February 7, 2023

Mr. Craig W. Murray, P.E.
D'Huy Engineering, Inc.
One East Broad Street, Suite 130
Bethlehem, PA 18018

Re: Project No. 16530
Earthen Berm Soil Sampling
Rodney Reservoir Site
1500 W Ninth Street
Wilmington, Delaware

Dear Mr. Murray:

Verdantas LLC (Verdantas) submits this report to document soil sampling conducted at the above-referenced site (the "Property" or "Site"), located at 1500 West Ninth Street at the intersection of North Rodney Street and West Ninth Street in Wilmington, Delaware. It is our understanding that soils from the earthen berm surrounding the reservoir structure are planned to be used as fill material following the demolition of the reservoir structure.

Soil sampling was completed in November and December 2022. The objective was to collect soil samples from the earthen berm for environmental analysis prior to reuse following demolition of the reservoir structure. The environmental soil sampling and analysis was performed at the request of the Property Owner, the City of Wilmington, to screen for environmental character of the soils prior to soil disturbing activities.

A. FIELD ACTIVITIES

On November 7, 2022 and December 19, 2022, Verdantas' subcontractor, Ground Penetrating Radar Systems (GPRS), completed an underground utility survey to pre-clear soil boring locations along the earthen berm surrounding the reservoir.

Following pre-clearing, Verdantas personnel completed 19 hand-auger soil borings in the following locations (see Figure 1):

Soil Boring Number	Berm Location	Depth of Boring (ft)	Refusal Encountered (Y/N)
SB-1	Northwest Corner	1.5	Yes
SB-2	Northeast Corner	4	No
SB-3	Southeast Corner	2	Yes
SB-4	Southwest Corner	1.5	Yes
SB-5	Northeast Corner	1.5	Yes
SB-6	Along N. Rodney Street	1.5	Yes
SB-7	Along N. Rodney Street	1.5	Yes

Soil Boring Number	Berm Location	Depth of Boring (ft)	Refusal Encountered (Y/N)
SB-8	Along N. Rodney Street	1.5	Yes
SB-9	Southeast Corner	1.5	Yes
SB-10	Along W. 8th Street	1.5	Yes
SB-11	Along W. 8th Street	2	Yes
SB-12	Southwest Corner	1.5	Yes
SB-13	Along N. Clayton Street	2	Yes
SB-14	Along N. Clayton Street	2	Yes
SB-15	Along N. Clayton Street	1.5	Yes
SB-16	Northwest Corner	1.5	Yes
SB-17	Along W. 9th Street	1.5	Yes
SB-18	Along W. 9th Street	1.5	Yes
SB-19	Along W. 9th Street	1.5	Yes

Four of the soil borings (SB-1 through SB-4) were completed on November 7, 2022. Following receipt of initial soil sample results, fifteen supplemental soil borings (SB-5 through SB-19) were completed on December 19, 2022, to provide additional soil data for statistical assessment of the analytical results.

During field activities, recovered soils were reviewed by Verdantas personnel for indications of environmental impact. A photoionization detector (PID) was used to evaluate the potential presence of volatile organic compounds (VOCs) in the soil borings. VOCs were not detected by the PID and no indications of environmental impact (e.g., odors, staining, debris) were observed.

Soils encountered during the field program generally consisted of topsoil from the surface to 0.5 feet below ground surface (bgs), underlain by reddish-brown sandy silt with gravel. Shallow refusal was encountered at depths between 1.5 – 2 feet bgs in all but one soil boring location due to the presence of 2 – 4-inch diameter stone.

One soil sample from each soil boring was collected for a total of 19 samples. Four samples (labeled SB-1 through SB-4) consisted of a composite sample representing the entire sampled depth and a discrete sample (e.g., grab) for analysis of VOCs. The remaining samples (labeled SB-5 through SB-19) consisted of one discrete sample. Collection of discrete samples was biased toward areas indicating the greatest environmental impact or at the terminal depth of the boring. Following sample collection, each soil boring was backfilled with soil cuttings to the ground surface.

