test Statistic					0.135	**Lilliefors Lognormal GOF Test**					
392	10% Lilliefors Critical Value					0.196	Data appear Lognormal at 10% Significance Level					
393	**Data appear Lognormal at 10% Significance Level**											
394												
395	**Lognormal Statistics**											
396	Minimum of Logged Data					3.822	Mean of logged Data					4.703
397	Maximum of Logged Data					5.118	SD of logged Data					0.376
398												
399	**Assuming Lognormal Distribution**											
400	95% H-UCL					142.8	90% Chebyshev (MVUE) UCL					151.7

401				95% Chebyshev (MVUE) UCL		167				97.5% Chebyshev (MVUE) UCL		188.3
402				99% Chebyshev (MVUE) UCL		230.1						
403												
404						**Nonparametric Distribution Free UCL Statistics**							
405						**Data appear to follow a Discernible Distribution**							
406												
407						**Nonparametric Distribution Free UCLs**							
408				95% CLT UCL		132.8				95% BCA Bootstrap UCL		132
409				95% Standard Bootstrap UCL		132.3				95% Bootstrap-t UCL		133.1
410				95% Hall's Bootstrap UCL		131.9				95% Percentile Bootstrap UCL		132.3
411				90% Chebyshev(Mean, Sd) UCL		145.8				95% Chebyshev(Mean, Sd) UCL		158.8
412				97.5% Chebyshev(Mean, Sd) UCL		176.8				99% Chebyshev(Mean, Sd) UCL		212.2
413												
414						**Suggested UCL to Use**							
415				95% Student's-t UCL		133.9						
416												
417						Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
418						Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.							
419						However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
420												
421						**Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be**							
422						**reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.**							
423												
424												
425	**Mercury**											
426												
427						**General Statistics**							
428				Total Number of Observations		16				Number of Distinct Observations		13
429										Number of Missing Observations		0
430				Minimum		0.023				Mean		0.24
431				Maximum		2.6				Median		0.082
432				SD		0.63				Std. Error of Mean		0.158
433				Coefficient of Variation		2.627				Skewness		3.986
434												
435						**Normal GOF Test**							
436				Shapiro Wilk Test Statistic		0.313				**Shapiro Wilk GOF Test**		
437				1% Shapiro Wilk Critical Value		0.844				Data Not Normal at 1% Significance Level		
438				Lilliefors Test Statistic		0.5				**Lilliefors GOF Test**		
439				1% Lilliefors Critical Value		0.248				Data Not Normal at 1% Significance Level		
440						**Data Not Normal at 1% Significance Level**							
441												
442						**Assuming Normal Distribution**							
443				**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**		
444				95% Student's-t UCL		0.516				95% Adjusted-CLT UCL (Chen-1995)		0.667
445										95% Modified-t UCL (Johnson-1978)		0.542
446												
447						**Gamma GOF Test**							
448				A-D Test Statistic		3.591				**Anderson-Darling Gamma GOF Test**		
449				5% A-D Critical Value		0.782				Data Not Gamma Distributed at 5% Significance Level		
450				K-S Test Statistic		0.427				**Kolmogorov-Smirnov Gamma GOF Test**		

451	5% K-S Critical Value					0.225	Data Not Gamma Distributed at 5% Significance Level					
452	**Data Not Gamma Distributed at 5% Significance Level**											
453												
454	**Gamma Statistics**											
455	k hat (MLE)					0.662	k star (bias corrected MLE)					0.579
456	Theta hat (MLE)					0.363	Theta star (bias corrected MLE)					0.414
457	nu hat (MLE)					21.17	nu star (bias corrected)					18.53
458	MLE Mean (bias corrected)					0.24	MLE Sd (bias corrected)					0.315
459							Approximate Chi Square Value (0.05)					9.777
460	Adjusted Level of Significance					0.0335	Adjusted Chi Square Value					9.059
461												
462	**Assuming Gamma Distribution**											
463	95% Approximate Gamma UCL					0.455	95% Adjusted Gamma UCL					0.491
464												
465	**Lognormal GOF Test**											
466	Shapiro Wilk Test Statistic					0.673	**Shapiro Wilk Lognormal GOF Test**					
467	10% Shapiro Wilk Critical Value					0.906	Data Not Lognormal at 10% Significance Level					
468	Lilliefors Test Statistic					0.285	**Lilliefors Lognormal GOF Test**					
469	10% Lilliefors Critical Value					0.196	Data Not Lognormal at 10% Significance Level					
470	**Data Not Lognormal at 10% Significance Level**											
471												
472	**Lognormal Statistics**											
473	Minimum of Logged Data					-3.772	Mean of logged Data					-2.349
474	Maximum of Logged Data					0.956	SD of logged Data					0.974
475												
476	**Assuming Lognormal Distribution**											
477	95% H-UCL					0.3	90% Chebyshev (MVUE) UCL					0.265
478	95% Chebyshev (MVUE) UCL					0.319	97.5% Chebyshev (MVUE) UCL					0.393
479	99% Chebyshev (MVUE) UCL					0.539						
480												
481	**Nonparametric Distribution Free UCL Statistics**											
482	**Data do not follow a Discernible Distribution**											
483												
484	**Nonparametric Distribution Free UCLs**											
485	95% CLT UCL					0.499	95% BCA Bootstrap UCL					0.716
486	95% Standard Bootstrap UCL					0.487	95% Bootstrap-t UCL					4.732
487	95% Hall's Bootstrap UCL					2.475	95% Percentile Bootstrap UCL					0.553
488	90% Chebyshev(Mean, Sd) UCL					0.712	95% Chebyshev(Mean, Sd) UCL					0.926
489	97.5% Chebyshev(Mean, Sd) UCL					1.223	99% Chebyshev(Mean, Sd) UCL					1.807
490												
491	**Suggested UCL to Use**											
492	95% Student's-t UCL					0.516						
493												
494	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
495	**Please verify the data were collected from random locations.**											
496	**If the data were collected using judgmental or other non-random methods,**											
497	**then contact a statistician to correctly calculate UCLs.**											
498												
499	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
500	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											

	A	B	C	D	E	F	G	H	I	J	K	L
501	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
502												
503	**Benzo(a)pyrene**											
504												
505	**General Statistics**											
506	Total Number of Observations					16	Number of Distinct Observations					15
507	Number of Detects					14	Number of Non-Detects					2
508	Number of Distinct Detects					13	Number of Distinct Non-Detects					2
509	Minimum Detect					0.018	Minimum Non-Detect					0.0099
510	Maximum Detect					3.1	Maximum Non-Detect					0.011
511	Variance Detects					0.657	Percent Non-Detects					12.5%
512	Mean Detects					0.307	SD Detects					0.81
513	Median Detects					0.0585	CV Detects					2.639
514	Skewness Detects					3.642	Kurtosis Detects					13.44
515	Mean of Logged Detects					-2.554	SD of Logged Detects					1.396
516												
517	**Normal GOF Test on Detects Only**											
518	Shapiro Wilk Test Statistic					0.387	**Shapiro Wilk GOF Test**					
519	1% Shapiro Wilk Critical Value					0.825	Detected Data Not Normal at 1% Significance Level					
520	Lilliefors Test Statistic					0.415	**Lilliefors GOF Test**					
521	1% Lilliefors Critical Value					0.263	Detected Data Not Normal at 1% Significance Level					
522	**Detected Data Not Normal at 1% Significance Level**											
523												
524	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
525	KM Mean					0.27	KM Standard Error of Mean					0.191
526	90KM SD					0.737	95% KM (BCA) UCL					0.644
527	95% KM (t) UCL					0.605	95% KM (Percentile Bootstrap) UCL					0.638
528	95% KM (z) UCL					0.584	95% KM Bootstrap t UCL					3.573
529	90% KM Chebyshev UCL					0.844	95% KM Chebyshev UCL					1.103
530	97.5% KM Chebyshev UCL					1.464	99% KM Chebyshev UCL					2.172
531												
532	**Gamma GOF Tests on Detected Observations Only**											
533	A-D Test Statistic					1.815	**Anderson-Darling GOF Test**					
534	5% A-D Critical Value					0.8	Detected Data Not Gamma Distributed at 5% Significance Level					
535	K-S Test Statistic					0.278	**Kolmogorov-Smirnov GOF**					
536	5% K-S Critical Value					0.243	Detected Data Not Gamma Distributed at 5% Significance Level					
537	**Detected Data Not Gamma Distributed at 5% Significance Level**											
538												
539	**Gamma Statistics on Detected Data Only**											
540	k hat (MLE)					0.467	k star (bias corrected MLE)					0.415
541	Theta hat (MLE)					0.657	Theta star (bias corrected MLE)					0.74
542	nu hat (MLE)					13.09	nu star (bias corrected)					11.61
543	Mean (detects)					0.307						
544												
545	**Gamma ROS Statistics using Imputed Non-Detects**											
546	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
547	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
548	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
549	This is especially true when the sample size is small.											
550	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											

	A	B	C	D	E	F	G	H	I	J	K	L
551					Minimum	0.01					Mean	0.27
552					Maximum	3.1					Median	0.049
553					SD	0.761					CV	2.82
554					k hat (MLE)	0.433					k star (bias corrected MLE)	0.393
555					Theta hat (MLE)	0.624					Theta star (bias corrected MLE)	0.686
556					nu hat (MLE)	13.85					nu star (bias corrected)	12.59
557					Adjusted Level of Significance (β)	0.0335						
558					Approximate Chi Square Value (12.59, α)	5.617					Adjusted Chi Square Value (12.59, β)	5.095
559					95% Gamma Approximate UCL	0.605					95% Gamma Adjusted UCL	0.667
560												
561	**Estimates of Gamma Parameters using KM Estimates**											
562					Mean (KM)	0.27					SD (KM)	0.737
563					Variance (KM)	0.543					SE of Mean (KM)	0.191
564					k hat (KM)	0.134					k star (KM)	0.151
565					nu hat (KM)	4.292					nu star (KM)	4.821
566					theta hat (KM)	2.012					theta star (KM)	1.792
567					80% gamma percentile (KM)	0.295					90% gamma percentile (KM)	0.801
568					95% gamma percentile (KM)	1.484					99% gamma percentile (KM)	3.466
569												
570	**Gamma Kaplan-Meier (KM) Statistics**											
571					Approximate Chi Square Value (4.82, α)	1.07					Adjusted Chi Square Value (4.82, β)	0.886
572					95% KM Approximate Gamma UCL	1.216					95% KM Adjusted Gamma UCL	1.468
573												
574	**Lognormal GOF Test on Detected Observations Only**											
575					Shapiro Wilk Test Statistic	0.866	**Shapiro Wilk GOF Test**					
576					10% Shapiro Wilk Critical Value	0.895	Detected Data Not Lognormal at 10% Significance Level					
577					Lilliefors Test Statistic	0.173	**Lilliefors GOF Test**					
578					10% Lilliefors Critical Value	0.208	Detected Data appear Lognormal at 10% Significance Level					
579	**Detected Data appear Approximate Lognormal at 10% Significance Level**											
580												
581	**Lognormal ROS Statistics Using Imputed Non-Detects**											
582					Mean in Original Scale	0.269					Mean in Log Scale	-2.947
583					SD in Original Scale	0.762					SD in Log Scale	1.686
584					95% t UCL (assumes normality of ROS data)	0.603					95% Percentile Bootstrap UCL	0.634
585					95% BCA Bootstrap UCL	0.852					95% Bootstrap t UCL	3.411
586					95% H-UCL (Log ROS)	1.178						
587												
588	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
589					KM Mean (logged)	-2.812					KM Geo Mean	0.0601
590					KM SD (logged)	1.431					95% Critical H Value (KM-Log)	3.421
591					KM Standard Error of Mean (logged)	0.371					95% H-UCL (KM -Log)	0.592
592					KM SD (logged)	1.431					95% Critical H Value (KM-Log)	3.421
593					KM Standard Error of Mean (logged)	0.371						
594												
595	**DL/2 Statistics**											
596	**DL/2 Normal**						**DL/2 Log-Transformed**					
597					Mean in Original Scale	0.269					Mean in Log Scale	-2.892
598					SD in Original Scale	0.761					SD in Log Scale	1.594
599					95% t UCL (Assumes normality)	0.603					95% H-Stat UCL	0.911
600	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											