Soil samples were submitted to Eurofins Environment Testing (Eurofins) for laboratory analysis of the parameters listed below. The samples were analyzed in general

accordance with clean fill testing requirements per the State of Delaware, Department of Natural Resources and Environmental Control – Remediation Section (DNREC-RS) Soil/Material Re-use Policy.

Four samples, SB-1, SB-2, SB-3, and SB-4 were analyzed for Target Compound List (TCL) VOCs (discrete samples), TCL semi-volatile organic compounds (SVOCs), TCL pesticides, polychlorinated biphenyls (PCB) aroclors, Target Analyte List (TAL) metals, and mercury. The remaining fifteen soil samples, SB-5 through SB-19, were analyzed for cobalt.

In addition, quality assurance/quality control (QA/QC) samples were submitted to the laboratory, which included, a trip blank for analysis of TCL VOCs for the November 7, 2022, sampling event and an equipment blank was submitted for analysis of cobalt for the December 19, 2022, sampling event.

B. ENVIRONMENTAL DATA SUMMARY

1. Analytical Results

Analytical results were compared to the DNREC-RS February 2022 Reporting Levels for Soil (Reporting Levels). Analytical results for detected compounds are summarized in Tables 1 and 2 (attached) and below. Due to file size, the analytical reports have been excluded from this report, however, copies of the November and December 2022 Eurofins analytical reports are available upon request.

Cobalt was reported at concentrations that exceeded the Reporting Level in two soil samples during the initial sampling in November. As a result, supplemental soil sampling was completed December 2022 to allow for an assessment of the potential impact of cobalt in the soils to human health and the environment.

a. TAL Metals, Mercury, and Cyanide

Multiple metals and mercury were reported in the soil samples. Only cobalt was reported at concentrations that exceeded the Reporting Level. Cobalt in five samples (SB-1-Composite, SB-4-Composite, SB-8, SB-11 and SB-15) was reported at concentrations ranging from 38.4 mg/kg to 59.8 mg/kg, which exceeded the Reporting Level of 34 mg/kg.

b. TCL SVOCs

Multiple SVOCs were reported in the soil samples, however, none of the concentrations exceeded the respective Reporting Levels.

c. TCL Pesticides

Pesticides were reported as not detected in the soil samples.

d. PCBs

PCBs were reported as not detected in the soil samples.

e. TCL VOCs

One VOC, methylene chloride, was detected in all analyzed samples. None of the reported concentrations exceeded the Reporting Level. Methylene chloride was also reported in the trip blank sample. Methylene chloride is a common laboratory contaminant and is unlikely to be present in soils on the Property.

C. RISK CALCULATION

Given the analytic results for cobalt, Verdantas quantitatively evaluated human health risk at the Site in general accordance with DNREC's "Guidance for Human Health Risk Assessment under the Hazardous Substance Cleanup Act" (HHRA Guidance), July 2020. The assessment considered the most conservative exposure scenario, residential land use.

Verdantas first input the maximum reported detection of cobalt (59.8 mg/kg) to the Delaware Risk Assessment Calculator (DERAC), a program developed by DNREC for use in human health risk assessments to provide quantitative assessment of cancer and non-cancer risks. Using the maximum detected of cobalt in the calculator results in an unacceptable non-cancer risk. Following DNREC's policy and using all data collected for cobalt, a 95% Upper Confidence Limit (UCL) was then calculated using the USEPA-developed statistical software ProUCL 5.1 (ProUCL). The calculated 95% UCL of cobalt was 34.33 mg/kg, which was then input to the DERAC. The resulting cancer risk and non-cancer risk values ($8x10^{-8}$ and 1, respectively) did not exceed the DNREC HSCA target cancer risk values of $1x10^{-5}$ and 1, respectively. Therefore, the risk calculation indicates that cobalt in soils does not pose unacceptable cancer and non-cancer risks under the regulation. A copy of the ProUCL input/output is included as Attachment A and a copy of the DERAC output is included as Attachment B.