	A	B	C	D	E	F	G	H	I	J	K	L
601												
602	**Nonparametric Distribution Free UCL Statistics**											
603	**Detected Data appear Approximate Lognormal Distributed at 10% Significance Level**											
604												
605	**Suggested UCL to Use**											
606	KM H-UCL					0.592						
607												
608	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
609	**Please verify the data were collected from random locations.**											
610	**If the data were collected using judgmental or other non-random methods,**											
611	**then contact a statistician to correctly calculate UCLs.**											
612												
613	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
614	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
615	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
616												
617	**Benz(a)anthracene**											
618												
619	**General Statistics**											
620	Total Number of Observations					16			Number of Distinct Observations			16
621	Number of Detects					13			Number of Non-Detects			3
622	Number of Distinct Detects					13			Number of Distinct Non-Detects			3
623	Minimum Detect					0.014			Minimum Non-Detect			0.028
624	Maximum Detect					3			Maximum Non-Detect			0.03
625	Variance Detects					0.663			Percent Non-Detects			18.75%
626	Mean Detects					0.338			SD Detects			0.814
627	Median Detects					0.061			CV Detects			2.406
628	Skewness Detects					3.401			Kurtosis Detects			11.83
629	Mean of Logged Detects					-2.371			SD of Logged Detects			1.4
630												
631	**Normal GOF Test on Detects Only**											
632	Shapiro Wilk Test Statistic					0.43			**Shapiro Wilk GOF Test**			
633	1% Shapiro Wilk Critical Value					0.814			Detected Data Not Normal at 1% Significance Level			
634	Lilliefors Test Statistic					0.418			**Lilliefors GOF Test**			
635	1% Lilliefors Critical Value					0.271			Detected Data Not Normal at 1% Significance Level			
636	**Detected Data Not Normal at 1% Significance Level**											
637												
638	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
639	KM Mean					0.278			KM Standard Error of Mean			0.186
640	90KM SD					0.716			95% KM (BCA) UCL			0.635
641	95% KM (t) UCL					0.604			95% KM (Percentile Bootstrap) UCL			0.631
642	95% KM (z) UCL					0.584			95% KM Bootstrap t UCL			3.774
643	90% KM Chebyshev UCL					0.837			95% KM Chebyshev UCL			1.09
644	97.5% KM Chebyshev UCL					1.442			99% KM Chebyshev UCL			2.133
645												
646	**Gamma GOF Tests on Detected Observations Only**											
647	A-D Test Statistic					1.635			**Anderson-Darling GOF Test**			
648	5% A-D Critical Value					0.791			Detected Data Not Gamma Distributed at 5% Significance Level			
649	K-S Test Statistic					0.302			**Kolmogorov-Smirnov GOF**			
650	5% K-S Critical Value					0.25			Detected Data Not Gamma Distributed at 5% Significance Level			

	A	B	C	D	E	F	G	H	I	J	K	L
651	**Detected Data Not Gamma Distributed at 5% Significance Level**											
652												
653	**Gamma Statistics on Detected Data Only**											
654					k hat (MLE)	0.494			k star (bias corrected MLE)			0.431
655					Theta hat (MLE)	0.685			Theta star (bias corrected MLE)			0.785
656					nu hat (MLE)	12.85			nu star (bias corrected)			11.22
657					Mean (detects)	0.338						
658												
659	**Gamma ROS Statistics using Imputed Non-Detects**											
660	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
661	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
662	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
663	This is especially true when the sample size is small.											
664	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
665					Minimum	0.01			Mean			0.277
666					Maximum	3			Median			0.052
667					SD	0.74			CV			2.674
668					k hat (MLE)	0.432			k star (bias corrected MLE)			0.392
669					Theta hat (MLE)	0.641			Theta star (bias corrected MLE)			0.706
670					nu hat (MLE)	13.81			nu star (bias corrected)			12.56
671					Adjusted Level of Significance (β)	0.0335						
672					Approximate Chi Square Value (12.56, α)	5.596			Adjusted Chi Square Value (12.56, β)			5.076
673					95% Gamma Approximate UCL	0.621			95% Gamma Adjusted UCL			0.685
674												
675	**Estimates of Gamma Parameters using KM Estimates**											
676					Mean (KM)	0.278			SD (KM)			0.716
677					Variance (KM)	0.513			SE of Mean (KM)			0.186
678					k hat (KM)	0.15			k star (KM)			0.164
679					nu hat (KM)	4.805			nu star (KM)			5.237
680					theta hat (KM)	1.849			theta star (KM)			1.696
681					80% gamma percentile (KM)	0.323			90% gamma percentile (KM)			0.832
682					95% gamma percentile (KM)	1.501			99% gamma percentile (KM)			3.41
683												
684	**Gamma Kaplan-Meier (KM) Statistics**											
685					Approximate Chi Square Value (5.24, α)	1.263			Adjusted Chi Square Value (5.24, β)			1.057
686					95% KM Approximate Gamma UCL	1.151			95% KM Adjusted Gamma UCL			1.375
687												
688	**Lognormal GOF Test on Detected Observations Only**											
689					Shapiro Wilk Test Statistic	0.888			**Shapiro Wilk GOF Test**			
690					10% Shapiro Wilk Critical Value	0.889			Detected Data Not Lognormal at 10% Significance Level			
691					Lilliefors Test Statistic	0.189			**Lilliefors GOF Test**			
692					10% Lilliefors Critical Value	0.215			Detected Data appear Lognormal at 10% Significance Level			
693	**Detected Data appear Approximate Lognormal at 10% Significance Level**											
694												
695	**Lognormal ROS Statistics Using Imputed Non-Detects**											
696					Mean in Original Scale	0.276			Mean in Log Scale			-2.84
697					SD in Original Scale	0.74			SD in Log Scale			1.607
698					95% t UCL (assumes normality of ROS data)	0.601			95% Percentile Bootstrap UCL			0.618
699					95% BCA Bootstrap UCL	0.844			95% Bootstrap t UCL			3.568
700					95% H-UCL (Log ROS)	1.002						

701												
702	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
703						KM Mean (logged)	-2.727				KM Geo Mean	0.0654
704						KM SD (logged)	1.421				95% Critical H Value (KM-Log)	3.403
705						KM Standard Error of Mean (logged)	0.37				95% H-UCL (KM -Log)	0.625
706						KM SD (logged)	1.421				95% Critical H Value (KM-Log)	3.403
707						KM Standard Error of Mean (logged)	0.37					
708												
709	**DL/2 Statistics**											
710					**DL/2 Normal**					**DL/2 Log-Transformed**		
711						Mean in Original Scale	0.278				Mean in Log Scale	-2.72
712						SD in Original Scale	0.74				SD in Log Scale	1.46
713						95% t UCL (Assumes normality)	0.602				95% H-Stat UCL	0.708
714	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
715												
716	**Nonparametric Distribution Free UCL Statistics**											
717	**Detected Data appear Approximate Lognormal Distributed at 10% Significance Level**											
718												
719	**Suggested UCL to Use**											
720						KM H-UCL	0.625					
721												
722	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
723	**Please verify the data were collected from random locations.**											
724	**If the data were collected using judgmental or other non-random methods,**											
725	**then contact a statistician to correctly calculate UCLs.**											
726												
727	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
728	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
729	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
730												
731	**Benzo(b)fluoranthene**											
732												
733	**General Statistics**											
734						Total Number of Observations	16				Number of Distinct Observations	16
735						Number of Detects	15				Number of Non-Detects	1
736						Number of Distinct Detects	15				Number of Distinct Non-Detects	1
737						Minimum Detect	0.012				Minimum Non-Detect	0.0096
738						Maximum Detect	3.8				Maximum Non-Detect	0.0096
739						Variance Detects	0.925				Percent Non-Detects	6.25%
740						Mean Detects	0.361				SD Detects	0.962
741						Median Detects	0.062				CV Detects	2.661
742						Skewness Detects	3.736				Kurtosis Detects	14.2
743						Mean of Logged Detects	-2.407				SD of Logged Detects	1.42
744												
745	**Normal GOF Test on Detects Only**											
746						Shapiro Wilk Test Statistic	0.385				**Shapiro Wilk GOF Test**	
747						1% Shapiro Wilk Critical Value	0.835				Detected Data Not Normal at 1% Significance Level	
748						Lilliefors Test Statistic	0.417				**Lilliefors GOF Test**	
749						1% Lilliefors Critical Value	0.255				Detected Data Not Normal at 1% Significance Level	
750	**Detected Data Not Normal at 1% Significance Level**											

	A	B	C	D	E	F	G	H	I	J	K	L
751												
752	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
753					KM Mean	0.339			KM Standard Error of Mean			0.234
754					90KM SD	0.904			95% KM (BCA) UCL			0.792
755					95% KM (t) UCL	0.749			95% KM (Percentile Bootstrap) UCL			0.789
756					95% KM (z) UCL	0.724			95% KM Bootstrap t UCL			4.228
757					90% KM Chebyshev UCL	1.041			95% KM Chebyshev UCL			1.359
758					97.5% KM Chebyshev UCL	1.8			99% KM Chebyshev UCL			2.666
759												
760	**Gamma GOF Tests on Detected Observations Only**											
761					A-D Test Statistic	1.878	**Anderson-Darling GOF Test**					
762					5% A-D Critical Value	0.801	Detected Data Not Gamma Distributed at 5% Significance Level					
763					K-S Test Statistic	0.284	**Kolmogorov-Smirnov GOF**					
764					5% K-S Critical Value	0.235	Detected Data Not Gamma Distributed at 5% Significance Level					
765	**Detected Data Not Gamma Distributed at 5% Significance Level**											
766												
767	**Gamma Statistics on Detected Data Only**											
768					k hat (MLE)	0.463			k star (bias corrected MLE)			0.415
769					Theta hat (MLE)	0.781			Theta star (bias corrected MLE)			0.872
770					nu hat (MLE)	13.88			nu star (bias corrected)			12.44
771					Mean (detects)	0.361						
772												
773	**Gamma ROS Statistics using Imputed Non-Detects**											
774	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
775	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
776	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
777	This is especially true when the sample size is small.											
778	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
779					Minimum	0.01			Mean			0.34
780					Maximum	3.8			Median			0.057
781					SD	0.933			CV			2.749
782					k hat (MLE)	0.442			k star (bias corrected MLE)			0.401
783					Theta hat (MLE)	0.768			Theta star (bias corrected MLE)			0.847
784					nu hat (MLE)	14.15			nu star (bias corrected)			12.83
785					Adjusted Level of Significance (β)	0.0335						
786					Approximate Chi Square Value (12.83, α)	5.779			Adjusted Chi Square Value (12.83, β)			5.249
787					95% Gamma Approximate UCL	0.754			95% Gamma Adjusted UCL			0.83
788												
789	**Estimates of Gamma Parameters using KM Estimates**											
790					Mean (KM)	0.339			SD (KM)			0.904
791					Variance (KM)	0.817			SE of Mean (KM)			0.234
792					k hat (KM)	0.141			k star (KM)			0.156
793					nu hat (KM)	4.516			nu star (KM)			5.002
794					theta hat (KM)	2.406			theta star (KM)			2.172
795					80% gamma percentile (KM)	0.382			90% gamma percentile (KM)			1.012
796					95% gamma percentile (KM)	1.853			99% gamma percentile (KM)			4.274
797												
798	**Gamma Kaplan-Meier (KM) Statistics**											
799					Approximate Chi Square Value (5.00, α)	1.153			Adjusted Chi Square Value (5.00, β)			0.96
800					95% KM Approximate Gamma UCL	1.473			95% KM Adjusted Gamma UCL			1.769

801												
802	**Lognormal GOF Test on Detected Observations Only**											
803					Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk GOF Test**					
804					10% Shapiro Wilk Critical Value	0.901	Detected Data Not Lognormal at 10% Significance Level					
805					Lilliefors Test Statistic	0.196	**Lilliefors GOF Test**					
806					10% Lilliefors Critical Value	0.202	Detected Data appear Lognormal at 10% Significance Level					
807	**Detected Data appear Approximate Lognormal at 10% Significance Level**											
808												
809	**Lognormal ROS Statistics Using Imputed Non-Detects**											
810					Mean in Original Scale	0.339			Mean in Log Scale	-2.616		
811					SD in Original Scale	0.933			SD in Log Scale	1.606		
812					95% t UCL (assumes normality of ROS data)	0.748			95% Percentile Bootstrap UCL	0.781		
813					95% BCA Bootstrap UCL	1.053			95% Bootstrap t UCL	4.037		
814					95% H-UCL (Log ROS)	1.249						
815												
816	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
817					KM Mean (logged)	-2.547			KM Geo Mean	0.0783		
818					KM SD (logged)	1.435			95% Critical H Value (KM-Log)	3.428		
819					KM Standard Error of Mean (logged)	0.371			95% H-UCL (KM -Log)	0.781		
820					KM SD (logged)	1.435			95% Critical H Value (KM-Log)	3.428		
821					KM Standard Error of Mean (logged)	0.371						
822												
823	**DL/2 Statistics**											
824	**DL/2 Normal**							**DL/2 Log-Transformed**				
825					Mean in Original Scale	0.339			Mean in Log Scale	-2.591		
826					SD in Original Scale	0.933			SD in Log Scale	1.556		
827					95% t UCL (Assumes normality)	0.748			95% H-Stat UCL	1.087		
828	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
829												
830	**Nonparametric Distribution Free UCL Statistics**											
831	**Detected Data appear Approximate Lognormal Distributed at 10% Significance Level**											
832												
833	**Suggested UCL to Use**											
834					KM H-UCL	0.781						
835												
836	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
837	**Please verify the data were collected from random locations.**											
838	**If the data were collected using judgmental or other non-random methods,**											
839	**then contact a statistician to correctly calculate UCLs.**											
840												
841	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
842	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
843	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
844												
845	**Dibenz(a,h)anthracene**											
846												
847	**General Statistics**											
848					Total Number of Observations	16			Number of Distinct Observations	7		
849					Number of Detects	6			Number of Non-Detects	10		
850					Number of Distinct Detects	6			Number of Distinct Non-Detects	3		

851					Minimum Detect	0.016					Minimum Non-Detect	0.016
852					Maximum Detect	0.5					Maximum Non-Detect	0.018
853					Variance Detects	0.0372					Percent Non-Detects	62.5%
854					Mean Detects	0.107					SD Detects	0.193
855					Median Detects	0.0305					CV Detects	1.807
856					Skewness Detects	2.427					Kurtosis Detects	5.915
857					Mean of Logged Detects	-3.167					SD of Logged Detects	1.286
858												
859	**Normal GOF Test on Detects Only**											
860					Shapiro Wilk Test Statistic	0.553	**Shapiro Wilk GOF Test**					
861					1% Shapiro Wilk Critical Value	0.713	Detected Data Not Normal at 1% Significance Level					
862					Lilliefors Test Statistic	0.455	**Lilliefors GOF Test**					
863					1% Lilliefors Critical Value	0.373	Detected Data Not Normal at 1% Significance Level					
864	**Detected Data Not Normal at 1% Significance Level**											
865												
866	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
867					KM Mean	0.0501					KM Standard Error of Mean	0.0319
868					90KM SD	0.117					95% KM (BCA) UCL	0.11
869					95% KM (t) UCL	0.106					95% KM (Percentile Bootstrap) UCL	0.11
870					95% KM (z) UCL	0.103					95% KM Bootstrap t UCL	0.707
871					90% KM Chebyshev UCL	0.146					95% KM Chebyshev UCL	0.189
872					97.5% KM Chebyshev UCL	0.249					99% KM Chebyshev UCL	0.368
873												
874	**Gamma GOF Tests on Detected Observations Only**											
875					A-D Test Statistic	0.998	**Anderson-Darling GOF Test**					
876					5% A-D Critical Value	0.727	Detected Data Not Gamma Distributed at 5% Significance Level					
877					K-S Test Statistic	0.393	**Kolmogorov-Smirnov GOF**					
878					5% K-S Critical Value	0.345	Detected Data Not Gamma Distributed at 5% Significance Level					
879	**Detected Data Not Gamma Distributed at 5% Significance Level**											
880												
881	**Gamma Statistics on Detected Data Only**											
882					k hat (MLE)	0.655					k star (bias corrected MLE)	0.439
883					Theta hat (MLE)	0.163					Theta star (bias corrected MLE)	0.243
884					nu hat (MLE)	7.865					nu star (bias corrected)	5.266
885					Mean (detects)	0.107						
886												
887	**Gamma ROS Statistics using Imputed Non-Detects**											
888	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
889	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
890	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
891	This is especially true when the sample size is small.											
892	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
893					Minimum	0.01					Mean	0.0463
894					Maximum	0.5					Median	0.01
895					SD	0.121					CV	2.623
896					k hat (MLE)	0.619					k star (bias corrected MLE)	0.545
897					Theta hat (MLE)	0.0748					Theta star (bias corrected MLE)	0.085
898					nu hat (MLE)	19.81					nu star (bias corrected)	17.43
899					Adjusted Level of Significance (β)	0.0335						
900					Approximate Chi Square Value (17.43, α)	8.979					Adjusted Chi Square Value (17.43, β)	8.295

901				95% Gamma Approximate UCL		0.0899				95% Gamma Adjusted UCL		0.0973
902												
903	**Estimates of Gamma Parameters using KM Estimates**											
904				Mean (KM)		0.0501				SD (KM)		0.117
905				Variance (KM)		0.0136				SE of Mean (KM)		0.0319
906				k hat (KM)		0.185				k star (KM)		0.192
907				nu hat (KM)		5.914				nu star (KM)		6.138
908				theta hat (KM)		0.271				theta star (KM)		0.261
909				80% gamma percentile (KM)		0.0645				90% gamma percentile (KM)		0.151
910				95% gamma percentile (KM)		0.261				99% gamma percentile (KM)		0.564
911												
912	**Gamma Kaplan-Meier (KM) Statistics**											
913				Approximate Chi Square Value (6.14, α)		1.711				Adjusted Chi Square Value (6.14, β)		1.459
914				95% KM Approximate Gamma UCL		0.18				95% KM Adjusted Gamma UCL		0.211
915												
916	**Lognormal GOF Test on Detected Observations Only**											
917				Shapiro Wilk Test Statistic		0.782				**Shapiro Wilk GOF Test**		
918				10% Shapiro Wilk Critical Value		0.826				Detected Data Not Lognormal at 10% Significance Level		
919				Lilliefors Test Statistic		0.299				**Lilliefors GOF Test**		
920				10% Lilliefors Critical Value		0.298				Detected Data Not Lognormal at 10% Significance Level		
921	**Detected Data Not Lognormal at 10% Significance Level**											
922												
923	**Lognormal ROS Statistics Using Imputed Non-Detects**											
924				Mean in Original Scale		0.0418				Mean in Log Scale		-5.139
925				SD in Original Scale		0.123				SD in Log Scale		1.91
926				95% t UCL (assumes normality of ROS data)		0.0957				95% Percentile Bootstrap UCL		0.101
927				95% BCA Bootstrap UCL		0.135				95% Bootstrap t UCL		0.443
928				95% H-UCL (Log ROS)		0.303						
929												
930	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
931				KM Mean (logged)		-3.771				KM Geo Mean		0.023
932				KM SD (logged)		0.858				95% Critical H Value (KM-Log)		2.493
933				KM Standard Error of Mean (logged)		0.235				95% H-UCL (KM -Log)		0.0578
934				KM SD (logged)		0.858				95% Critical H Value (KM-Log)		2.493
935				KM Standard Error of Mean (logged)		0.235						
936												
937	**DL/2 Statistics**											
938	**DL/2 Normal**									**DL/2 Log-Transformed**		
939				Mean in Original Scale		0.0454				Mean in Log Scale		-4.168
940				SD in Original Scale		0.122				SD in Log Scale		1.093
941				95% t UCL (Assumes normality)		0.0988				95% H-Stat UCL		0.0628
942	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
943												
944	**Nonparametric Distribution Free UCL Statistics**											
945	**Data do not follow a Discernible Distribution**											
946												
947	**Suggested UCL to Use**											
948				95% KM (t) UCL		0.106						
949												
950	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											

	A	B	C	D	E	F	G	H	I	J	K	L
951	**Please verify the data were collected from random locations.**											
952	**If the data were collected using judgmental or other non-random methods,**											
953	**then contact a statistician to correctly calculate UCLs.**											
954												
955	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
956	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
957	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
958												
959	**Indeno(1,2,3-cd)pyrene**											
960												
961	**General Statistics**											
962						Total Number of Observations	16				Number of Distinct Observations	12	
963						Number of Detects	15				Number of Non-Detects	1	
964						Number of Distinct Detects	12				Number of Distinct Non-Detects	1	
965						Minimum Detect	0.016				Minimum Non-Detect	0.016	
966						Maximum Detect	2.3				Maximum Non-Detect	0.016	
967						Variance Detects	0.337				Percent Non-Detects	6.25%	
968						Mean Detects	0.208				SD Detects	0.581	
969						Median Detects	0.042				CV Detects	2.792	
970						Skewness Detects	3.829				Kurtosis Detects	14.75	
971						Mean of Logged Detects	-2.862				SD of Logged Detects	1.269	
972													
973	**Normal GOF Test on Detects Only**											
974						Shapiro Wilk Test Statistic	0.348				**Shapiro Wilk GOF Test**		
975						1% Shapiro Wilk Critical Value	0.835				Detected Data Not Normal at 1% Significance Level		
976						Lilliefors Test Statistic	0.446				**Lilliefors GOF Test**		
977						1% Lilliefors Critical Value	0.255				Detected Data Not Normal at 1% Significance Level		
978	**Detected Data Not Normal at 1% Significance Level**											
979													
980	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
981						KM Mean	0.196				KM Standard Error of Mean	0.141	
982						90KM SD	0.545				95% KM (BCA) UCL	0.476	
983						95% KM (t) UCL	0.443				95% KM (Percentile Bootstrap) UCL	0.475	
984						95% KM (z) UCL	0.428				95% KM Bootstrap t UCL	2.953	
985						90% KM Chebyshev UCL	0.619				95% KM Chebyshev UCL	0.811	
986						97.5% KM Chebyshev UCL	1.077				99% KM Chebyshev UCL	1.6	
987													
988	**Gamma GOF Tests on Detected Observations Only**											
989						A-D Test Statistic	2.305				**Anderson-Darling GOF Test**		
990						5% A-D Critical Value	0.795				Detected Data Not Gamma Distributed at 5% Significance Level		
991						K-S Test Statistic	0.352				**Kolmogorov-Smirnov GOF**		
992						5% K-S Critical Value	0.234				Detected Data Not Gamma Distributed at 5% Significance Level		
993	**Detected Data Not Gamma Distributed at 5% Significance Level**											
994													
995	**Gamma Statistics on Detected Data Only**											
996						k hat (MLE)	0.493				k star (bias corrected MLE)	0.439	
997						Theta hat (MLE)	0.422				Theta star (bias corrected MLE)	0.474	
998						nu hat (MLE)	14.78				nu star (bias corrected)	13.16	
999						Mean (detects)	0.208						
1000													

	A	B	C	D	E	F	G	H	I	J	K	L
1001	**Gamma ROS Statistics using Imputed Non-Detects**											
1002	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
1003	GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)											
1004	For such situations, GROS method may yield incorrect values of UCLs and BTVs											
1005	This is especially true when the sample size is small.											
1006	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
1007					Minimum	0.01				Mean	0.196	
1008					Maximum	2.3				Median	0.0415	
1009					SD	0.563				CV	2.879	
1010					k hat (MLE)	0.478				k star (bias corrected MLE)	0.43	
1011					Theta hat (MLE)	0.41				Theta star (bias corrected MLE)	0.455	
1012					nu hat (MLE)	15.28				nu star (bias corrected)	13.75	
1013					Adjusted Level of Significance (β)	0.0335						
1014					Approximate Chi Square Value (13.75, α)	6.401				Adjusted Chi Square Value (13.75, β)	5.838	
1015					95% Gamma Approximate UCL	0.42				95% Gamma Adjusted UCL	0.461	
1016												
1017	**Estimates of Gamma Parameters using KM Estimates**											
1018					Mean (KM)	0.196				SD (KM)	0.545	
1019					Variance (KM)	0.297				SE of Mean (KM)	0.141	
1020					k hat (KM)	0.129				k star (KM)	0.147	
1021					nu hat (KM)	4.137				nu star (KM)	4.694	
1022					theta hat (KM)	1.516				theta star (KM)	1.336	
1023					80% gamma percentile (KM)	0.209				90% gamma percentile (KM)	0.579	
1024					95% gamma percentile (KM)	1.083				99% gamma percentile (KM)	2.553	
1025												
1026	**Gamma Kaplan-Meier (KM) Statistics**											
1027					Approximate Chi Square Value (4.69, α)	1.014				Adjusted Chi Square Value (4.69, β)	0.837	
1028					95% KM Approximate Gamma UCL	0.908				95% KM Adjusted Gamma UCL	1.1	
1029												
1030	**Lognormal GOF Test on Detected Observations Only**											
1031					Shapiro Wilk Test Statistic	0.826				**Shapiro Wilk GOF Test**		
1032					10% Shapiro Wilk Critical Value	0.901				Detected Data Not Lognormal at 10% Significance Level		
1033					Lilliefors Test Statistic	0.196				**Lilliefors GOF Test**		
1034					10% Lilliefors Critical Value	0.202				Detected Data appear Lognormal at 10% Significance Level		
1035	**Detected Data appear Approximate Lognormal at 10% Significance Level**											
1036												
1037	**Lognormal ROS Statistics Using Imputed Non-Detects**											
1038					Mean in Original Scale	0.195				Mean in Log Scale	-3.042	
1039					SD in Original Scale	0.563				SD in Log Scale	1.422	
1040					95% t UCL (assumes normality of ROS data)	0.442				95% Percentile Bootstrap UCL	0.47	
1041					95% BCA Bootstrap UCL	0.622				95% Bootstrap t UCL	2.857	
1042					95% H-UCL (Log ROS)	0.458						
1043												
1044	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**											
1045					KM Mean (logged)	-2.942				KM Geo Mean	0.0528	
1046					KM SD (logged)	1.226				95% Critical H Value (KM-Log)	3.069	
1047					KM Standard Error of Mean (logged)	0.317				95% H-UCL (KM -Log)	0.296	
1048					KM SD (logged)	1.226				95% Critical H Value (KM-Log)	3.069	
1049					KM Standard Error of Mean (logged)	0.317						
1050												

	A	B	C	D	E	F	G	H	I	J	K	L
1051	**DL/2 Statistics**											
1052	**DL/2 Normal**						**DL/2 Log-Transformed**					
1053	Mean in Original Scale					0.196	Mean in Log Scale					-2.985
1054	SD in Original Scale					0.563	SD in Log Scale					1.321
1055	95% t UCL (Assumes normality)					0.442	95% H-Stat UCL					0.364
1056	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
1057												
1058	**Nonparametric Distribution Free UCL Statistics**											
1059	**Detected Data appear Approximate Lognormal Distributed at 10% Significance Level**											
1060												
1061	**Suggested UCL to Use**											
1062	KM H-UCL					0.296						
1063												
1064	**The calculated UCLs are based on assumptions that the data were collected in a random and unbiased manner.**											
1065	**Please verify the data were collected from random locations.**											
1066	**If the data were collected using judgmental or other non-random methods,**											
1067	**then contact a statistician to correctly calculate UCLs.**											
1068												
1069	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
1070	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
1071	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
1072												

ATTACHMENT D

DERAC OUTPUTS

SHALLOW SOIL DERAC OUTPUT

Project Number 16530
Verdantas LLC

Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
ρ_b (dry soil bulk density) g/cm ^{3}	1.5	1.5
ρ_b (dry soil bulk density - mass limit) g/cm ^{3}	1.5	1.5
PEF (particulate emission factor) m ^{3}/kg	1359344438	1359344438
ρ_s (soil particle density) g/cm ^{3}	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (mutagenic skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{2-6} (mutagenic skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{6-16} (mutagenic skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{16-26} (mutagenic skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{res-a} (skin adherence factor - adult) mg/cm ^{2}	0.07	0.07
AF_{res-c} (skin adherence factor - child) mg/cm ^{2}	0.2	0.2
AT_{res} (averaging time - resident carcinogenic)	365	365

Output generated 31AUG2023:09:24:31

Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Site-Specific Value
BW_{0-2} (mutagenic body weight) kg	15	15
BW_{2-6} (mutagenic body weight) kg	15	15
BW_{6-16} (mutagenic body weight) kg	80	80
BW_{16-26} (mutagenic body weight) kg	80	80
BW_{res-a} (body weight - adult) kg	80	80
BW_{res-c} (body weight - child) kg	15	15
$DFS_{res-adj}$ (age-adjusted soil dermal factor) mg/kg	103390	103390
$DFSM_{res-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	428260	428260
ED_{res} (exposure duration) years	26	26
ED_{0-2} (mutagenic exposure duration) years	2	2
ED_{2-6} (mutagenic exposure duration) years	4	4
ED_{6-16} (mutagenic exposure duration) years	10	10
ED_{16-26} (mutagenic exposure duration) years	10	10
ED_{res-a} (exposure duration - adult) years	20	20
ED_{res-c} (exposure duration - child) years	6	6
EF_{res} (exposure frequency) days/year	350	350
EF_{0-2} (mutagenic exposure frequency) days/year	350	350
EF_{2-6} (mutagenic exposure frequency) days/year	350	350
EF_{6-16} (mutagenic exposure frequency) days/year	350	350
EF_{16-26} (mutagenic exposure frequency) days/year	350	350
EF_{res-a} (exposure frequency - adult) days/year	350	350
EF_{res-c} (exposure frequency - child) days/year	350	350
ET_{res} (exposure time) hours/day	24	24
ET_{0-2} (mutagenic exposure time) hours/day	24	24
ET_{2-6} (mutagenic exposure time) hours/day	24	24
ET_{6-16} (mutagenic exposure time) hours/day	24	24
ET_{16-26} (mutagenic exposure time) hours/day	24	24
ET_{res-a} (adult exposure time) hours/day	24	24
ET_{res-c} (child exposure time) hours/day	24	24
$IFS_{res-adj}$ (age-adjusted soil ingestion factor) mg/kg	36750	36750
$IFSM_{res-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	166833.3	166833.3

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Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Site-Specific Value
IRS_{0-2} (mutagenic soil intake rate) mg/day	200	200
IRS_{2-6} (mutagenic soil intake rate) mg/day	200	200
IRS_{6-16} (mutagenic soil intake rate) mg/day	100	100
IRS_{16-26} (mutagenic soil intake rate) mg/day	100	100
IRS_{res-a} (soil intake rate - adult) mg/day	100	100
IRS_{res-c} (soil intake rate - child) mg/day	200	200
LT (lifetime) years	70	70
SA_{0-2} (mutagenic skin surface area) cm^2/day	2373	2373
SA_{2-6} (mutagenic skin surface area) cm^2/day	2373	2373
SA_{6-16} (mutagenic skin surface area) cm^2/day	6032	6032
SA_{16-26} (mutagenic skin surface area) cm^2/day	6032	6032
SA_{res-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{res-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 31AUG2023:09:24:31

Site-specific Risk
Resident for Soil

Chemical	CAS Number	Mutagen?	VOC?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	SF_o $(mg/kg\text{-}day)^{-1}$	SF_o Ref	IUR $(ug/m^3)^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}
Benz[a]anthracene	56-55-3	Yes	Yes	-		-		1.00E-01	IRIS Current	6.00E-05	IRIS Current	1	0.13
Benzo[a]pyrene	50-32-8	Yes	No	3.00E-04	IRIS Current	2.00E-06	IRIS Current	1.00E+00	IRIS Current	6.00E-04	IRIS Current	1	0.13
Benzo[b]fluoranthene	205-99-2	Yes	No	-		-		1.00E-01	IRIS Current	6.00E-05	IRIS Current	1	0.13
Cobalt	7440-48-4	No	No	3.00E-04	PPRTV Current	6.00E-06	PPRTV Current	-		9.00E-03	PPRTV Current	1	-
Thallium (Soluble Salts)	7440-28-0	No	No	1.00E-05	SCREEN Current	-		-		-		1	-
Vanadium and Compounds	7440-62-2	No	No	5.04E-03	SURROGATE	1.00E-04	ATSDR Final	-		-		0.026	-
**Total Risk/HI*				-		-		-		-		-	-

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Site-specific Risk
Resident for Soil

Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref
4.41E+06	-	4.41E+06	6.83E-10	1.36E+09	-	1	1.20E-05	4.91E-04	PHYSPROP	4.91E-04	7.11E+02	PHYSPROP
-	-	-	-	1.36E+09	-	1	4.57E-07	1.87E-05	PHYSPROP	1.87E-05	7.68E+02	PHYSPROP
-	-	-	-	1.36E+09	-	1	6.57E-07	2.69E-05	PHYSPROP	2.69E-05	7.16E+02	EPI
-	-	-	-	1.36E+09	-	1	-	-		-	3.20E+03	CRC
-	-	-	-	1.36E+09	-	1	-	-		-	1.73E+03	PHYSPROP
-	-	-	-	1.36E+09	-	1	-	-		-	3.68E+03	CRC
-	-	-	-	-	-	-	-	-		-	-	

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Site-specific Risk
Resident for Soil

Critical Temperature T_c\ (K)	T_c\ Ref	D_{ia}\ (cm^2/s)	D_{iw}\ (cm^2/s)	Soil Concentration (mg/kg)	Child Ingestion Noncarcinogenic CDI (mg/kg-day)	Child Dermal Noncarcinogenic CDI (mg/kg-day)	Child Inhalation Noncarcinogenic CDI (mg/m^3)	Adult Ingestion Noncarcinogenic CDI (mg/kg-day)	Adult Dermal Noncarcinogenic CDI (mg/kg-day)
9.79E+02	YAWS	2.61E-02	6.75E-06	3	3.84E-05	1.18E-05	6.54E-07	3.60E-06	1.97E-06
9.69E+02	EPA 2001 Fact Sheet	2.55E-02	6.58E-06	3.1	3.96E-05	1.22E-05	2.19E-09	3.72E-06	2.04E-06
9.69E+02	EPA 2001 Fact Sheet	2.50E-02	6.43E-06	1.96	2.51E-05	7.73E-06	1.38E-09	2.35E-06	1.29E-06
7.40E+03	YAWS	-	-	39.04	4.99E-04	-	2.75E-08	4.68E-05	-
4.65E+03	YAWS	-	-	0.17	2.17E-06	-	1.20E-10	2.04E-07	-
1.13E+04	YAWS	-	-	134.5	1.72E-03	-	9.49E-08	1.61E-04	-
-		-	-	-	-	-	-	-	-

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Site-specific Risk
Resident for Soil

Adult Inhalation Noncarcinogenic CDI (mg/m^3)	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)	Adjusted Dermal Noncarcinogenic CDI (mg/kg-day)	Adjusted Inhalation Noncarcinogenic CDI (mg/m^3)	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Child Ingestion HQ	Child Dermal HQ	Child Inhalation HQ
6.54E-07	1.16E-05	4.25E-06	6.54E-07	1.96E-05	6.54E-06	6.73E-04	-	-	-
2.19E-09	1.20E-05	4.39E-06	2.19E-09	2.02E-05	6.75E-06	2.25E-06	**1.32E-01**	4.08E-02	1.09E-03
1.38E-09	7.59E-06	2.78E-06	1.38E-09	1.28E-05	4.27E-06	1.42E-06	-	-	-
2.75E-08	1.51E-04	-	2.75E-08	5.62E-05	-	1.02E-05	**1.66E+00**	-	4.59E-03
1.20E-10	6.58E-07	-	1.20E-10	2.45E-07	-	4.45E-08	**2.17E-01**	-	-
9.49E-08	5.21E-04	-	9.49E-08	1.93E-04	-	3.52E-05	**3.41E-01**	-	9.49E-04
-	-	-	-	-	-	-	***2.35E+00***	*4.08E-02*	*6.63E-03*

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Site-specific Risk
Resident for Soil

Child Total HI	Adult Ingestion HQ	Adult Dermal HQ	Adult Inhalation HQ	Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
-	-	-	-	-	-	-	-	-	1.96E-06	6.54E-07	4.04E-08	2.65E-06
1.74E-01	1.24E-02	6.80E-03	1.09E-03	2.03E-02	4.00E-02	1.46E-02	1.09E-03	5.57E-02	2.02E-05	6.75E-06	1.35E-09	2.70E-05
-	-	-	-	-	-	-	-	-	1.28E-06	4.27E-07	8.53E-11	1.71E-06
1.67E+00	1.56E-01	-	4.59E-03	1.61E-01	5.04E-01	-	4.59E-03	5.09E-01	-	-	9.21E-08	9.21E-08
2.17E-01	2.04E-02	-	-	2.04E-02	6.58E-02	-	-	6.58E-02	-	-	-	-
3.42E-01	3.20E-02	-	9.49E-04	3.29E-02	1.03E-01	-	9.49E-04	1.04E-01	-	-	-	-
2.40E+00	*2.21E-01*	*6.80E-03*	*6.63E-03*	*2.34E-01*	*7.13E-01*	*1.46E-02*	*6.63E-03*	*7.34E-01*	*2.35E-05*	*7.84E-06*	*1.34E-07*	*3.15E-05*

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Site-specific Risk
Outdoor Worker Soil Inputs

Variable	Outdoor Worker Soil Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_h (dry soil bulk density) g/cm ^{3}	1.5	1.5
p_h (dry soil bulk density - mass limit) g/cm ^{3}	1.5	1.5
PEF (particulate emission factor) m ^{3}/kg	1359344438	1359344438
p_s (soil particle density) g/cm ^{3}	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{out} (skin adherence factor - outdoor worker) mg/cm ^{2}	0.12	0.12
AT_{out} (averaging time - outdoor worker)	365	365
BW_{out} (body weight - outdoor worker)	80	80
ED_{out} (exposure duration - outdoor worker) yr	25	25
EF_{out} (exposure frequency - outdoor worker) day/yr	225	225
ET_{out} (exposure time - outdoor worker) hr	8	8

Output generated 29AUG2023:08:48:37

Site-specific Risk
Outdoor Worker Soil Inputs

Variable	Outdoor Worker Soil Default Value	Site-Specific Value
IRS_{out} (soil ingestion rate - outdoor worker) mg/day	100	100
LT (lifetime) yr	70	70
SA_{out} (surface area - outdoor worker) cm^2/day	3527	3527
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 29AUG2023:08:48:37

Site-specific Risk
Outdoor Worker for Soil

Chemical	CAS Number	Mutagen?	VOC?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	SF_o $(mg/kg\text{-}day)^{-1}$	SF_o Ref	IUR $(ug/m^3)^{-1}$	IUR Ref	ABS_{gi}
Benz[a]anthracene	56-55-3	Yes	Yes	-		-		1.00E-01	IRIS Current	6.00E-05	IRIS Current	1
Benzo[a]pyrene	50-32-8	Yes	No	3.00E-04	IRIS Current	2.00E-06	IRIS Current	1.00E+00	IRIS Current	6.00E-04	IRIS Current	1
Benzo[b]fluoranthene	205-99-2	Yes	No	-		-		1.00E-01	IRIS Current	6.00E-05	IRIS Current	1
Cobalt	7440-48-4	No	No	3.00E-04	PPRTV Current	6.00E-06	PPRTV Current	-		9.00E-03	PPRTV Current	1
Thallium (Soluble Salts)	7440-28-0	No	No	1.00E-05	SCREEN Current	-		-		-		1
Vanadium and Compounds	7440-62-2	No	No	5.04E-03	SURROGATE	1.00E-04	ATSDR Final	-		-		0.026
**Total Risk/HI*				-		-		-		-		-

Output generated 29AUG2023:08:48:37

Site-specific Risk
Outdoor Worker for Soil

ABS_{derm}	Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)
0.13	4.41E+06	-	4.41E+06	6.83E-10	1.36E+09	-	1.20E-05	4.91E-04	PHYSPROP	4.91E-04
0.13	-	-	-	-	1.36E+09	-	4.57E-07	1.87E-05	PHYSPROP	1.87E-05
0.13	-	-	-	-	1.36E+09	-	6.57E-07	2.69E-05	PHYSPROP	2.69E-05
-	-	-	-	-	1.36E+09	-	-	-		-
-	-	-	-	-	1.36E+09	-	-	-		-
-	-	-	-	-	1.36E+09	-	-	-		-
-	-	-	-	-	-	-	-	-		-

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Site-specific Risk
Outdoor Worker for Soil

Normal Boiling Point BP (K)	BP Ref	Critical Temperature T_C (K)	T_C Ref	D_{ia} (cm^2/s)	D_{iw} (cm^2/s)	Soil Concentration (mg/kg)	Ingestion Noncarcinogenic CDI (mg/kg-day)	Dermal Noncarcinogenic CDI (mg/kg-day)	Inhalation Noncarcinogenic CDI (mg/m^3)
7.11E+02	PHYSPROP	9.79E+02	YAWS	2.61E-02	6.75E-06	1.96	1.51E-06	8.31E-07	9.16E-08
7.68E+02	PHYSPROP	9.69E+02	EPA 2001 Fact Sheet	2.55E-02	6.58E-06	3.1	2.39E-06	1.31E-06	4.69E-10
7.16E+02	EPI	9.69E+02	EPA 2001 Fact Sheet	2.50E-02	6.43E-06	3	2.31E-06	1.27E-06	4.53E-10
3.20E+03	CRC	7.40E+03	YAWS	-	-	39.04	3.01E-05	-	5.90E-09
1.73E+03	PHYSPROP	4.65E+03	YAWS	-	-	0.17	1.31E-07	-	2.57E-11
3.68E+03	CRC	1.13E+04	YAWS	-	-	134.5	1.04E-04	-	2.03E-08
-		-		-	-	-	-	-	-

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Site-specific Risk
Outdoor Worker for Soil

Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Ingestion HQ	Dermal HQ	Inhalation HQ	Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
5.39E-07	2.97E-07	3.27E-05	-	-	-	-	5.39E-08	2.97E-08	1.96E-09	8.56E-08
8.53E-07	4.69E-07	1.67E-07	7.96E-03	4.38E-03	2.34E-04	1.26E-02	8.53E-07	4.69E-07	1.00E-10	**1.32E-06**
8.26E-07	4.54E-07	1.62E-07	-	-	-	-	8.26E-08	4.54E-08	9.72E-12	1.28E-07
1.07E-05	-	2.11E-06	**1.00E-01**	-	9.84E-04	**1.01E-01**	-	-	1.90E-08	1.90E-08
4.68E-08	-	9.18E-09	1.31E-02	-	-	1.31E-02	-	-	-	-
3.70E-05	-	7.26E-06	2.06E-02	-	2.03E-04	2.08E-02	-	-	-	-
-	-	-	***1.42E-01***	*4.38E-03*	*1.42E-03*	***1.48E-01***	*9.90E-07*	*5.44E-07*	*2.10E-08*	***1.56E-06***

Output generated 29AUG2023:08:48:37

Site-specific Risk
Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_h (dry soil bulk density) g/cm ^{3}	1.5	1.5
p_h (dry soil bulk density - mass limit) g/cm ^{3}	1.5	1.5
PEF (particulate emission factor) m ^{3}/kg	1359344438	1359344438
p_s (soil particle density) g/cm ^{3}	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{ew} (skin adherence factor - excavation worker) mg/cm ^{2}	0.3	0.3
AT_{ew} (averaging time - excavation worker)	365	365
BW_{ew} (body weight - excavation worker) kg	80	80
ED_{ew} (exposure duration - excavation worker) yr	1	1
EF_{ew} (exposure frequency - excavation worker) day/yr	20	20
ET_{ew} (exposure time - excavation worker) hr	8	8

Output generated 29AUG2023:08:51:35

Site-specific Risk
Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Site-Specific Value
IR_{ew} (soil ingestion rate - excavation worker) mg/day	330	330
LT (lifetime) yr	70	70
SA_{ew} (surface area - excavation worker) cm^2/day	3527	3527
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 29AUG2023:08:51:35

Site-specific Risk
Excavation Worker for Soil

Chemical	CAS Number	Mutagen?	VOC?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	SF_o $(mg/kg\text{-}day)^{-1}$	SF_o Ref	IUR $(ug/m^3)^{-1}$	IUR Ref	ABS_{gi}
Benz[a]anthracene	56-55-3	Yes	Yes	-		-		1.00E-01	IRIS Current	6.00E-05	IRIS Current	1
Benzo[a]pyrene	50-32-8	Yes	No	3.00E-04	IRIS Current	2.00E-06	IRIS Current	1.00E+00	IRIS Current	6.00E-04	IRIS Current	1
Benzo[b]fluoranthene	205-99-2	Yes	No	-		-		1.00E-01	IRIS Current	6.00E-05	IRIS Current	1
Cobalt	7440-48-4	No	No	3.00E-03	PPRTV Current	2.00E-05	PPRTV Current	-		9.00E-03	PPRTV Current	1
Thallium (Soluble Salts)	7440-28-0	No	No	4.00E-05	SCREEN Current	-		-		-		1
Vanadium and Compounds	7440-62-2	No	No	1.00E-02	ATSDR Final	1.00E-04	ATSDR Final	-		-		0.026
*Total Risk/HI				-		-		-		-		-

Output generated 29AUG2023:08:51:35

Site-specific Risk
Excavation Worker for Soil

ABS_{derm}	Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)
0.13	4.41E+06	-	4.41E+06	6.83E-10	1.36E+09	-	1.20E-05	4.91E-04	PHYSPROP	4.91E-04
0.13	-	-	-	-	1.36E+09	-	4.57E-07	1.87E-05	PHYSPROP	1.87E-05
0.13	-	-	-	-	1.36E+09	-	6.57E-07	2.69E-05	PHYSPROP	2.69E-05
-	-	-	-	-	1.36E+09	-	-	-		-
-	-	-	-	-	1.36E+09	-	-	-		-
-	-	-	-	-	1.36E+09	-	-	-		-
-	-	-	-	-	-	-	-	-		-

Output generated 29AUG2023:08:51:35

Site-specific Risk
Excavation Worker for Soil

Normal Boiling Point BP (K)	BP Ref	Critical Temperature T_C (K)	T_C Ref	D_{ia} (cm^2/s)	D_{iw} (cm^2/s)	Soil Concentration (mg/kg)	Ingestion Noncarcinogenic CDI (mg/kg-day)	Dermal Noncarcinogenic CDI (mg/kg-day)	Inhalation Noncarcinogenic CDI (mg/m^3)
7.11E+02	PHYSPROP	9.79E+02	YAWS	2.61E-02	6.75E-06	1.96	4.43E-07	1.85E-07	8.14E-09
7.68E+02	PHYSPROP	9.69E+02	EPA 2001 Fact Sheet	2.55E-02	6.58E-06	3.1	7.01E-07	2.92E-07	4.17E-11
7.16E+02	EPI	9.69E+02	EPA 2001 Fact Sheet	2.50E-02	6.43E-06	3	6.78E-07	2.83E-07	4.03E-11
3.20E+03	CRC	7.40E+03	YAWS	-	-	39.04	8.82E-06	-	5.25E-10
1.73E+03	PHYSPROP	4.65E+03	YAWS	-	-	0.17	3.84E-08	-	2.28E-12
3.68E+03	CRC	1.13E+04	YAWS	-	-	134.5	3.04E-05	-	1.81E-09
-		-		-	-	-	-	-	-

Output generated 29AUG2023:08:51:35

Site-specific Risk
Excavation Worker for Soil

Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Ingestion HQ	Dermal HQ	Inhalation HQ	Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
6.33E-09	2.64E-09	1.16E-07	-	-	-	-	6.33E-10	2.64E-10	6.98E-12	9.04E-10
1.00E-08	4.17E-09	5.95E-10	2.34E-03	9.74E-04	2.08E-05	3.33E-03	1.00E-08	4.17E-09	3.57E-13	1.42E-08
9.69E-09	4.04E-09	5.76E-10	-	-	-	-	9.69E-10	4.04E-10	3.46E-14	1.37E-09
1.26E-07	-	7.49E-09	2.94E-03	-	2.62E-05	2.97E-03	-	-	6.74E-11	6.74E-11
5.49E-10	-	3.26E-11	9.61E-04	-	-	9.61E-04	-	-	-	-
4.34E-07	-	2.58E-08	3.04E-03	-	1.81E-05	3.06E-03	-	-	-	-
-	*-*	*-*	*9.28E-03*	*9.74E-04*	*6.51E-05*	*1.03E-02*	*1.16E-08*	*4.84E-09*	*7.48E-11*	*1.65E-08*

Output generated 29AUG2023:08:51:35

Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_h (dry soil bulk density) g/cm ^{3}	1.5	1.5
p_h (dry soil bulk density - mass limit) g/cm ^{3}	1.5	1.5
PEF (particulate emission factor) m ^{3}/kg	1359344438	1359344438
p_s (soil particle density) g/cm ^{3}	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{2-6} (skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{6-16} (skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{16-30} (skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{rec-a} (skin adherence factor - adult) mg/cm ^{2}	0.07	0.07
AF_{rec-c} (skin adherence factor - child) mg/cm ^{2}	0.2	0.2
AT_{rec} (averaging time)	365	365

Output generated 29AUG2023:08:56:49

Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific Value
BW_{0-2} (body weight) kg	15	15
BW_{2-6} (body weight) kg	15	15
BW_{6-16} (body weight) kg	80	80
BW_{16-30} (body weight) kg	80	80
BW_{rec-a} (body weight - adult) kg	80	80
BW_{rec-c} (body weight - child) kg	15	15
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	22155	22155
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	91770	91770
ED_{rec} (exposure duration - recreator) years	26	26
ED_{0-2} (exposure duration) year	2	2
ED_{2-6} (exposure duration) year	4	4
ED_{6-16} (exposure duration) year	10	10
ED_{16-30} (exposure duration) year	10	10
ED_{rec-c} (exposure duration - child) years	6	6
EF_{rec} (exposure frequency) days/year	75	75
EF_{0-2} (exposure frequency) days/year	75	75
EF_{2-6} (exposure frequency) days/year	75	75
EF_{6-16} (exposure frequency) days/year	75	75
EF_{16-30} (exposure frequency) days/year	75	75
EF_{rec-a} (exposure frequency - adult) days/year	75	75
EF_{rec-c} (exposure frequency - child) days/year	75	75
ET_{rec} (exposure time - recreator) hours/day	1	1
ET_{0-2} (exposure time) hours/day	1	1
ET_{2-6} (exposure time) hours/day	1	1
ET_{6-16} (exposure time) hours/day	1	1
ET_{16-30} (exposure time) hours/day	1	1
ET_{rec-a} (adult exposure time) hours/day	1	1
ET_{rec-c} (child exposure time) hours/day	1	1
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	7875	7875
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	35750	35750
IRS_{0-2} (soil intake rate) mg/day	200	200

Output generated 29AUG2023:08:56:49

Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific Value
IRS_{2-6} (soil intake rate) mg/day	200	200
IRS_{6-16} (soil intake rate) mg/day	100	100
IRS_{16-30} (soil intake rate) mg/day	100	100
IRS_{rec-a} (soil intake rate - adult) mg/day	100	100
IRS_{rec-c} (soil intake rate - child) mg/day	200	200
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm^2/day	2373	2373
SA_{2-6} (skin surface area) cm^2/day	2373	2373
SA_{6-16} (skin surface area) cm^2/day	6032	6032
SA_{16-30} (skin surface area) cm^2/day	6032	6032
SA_{rec-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{rec-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

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Site-specific Risk
Recreator for Soil/Sediment

Chemical	CAS Number	Mutagen?	VOC?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	SF_o $(mg/kg\text{-}day)^{-1}$	SF_o Ref	IUR $(ug/m^3)^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}
Benz[a]anthracene	56-55-3	Yes	Yes	-		-		1.00E-01	IRIS Current	6.00E-05	IRIS Current	1	0.13
Benzo[a]pyrene	50-32-8	Yes	No	3.00E-04	IRIS Current	2.00E-06	IRIS Current	1.00E+00	IRIS Current	6.00E-04	IRIS Current	1	0.13
Benzo[b]fluoranthene	205-99-2	Yes	No	-		-		1.00E-01	IRIS Current	6.00E-05	IRIS Current	1	0.13
Cobalt	7440-48-4	No	No	3.00E-04	PPRTV Current	6.00E-06	PPRTV Current	-		9.00E-03	PPRTV Current	1	-
Thallium (Soluble Salts)	7440-28-0	No	No	1.00E-05	SCREEN Current	-		-		-		1	-
Vanadium and Compounds	7440-62-2	No	No	5.04E-03	SURROGATE	1.00E-04	ATSDR Final	-		-		0.026	-
**Total Risk/HI*				-		-		-		-		-	-

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Site-specific Risk
Recreator for Soil/Sediment

Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref
4.41E+06	-	4.41E+06	6.83E-10	1.36E+09	-	1	1.20E-05	4.91E-04	PHYSPROP	4.91E-04	7.11E+02	PHYSPROP
-	-	-	-	1.36E+09	-	1	4.57E-07	1.87E-05	PHYSPROP	1.87E-05	7.68E+02	PHYSPROP
-	-	-	-	1.36E+09	-	1	6.57E-07	2.69E-05	PHYSPROP	2.69E-05	7.16E+02	EPI
-	-	-	-	1.36E+09	-	1	-	-		-	3.20E+03	CRC
-	-	-	-	1.36E+09	-	1	-	-		-	1.73E+03	PHYSPROP
-	-	-	-	1.36E+09	-	1	-	-		-	3.68E+03	CRC
-	-	-	-	-	-	-	-	-		-	-	

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Site-specific Risk
Recreator for Soil/Sediment

Critical Temperature T_c\ (K)	T_c\ Ref	D_{ia}\ (cm^2/s)	D_{iw}\ (cm^2/s)	Soil Concentration (mg/kg)	Child Ingestion Noncarcinogenic CDI (mg/kg-day)	Child Dermal Noncarcinogenic CDI (mg/kg-day)	Child Inhalation Noncarcinogenic CDI (mg/m^3)	Adult Ingestion Noncarcinogenic CDI (mg/kg-day)	Adult Dermal Noncarcinogenic CDI (mg/kg-day)
9.79E+02	YAWS	2.61E-02	6.75E-06	3	8.22E-06	2.54E-06	5.84E-09	7.71E-07	4.23E-07
9.69E+02	EPA 2001 Fact Sheet	2.55E-02	6.58E-06	3.1	8.49E-06	2.62E-06	1.95E-11	7.96E-07	4.37E-07
9.69E+02	EPA 2001 Fact Sheet	2.50E-02	6.43E-06	1.96	5.37E-06	1.66E-06	1.23E-11	5.03E-07	2.76E-07
7.40E+03	YAWS	-	-	39.04	1.07E-04	-	2.46E-10	1.00E-05	-
4.65E+03	YAWS	-	-	0.17	4.66E-07	-	1.07E-12	4.37E-08	-
1.13E+04	YAWS	-	-	134	3.67E-04	-	8.44E-10	3.44E-05	-
-		-	-	-	-	-	-	-	-

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Site-specific Risk
Recreator for Soil/Sediment

Adult Inhalation Noncarcinogenic CDI (mg/m^3)	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)	Adjusted Dermal Noncarcinogenic CDI (mg/kg-day)	Adjusted Inhalation Noncarcinogenic CDI (mg/m^3)	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Child Ingestion HQ	Child Dermal HQ	Child Inhalation HQ
5.84E-09	2.49E-06	9.10E-07	5.84E-09	4.20E-06	1.40E-06	6.01E-06	-	-	-
1.95E-11	2.57E-06	9.41E-07	1.95E-11	4.34E-06	1.45E-06	2.01E-08	2.83E-02	8.73E-03	9.76E-06
1.23E-11	1.63E-06	5.95E-07	1.23E-11	2.74E-06	9.15E-07	1.27E-08	-	-	-
2.46E-10	3.24E-05	-	2.46E-10	1.20E-05	-	9.13E-08	**3.57E-01**	-	4.10E-05
1.07E-12	1.41E-07	-	1.07E-12	5.24E-08	-	3.98E-10	4.66E-02	-	-
8.44E-10	1.11E-04	-	8.44E-10	4.13E-05	-	3.13E-07	7.28E-02	-	8.44E-06
-	-	-	-	-	-	-	***5.04E-01***	*8.73E-03*	*5.92E-05*

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Site-specific Risk
Recreator for Soil/Sediment

Child Total HI	Adult Ingestion HQ	Adult Dermal HQ	Adult Inhalation HQ	Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
-	-	-	-	-	-	-	-	-	4.20E-07	1.40E-07	3.61E-10	5.60E-07
3.71E-02	2.65E-03	1.46E-03	9.76E-06	4.12E-03	8.57E-03	3.14E-03	9.76E-06	1.17E-02	**4.34E-06**	**1.45E-06**	1.20E-11	**5.79E-06**
-	-	-	-	-	-	-	-	-	2.74E-07	9.15E-08	7.62E-13	3.66E-07
3.57E-01	3.34E-02	-	4.10E-05	3.35E-02	**1.08E-01**	-	4.10E-05	**1.08E-01**	-	-	8.22E-10	8.22E-10
4.66E-02	4.37E-03	-	-	4.37E-03	1.41E-02	-	-	1.41E-02	-	-	-	-
7.29E-02	6.83E-03	-	8.44E-06	6.84E-03	2.21E-02	-	8.44E-06	2.21E-02	-	-	-	-
5.13E-01	*4.73E-02*	*1.46E-03*	*5.92E-05*	*4.88E-02*	***1.53E-01***	*3.14E-03*	*5.92E-05*	***1.56E-01***	*5.03E-06*	*1.68E-06*	*1.20E-09*	*6.71E-06*

Output generated 29AUG2023:08:56:49

COMBINED SOIL DERAC OUTPUT

Project Number 16530
Verdantas LLC

Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_h (dry soil bulk density) g/cm ^{3}	1.5	1.5
p_h (dry soil bulk density - mass limit) g/cm ^{3}	1.5	1.5
PEF (particulate emission factor) m ^{3}/kg	1359344438	1359344438
p_s (soil particle density) g/cm ^{3}	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (mutagenic skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{2-6} (mutagenic skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{6-16} (mutagenic skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{16-26} (mutagenic skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{res-a} (skin adherence factor - adult) mg/cm ^{2}	0.07	0.07
AF_{res-c} (skin adherence factor - child) mg/cm ^{2}	0.2	0.2
AT_{res} (averaging time - resident carcinogenic)	365	365

Output generated 29AUG2023:09:14:54

Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Site-Specific Value
BW_{0-2} (mutagenic body weight) kg	15	15
BW_{2-6} (mutagenic body weight) kg	15	15
BW_{6-16} (mutagenic body weight) kg	80	80
BW_{16-26} (mutagenic body weight) kg	80	80
BW_{res-a} (body weight - adult) kg	80	80
BW_{res-c} (body weight - child) kg	15	15
$DFS_{res-adj}$ (age-adjusted soil dermal factor) mg/kg	103390	103390
$DFSM_{res-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	428260	428260
ED_{res} (exposure duration) years	26	26
ED_{0-2} (mutagenic exposure duration) years	2	2
ED_{2-6} (mutagenic exposure duration) years	4	4
ED_{6-16} (mutagenic exposure duration) years	10	10
ED_{16-26} (mutagenic exposure duration) years	10	10
ED_{res-a} (exposure duration - adult) years	20	20
ED_{res-c} (exposure duration - child) years	6	6
EF_{res} (exposure frequency) days/year	350	350
EF_{0-2} (mutagenic exposure frequency) days/year	350	350
EF_{2-6} (mutagenic exposure frequency) days/year	350	350
EF_{6-16} (mutagenic exposure frequency) days/year	350	350
EF_{16-26} (mutagenic exposure frequency) days/year	350	350
EF_{res-a} (exposure frequency - adult) days/year	350	350
EF_{res-c} (exposure frequency - child) days/year	350	350
ET_{res} (exposure time) hours/day	24	24
ET_{0-2} (mutagenic exposure time) hours/day	24	24
ET_{2-6} (mutagenic exposure time) hours/day	24	24
ET_{6-16} (mutagenic exposure time) hours/day	24	24
ET_{16-26} (mutagenic exposure time) hours/day	24	24
ET_{res-a} (adult exposure time) hours/day	24	24
ET_{res-c} (child exposure time) hours/day	24	24
$IFS_{res-adj}$ (age-adjusted soil ingestion factor) mg/kg	36750	36750
$IFSM_{res-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	166833.3	166833.3

Output generated 29AUG2023:09:14:54

Site-specific Risk
Resident Soil Inputs

Variable	Resident Soil Default Value	Site-Specific Value
IRS_{0-2} (mutagenic soil intake rate) mg/day	200	200
IRS_{2-6} (mutagenic soil intake rate) mg/day	200	200
IRS_{6-16} (mutagenic soil intake rate) mg/day	100	100
IRS_{16-26} (mutagenic soil intake rate) mg/day	100	100
IRS_{res-a} (soil intake rate - adult) mg/day	100	100
IRS_{res-c} (soil intake rate - child) mg/day	200	200
LT (lifetime) years	70	70
SA_{0-2} (mutagenic skin surface area) cm^2/day	2373	2373
SA_{2-6} (mutagenic skin surface area) cm^2/day	2373	2373
SA_{6-16} (mutagenic skin surface area) cm^2/day	6032	6032
SA_{16-26} (mutagenic skin surface area) cm^2/day	6032	6032
SA_{res-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{res-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 29AUG2023:09:14:54

Site-specific Risk
Resident for Soil

Chemical	CAS Number	Mutagen?	VOC?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	SF_o $(mg/kg\text{-}day)^{-1}$	SF_o Ref	IUR $(ug/m^3)^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}
Benzo[a]pyrene	50-32-8	Yes	No	3.00E-04	IRIS Current	2.00E-06	IRIS Current	1.00E+00	IRIS Current	6.00E-04	IRIS Current	1	0.13
Cobalt	7440-48-4	No	No	3.00E-04	PPRTV Current	6.00E-06	PPRTV Current	-		9.00E-03	PPRTV Current	1	-
Thallium (Soluble Salts)	7440-28-0	No	No	1.00E-05	SCREEN Current	-		-		-		1	-
*Total Risk/HI				-		-		-		-		-	-

Output generated 29AUG2023:09:14:54

Site-specific Risk
Resident for Soil

Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref
-	-	-	-	1.36E+09	-	1	4.57E-07	1.87E-05	PHYSPROP	1.87E-05	7.68E+02	PHYSPROP
-	-	-	-	1.36E+09	-	1	-	-		-	3.20E+03	CRC
-	-	-	-	1.36E+09	-	1	-	-		-	1.73E+03	PHYSPROP
-	-	-	-	-	-	-	-	-		-	-	

Output generated 29AUG2023:09:14:54

Site-specific Risk
Resident for Soil

Critical Temperature T_C\ (K)	T_C\ Ref	D_{ia}\ (cm^2/s)	D_{iw}\ (cm^2/s)	Soil Concentration (mg/kg)	Child Ingestion Noncarcinogenic CDI (mg/kg-day)	Child Dermal Noncarcinogenic CDI (mg/kg-day)	Child Inhalation Noncarcinogenic CDI (mg/m^3)	Adult Ingestion Noncarcinogenic CDI (mg/kg-day)	Adult Dermal Noncarcinogenic CDI (mg/kg-day)
9.69E+02	EPA 2001 Fact Sheet	2.55E-02	6.58E-06	0.59	7.54E-06	2.33E-06	4.16E-10	7.07E-07	3.88E-07
7.40E+03	YAWS	-	-	37.49	4.79E-04	-	2.64E-08	4.49E-05	-
4.65E+03	YAWS	-	-	0.17	2.17E-06	-	1.20E-10	2.04E-07	-
-		-	-	-	-	-	-	-	-

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Site-specific Risk
Resident for Soil

Adult Inhalation Noncarcinogenic CDI (mg/m^3)	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)	Adjusted Dermal Noncarcinogenic CDI (mg/kg-day)	Adjusted Inhalation Noncarcinogenic CDI (mg/m^3)	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Child Ingestion HQ	Child Dermal HQ	Child Inhalation HQ
4.16E-10	2.28E-06	8.36E-07	4.16E-10	3.85E-06	1.29E-06	4.28E-07	2.51E-02	7.76E-03	2.08E-04
2.64E-08	1.45E-04	-	2.64E-08	5.39E-05	-	9.82E-06	**1.60E+00**	-	4.41E-03
1.20E-10	6.58E-07	-	1.20E-10	2.45E-07	-	4.45E-08	**2.17E-01**	-	-
-	-	-	-	-	-	-	***1.84E+00***	*7.76E-03*	*4.62E-03*

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Site-specific Risk
Resident for Soil

Child Total HI	Adult Ingestion HQ	Adult Dermal HQ	Adult Inhalation HQ	Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
3.31E-02	2.36E-03	1.29E-03	2.08E-04	3.86E-03	7.62E-03	2.79E-03	2.08E-04	1.06E-02	3.85E-06	1.29E-06	2.57E-10	5.14E-06
1.60E+00	1.50E-01	-	4.41E-03	1.54E-01	4.84E-01	-	4.41E-03	4.88E-01	-	-	8.84E-08	8.84E-08
2.17E-01	2.04E-02	-	-	2.04E-02	6.58E-02	-	-	6.58E-02	-	-	-	-
1.85E+00	*1.73E-01*	*1.29E-03*	*4.62E-03*	*1.78E-01*	*5.57E-01*	*2.79E-03*	*4.62E-03*	*5.65E-01*	*3.85E-06*	*1.29E-06*	*8.87E-08*	*5.23E-06*

Output generated 29AUG2023:09:14:54

Site-specific Risk
Outdoor Worker Soil Inputs

Variable	Outdoor Worker Soil Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_h (dry soil bulk density) g/cm ^{3}	1.5	1.5
p_h (dry soil bulk density - mass limit) g/cm ^{3}	1.5	1.5
PEF (particulate emission factor) m ^{3}/kg	1359344438	1359344438
p_s (soil particle density) g/cm ^{3}	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{out} (skin adherence factor - outdoor worker) mg/cm ^{2}	0.12	0.12
AT_{out} (averaging time - outdoor worker)	365	365
BW_{out} (body weight - outdoor worker)	80	80
ED_{out} (exposure duration - outdoor worker) yr	25	25
EF_{out} (exposure frequency - outdoor worker) day/yr	225	225
ET_{out} (exposure time - outdoor worker) hr	8	8

Output generated 29AUG2023:09:02:38

Site-specific Risk
Outdoor Worker Soil Inputs

Variable	Outdoor Worker Soil Default Value	Site-Specific Value
IRS_{out} (soil ingestion rate - outdoor worker) mg/day	100	100
LT (lifetime) yr	70	70
SA_{out} (surface area - outdoor worker) cm^2/day	3527	3527
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 29AUG2023:09:02:38

Site-specific Risk
Outdoor Worker for Soil

Chemical	CAS Number	Mutagen?	VOC?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	SF_o $(mg/kg\text{-}day)^{-1}$	SF_o Ref	IUR $(ug/m^3)^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}
Benzo[a]pyrene	50-32-8	Yes	No	3.00E-04	IRIS Current	2.00E-06	IRIS Current	1.00E+00	IRIS Current	6.00E-04	IRIS Current	1	0.13
Cobalt	7440-48-4	No	No	3.00E-04	PPRTV Current	6.00E-06	PPRTV Current	-		9.00E-03	PPRTV Current	1	-
Thallium (Soluble Salts)	7440-28-0	No	No	1.00E-05	SCREEN Current	-		-		-		1	-
*Total Risk/HI				-		-		-		-		-	-

Output generated 29AUG2023:09:02:38

Site-specific Risk
Outdoor Worker for Soil

Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)
-	-	-	-	1.36E+09	-	4.57E-07	1.87E-05	PHYSPROP	1.87E-05	7.68E+02
-	-	-	-	1.36E+09	-	-	-		-	3.20E+03
-	-	-	-	1.36E+09	-	-	-		-	1.73E+03
-	-	-	-	-	-	-	-		-	-

Output generated 29AUG2023:09:02:38

Site-specific Risk
Outdoor Worker for Soil

BP Ref	Critical Temperature T_C \ (K)	T_C \ Ref	D_{ia} \ (cm^2/s)	D_{iw} \ (cm^2/s)	Soil Concentration (mg/kg)	Ingestion Noncarcinogenic CDI (mg/kg-day)	Dermal Noncarcinogenic CDI (mg/kg-day)	Inhalation Noncarcinogenic CDI (mg/m^3)	Ingestion Carcinogenic CDI (mg/kg-day)
PHYSPROP	9.69E+02	EPA 2001 Fact Sheet	2.55E-02	6.58E-06	0.59	4.55E-07	2.50E-07	8.92E-11	1.62E-07
CRC	7.40E+03	YAWS	-	-	37.49	2.89E-05	-	5.67E-09	1.03E-05
PHYSPROP	4.65E+03	YAWS	-	-	0.17	1.31E-07	-	2.57E-11	4.68E-08
	-		-	-	-	-	-	-	-

Output generated 29AUG2023:09:02:38

Site-specific Risk
Outdoor Worker for Soil

Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m³)	Ingestion HQ	Dermal HQ	Inhalation HQ	Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
8.93E-08	3.19E-08	1.52E-03	8.34E-04	4.46E-05	2.39E-03	1.62E-07	8.93E-08	1.91E-11	2.52E-07
-	2.02E-06	9.63E-02	-	9.45E-04	9.72E-02	-	-	1.82E-08	1.82E-08
-	9.18E-09	1.31E-02	-	-	1.31E-02	-	-	-	-
-	-	***1.11E-01***	*8.34E-04*	*9.89E-04*	***1.13E-01***	*1.62E-07*	*8.93E-08*	*1.82E-08*	*2.70E-07*

Output generated 29AUG2023:09:02:38

Site-specific Risk
Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
p_h (dry soil bulk density) g/cm ^{3}	1.5	1.5
p_h (dry soil bulk density - mass limit) g/cm ^{3}	1.5	1.5
PEF (particulate emission factor) m ^{3}/kg	1359344438	1359344438
p_s (soil particle density) g/cm ^{3}	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{ew} (skin adherence factor - excavation worker) mg/cm ^{2}	0.3	0.3
AT_{ew} (averaging time - excavation worker)	365	365
BW_{ew} (body weight - excavation worker) kg	80	80
ED_{ew} (exposure duration - excavation worker) yr	1	1
EF_{ew} (exposure frequency - excavation worker) day/yr	20	20
ET_{ew} (exposure time - excavation worker) hr	8	8

Output generated 29AUG2023:09:04:13

Site-specific Risk
Excavation Worker Soil Inputs

Variable	Excavation Worker Soil Default Value	Site-Specific Value
IR_{ew} (soil ingestion rate - excavation worker) mg/day	330	330
LT (lifetime) yr	70	70
SA_{ew} (surface area - excavation worker) cm^2/day	3527	3527
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 29AUG2023:09:04:13

Site-specific Risk
Excavation Worker for Soil

Chemical	CAS Number	Mutagen?	VOC?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	SF_o $(mg/kg\text{-}day)^{-1}$	SF_o Ref	IUR $(ug/m^3)^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}
Benzo[a]pyrene	50-32-8	Yes	No	3.00E-04	IRIS Current	2.00E-06	IRIS Current	1.00E+00	IRIS Current	6.00E-04	IRIS Current	1	0.13
Cobalt	7440-48-4	No	No	3.00E-03	PPRTV Current	2.00E-05	PPRTV Current	-		9.00E-03	PPRTV Current	1	-
Thallium (Soluble Salts)	7440-28-0	No	No	4.00E-05	SCREEN Current	-		-		-		1	-
*Total Risk/HI				-		-		-		-		-	-

Output generated 29AUG2023:09:04:13

Site-specific Risk
Excavation Worker for Soil

Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)
-	-	-	-	1.36E+09	-	4.57E-07	1.87E-05	PHYSPROP	1.87E-05	7.68E+02
-	-	-	-	1.36E+09	-	-	-		-	3.20E+03
-	-	-	-	1.36E+09	-	-	-		-	1.73E+03
-	-	-	-	-	-	-	-		-	-

Output generated 29AUG2023:09:04:13

Site-specific Risk
Excavation Worker for Soil

BP Ref	Critical Temperature T_c \ (K)	T_c \ Ref	D_{ia} \ (cm^2/s)	D_{iw} \ (cm^2/s)	Soil Concentration (mg/kg)	Ingestion Noncarcinogenic CDI (mg/kg-day)	Dermal Noncarcinogenic CDI (mg/kg-day)	Inhalation Noncarcinogenic CDI (mg/m^3)	Ingestion Carcinogenic CDI (mg/kg-day)
PHYSPROP	9.69E+02	EPA 2001 Fact Sheet	2.55E-02	6.58E-06	0.59	1.33E-07	5.56E-08	7.93E-12	1.91E-09
CRC	7.40E+03	YAWS	-	-	37.49	8.47E-06	-	5.04E-10	1.21E-07
PHYSPROP	4.65E+03	YAWS	-	-	0.17	3.84E-08	-	2.28E-12	5.49E-10
	-		-	-	-	-	-	-	-

Output generated 29AUG2023:09:04:13

Site-specific Risk
Excavation Worker for Soil

Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Ingestion HQ	Dermal HQ	Inhalation HQ	Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
7.94E-10	1.13E-10	4.45E-04	1.85E-04	3.96E-06	6.34E-04	1.91E-09	7.94E-10	6.80E-14	2.70E-09
-	7.20E-09	2.82E-03	-	2.52E-05	2.85E-03	-	-	6.48E-11	6.48E-11
-	3.26E-11	9.61E-04	-	-	9.61E-04	-	-	-	-
-	*-*	*4.23E-03*	*1.85E-04*	*2.92E-05*	*4.44E-03*	*1.91E-09*	*7.94E-10*	*6.48E-11*	*2.76E-09*

Output generated 29AUG2023:09:04:13

Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific Value
A (PEF Dispersion Constant)	16.2302	16.2302
A (VF Dispersion Constant)	11.911	11.911
A (VF Dispersion Constant - mass limit)	11.911	11.911
B (PEF Dispersion Constant)	18.7762	18.7762
B (VF Dispersion Constant)	18.4385	18.4385
B (VF Dispersion Constant - mass limit)	18.4385	18.4385
City (PEF Climate Zone) Selection	Default	Default
City (VF Climate Zone) Selection	Default	Default
C (PEF Dispersion Constant)	216.108	216.108
C (VF Dispersion Constant)	209.7845	209.7845
C (VF Dispersion Constant - mass limit)	209.7845	209.7845
foc (fraction organic carbon in soil) g/g	0.006	0.006
F(x) (function dependent on U_m/U_t) unitless	0.194	0.194
n (total soil porosity) L_{pore}/L_{soil}	0.43396	0.43396
ρ_b (dry soil bulk density) g/cm ^{3}	1.5	1.5
ρ_b (dry soil bulk density - mass limit) g/cm ^{3}	1.5	1.5
PEF (particulate emission factor) m ^{3}/kg	1359344438	1359344438
ρ_s (soil particle density) g/cm ^{3}	2.65	2.65
Q/C_{wind} (g/m^2-s per kg/m^3)	93.77	93.77
Q/C_{vol} (g/m^2-s per kg/m^3)	68.18	68.18
Q/C_{vol} (g/m^2-s per kg/m^3 - mass limit)	68.18	68.18
A_s (PEF acres)	0.5	0.5
A_s (VF acres)	0.5	0.5
A_s (VF mass-limit acres)	0.5	0.5
AF_{0-2} (skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{2-6} (skin adherence factor) mg/cm ^{2}	0.2	0.2
AF_{6-16} (skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{16-30} (skin adherence factor) mg/cm ^{2}	0.07	0.07
AF_{rec-a} (skin adherence factor - adult) mg/cm ^{2}	0.07	0.07
AF_{rec-c} (skin adherence factor - child) mg/cm ^{2}	0.2	0.2
AT_{rec} (averaging time)	365	365

Output generated 29AUG2023:09:10:10

Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific Value
BW_{0-2} (body weight) kg	15	15
BW_{2-6} (body weight) kg	15	15
BW_{6-16} (body weight) kg	80	80
BW_{16-30} (body weight) kg	80	80
BW_{rec-a} (body weight - adult) kg	80	80
BW_{rec-c} (body weight - child) kg	15	15
$DFS_{rec-adj}$ (age-adjusted soil dermal factor) mg/kg	22155	22155
$DFSM_{rec-adj}$ (mutagenic age-adjusted soil dermal factor) mg/kg	91770	91770
ED_{rec} (exposure duration - recreator) years	26	26
ED_{0-2} (exposure duration) year	2	2
ED_{2-6} (exposure duration) year	4	4
ED_{6-16} (exposure duration) year	10	10
ED_{16-30} (exposure duration) year	10	10
ED_{rec-c} (exposure duration - child) years	6	6
EF_{rec} (exposure frequency) days/year	75	75
EF_{0-2} (exposure frequency) days/year	75	75
EF_{2-6} (exposure frequency) days/year	75	75
EF_{6-16} (exposure frequency) days/year	75	75
EF_{16-30} (exposure frequency) days/year	75	75
EF_{rec-a} (exposure frequency - adult) days/year	75	75
EF_{rec-c} (exposure frequency - child) days/year	75	75
ET_{rec} (exposure time - recreator) hours/day	1	1
ET_{0-2} (exposure time) hours/day	1	1
ET_{2-6} (exposure time) hours/day	1	1
ET_{6-16} (exposure time) hours/day	1	1
ET_{16-30} (exposure time) hours/day	1	1
ET_{rec-a} (adult exposure time) hours/day	1	1
ET_{rec-c} (child exposure time) hours/day	1	1
$IFS_{rec-adj}$ (age-adjusted soil ingestion factor) mg/kg	7875	7875
$IFSM_{rec-adj}$ (mutagenic age-adjusted soil ingestion factor) mg/kg	35750	35750
IRS_{0-2} (soil intake rate) mg/day	200	200

Output generated 29AUG2023:09:10:10

Site-specific Risk
Recreator Soil/Sediment Inputs

Variable	Recreator Soil/Sediment Default Value	Site-Specific Value
IRS_{2-6} (soil intake rate) mg/day	200	200
IRS_{6-16} (soil intake rate) mg/day	100	100
IRS_{16-30} (soil intake rate) mg/day	100	100
IRS_{rec-a} (soil intake rate - adult) mg/day	100	100
IRS_{rec-c} (soil intake rate - child) mg/day	200	200
LT (lifetime - recreator) years	70	70
SA_{0-2} (skin surface area) cm^2/day	2373	2373
SA_{2-6} (skin surface area) cm^2/day	2373	2373
SA_{6-16} (skin surface area) cm^2/day	6032	6032
SA_{16-30} (skin surface area) cm^2/day	6032	6032
SA_{rec-a} (skin surface area - adult) cm^2/day	6032	6032
SA_{rec-c} (skin surface area - child) cm^2/day	2373	2373
T_w (groundwater temperature) Celsius	25	25
$Theta_a$ (air-filled soil porosity) L_{air}/L_{soil}	0.28396	0.28396
$Theta_w$ (water-filled soil porosity) L_{water}/L_{soil}	0.15	0.15
T (exposure interval) s	819936000	819936000
T (exposure interval) yr	26	26
U_m (mean annual wind speed) m/s	4.69	4.69
U_t (equivalent threshold value)	11.32	11.32
V (fraction of vegetative cover) unitless	0.5	0.5

Output generated 29AUG2023:09:10:10

Site-specific Risk
Recreator for Soil/Sediment

Chemical	CAS Number	Mutagen?	VOC?	RfD (mg/kg-day)	RfD Ref	RfC (mg/m^3)	RfC Ref	SF_o $(mg/kg\text{-}day)^{-1}$	SF_o Ref	IUR $(ug/m^3)^{-1}$	IUR Ref	ABS_{gi}	ABS_{derm}
Benzo[a]pyrene	50-32-8	Yes	No	3.00E-04	IRIS Current	2.00E-06	IRIS Current	1.00E+00	IRIS Current	6.00E-04	IRIS Current	1	0.13
Cobalt	7440-48-4	No	No	3.00E-04	PPRTV Current	6.00E-06	PPRTV Current	-		9.00E-03	PPRTV Current	1	-
Thallium (Soluble Salts)	7440-28-0	No	No	1.00E-05	SCREEN Current	-		-		-		1	-
*Total Risk/HI				-		-		-		-		-	-

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Site-specific Risk
Recreator for Soil/Sediment

Volatilization Factor Unlimited Reservoir (m^3/kg)	Volatilization Factor Mass Limit (m^3/kg)	Volatilization Factor Selected (m^3/kg)	DA	Particulate Emission Factor (m^3/kg)	Soil Saturation Concentration (mg/kg)	RBA	HLC (atm-m^3/mole)	Henry's Law Constant (unitless)	H` and HLC Ref	Henry's Law Constant Used in Calcs (unitless)	Normal Boiling Point BP (K)	BP Ref
-	-	-	-	1.36E+09	-	1	4.57E-07	1.87E-05	PHYSPROP	1.87E-05	7.68E+02	PHYSPROP
-	-	-	-	1.36E+09	-	1	-	-		-	3.20E+03	CRC
-	-	-	-	1.36E+09	-	1	-	-		-	1.73E+03	PHYSPROP
-	-	-	-	-	-	-	-	-		-	-	

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Site-specific Risk
Recreator for Soil/Sediment

Critical Temperature T_C \ (K)	T_C \ Ref	D_{ia} \ (cm^2/s)	D_{iw} \ (cm^2/s)	Soil Concentration (mg/kg)	Child Ingestion Noncarcinogenic CDI (mg/kg-day)	Child Dermal Noncarcinogenic CDI (mg/kg-day)	Child Inhalation Noncarcinogenic CDI (mg/m^3)	Adult Ingestion Noncarcinogenic CDI (mg/kg-day)	Adult Dermal Noncarcinogenic CDI (mg/kg-day)
9.69E+02	EPA 2001 Fact Sheet	2.55E-02	6.58E-06	0.59	1.62E-06	4.99E-07	3.72E-12	1.52E-07	8.32E-08
7.40E+03	YAWS	-	-	37.49	1.03E-04	-	2.36E-10	9.63E-06	-
4.65E+03	YAWS	-	-	0.17	4.66E-07	-	1.07E-12	4.37E-08	-
-		-	-	-	-	-	-	-	-

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Site-specific Risk
Recreator for Soil/Sediment

Adult Inhalation Noncarcinogenic CDI (mg/m^3)	Adjusted Ingestion Noncarcinogenic CDI (mg/kg-day)	Adjusted Dermal Noncarcinogenic CDI (mg/kg-day)	Adjusted Inhalation Noncarcinogenic CDI (mg/m^3)	Ingestion Carcinogenic CDI (mg/kg-day)	Dermal Carcinogenic CDI (mg/kg-day)	Inhalation Carcinogenic CDI (ug/m^3)	Child Ingestion HQ	Child Dermal HQ	Child Inhalation HQ
3.72E-12	4.90E-07	1.79E-07	3.72E-12	8.26E-07	2.75E-07	3.82E-09	5.39E-03	1.66E-03	1.86E-06
2.36E-10	3.11E-05	-	2.36E-10	1.16E-05	-	8.77E-08	**3.42E-01**	-	3.94E-05
1.07E-12	1.41E-07	-	1.07E-12	5.24E-08	-	3.98E-10	4.66E-02	-	-
-	-	-	-	-	-	-	***3.94E-01***	*1.66E-03*	*4.12E-05*

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Site-specific Risk
Recreator for Soil/Sediment

Child Total HI	Adult Ingestion HQ	Adult Dermal HQ	Adult Inhalation HQ	Adult Total HI	Adjusted Ingestion HQ	Adjusted Dermal HQ	Adjusted Inhalation HQ	Adjusted Total HI	Ingestion Risk	Dermal Risk	Inhalation Risk	Total Risk
7.05E-03	5.05E-04	2.77E-04	1.86E-06	7.84E-04	1.63E-03	5.97E-04	1.86E-06	2.23E-03	8.26E-07	2.75E-07	2.29E-12	**1.10E-06**
3.42E-01	3.21E-02	-	3.94E-05	3.21E-02	**1.04E-01**	-	3.94E-05	**1.04E-01**	-	-	7.89E-10	7.89E-10
4.66E-02	4.37E-03	-	-	4.37E-03	1.41E-02	-	-	1.41E-02	-	-	-	-
3.96E-01	*3.70E-02*	*2.77E-04*	*4.12E-05*	*3.73E-02*	***1.19E-01***	*5.97E-04*	*4.12E-05*	***1.20E-01***	*8.26E-07*	*2.75E-07*	*7.92E-10*	***1.10E-06***

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