D. CONCLUSIONS

Verdantas collected soil samples from the earthen berm surrounding the Rodney reservoir in November and December 2022. Analytical results for the soil samples were compared to DNREC-RS Reporting Levels. No VOCs, SVOCs, pesticides, or 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 was conducted using the calculated 95% UCL concentration of cobalt and a conservative, residential exposure scenario. The results of the calculation indicated that the presence of cobalt in soils does not pose an unacceptable risk to human health under Delaware's Regulations Governing Hazardous Substance Cleanup target cancer risk value and target non-cancer risk value of $1x10^{-5}$ and 1, respectively.

Due to the reported concentrations of cobalt exceeding the DNREC-RS Reporting Level, Owners or Operators are required to notify DNREC-RS in writing and 30-days in advance of any planned land disturbing activities at the Property. When the schedule is determined for the soil disturbance, we recommend contacting DNREC-RS and providing a copy of this report as soon as practical, to allow adequate time for review and discussion of the project prior to initiating site work.

We appreciate the opportunity to have been of service to you and look forward to providing you with continuing professional assistance with this project. If you have any questions or concerns with respect to this report or require further assistance, please do not hesitate to contact us.

Sincerely,

VERDANTAS LLC

Tre' Robinson
Staff Engineer I

Robert B. Smagala Jr.
Environmental Project Manager

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Attachments

Tables

Table 1: November 2022 Soil Sample Results
Table 2: Cobalt Analytical Results November & December 2022 Sampling Events

Figures

Figure 1: Site Features Sketch
Figure 2: Soil Sample Exceedance Sketch

Attachments

Attachment A – ProUCL Input/Output
Attachment B – Risk Assessment DERAC Output

Tables

Table 1 - Confirmatory Analytical Detections
November 2022 Sampling Event
Rodney Reservoir Site, Wilmington, Delaware

Client ID	DNREC-RS	SB-1		SB-2		SB-3		SB-4	
Lab Sample ID	Reporting Levels	460-269445-1		460-269445-2		460-269445-3		460-269445-4	
Sampling Date	Soil	11/7/2022		11/7/2022		11/7/2022		11/7/2022	
Matrix	February 2022	Soil		Soil		Soil		Soil	
Unit	mg/kg	mg/kg		mg/kg		mg/kg		mg/kg	
		Result	Q	Result	Q	Result	Q	Result	Q
Target Compound List (TCL) Volatile Organic Compounds (VOCs)									
Methylene Chloride	**350**	0.11	J	0.093	J	0.047	U	0.1	J
Target Compound List (TCL) Semivolatie Organic Compounds (SVOCs)									
Acenaphthylene	**3600**	0.012	U	0.012	U	0.011	U	0.036	J
Anthracene	**18000**	0.026	J	0.012	U	0.012	U	0.16	J
Benzo[a]anthracene	**11**	0.19		0.014	J	0.031	J	0.60	
Benzo[a]pyrene	**1.1**	0.19		0.011	U	0.026	J	0.40	
Benzo[b]fluoranthene	**11**	0.24		0.012	J	0.034	J	0.57	
Benzo[g,h,i]perylene	**-**	0.083	J	0.012	U	0.012	J	0.12	J
Benzo[k]fluoranthene	**110**	0.11		0.0079	U	0.013	J	0.19	
Carbazole	**-**	0.015	U	0.015	U	0.014	U	0.021	J
Chrysene	**1100**	0.18	J	0.0083	J	0.029	J	0.51	
Dibenz(a,h)anthracene	**1.1**	0.023	J	0.017	U	0.016	U	0.047	
Fluoranthene	**2400**	0.43		0.014	U	0.053	J	1	
Fluorene	**2400**	0.012	U	0.012	U	0.011	U	0.047	J
Indeno[1,2,3-cd]pyrene	**11**	0.10		0.016	U	0.016	J	0.19	
Naphthalene	**20**	0.0070	U	0.0070	U	0.0066	U	0.012	J
Phenanthrene	**1800**	0.12	J	0.0071	U	0.033	J	0.53	
Pyrene	**1800**	0.36	J	0.011	J	0.041	J	0.72	
TCL Pesticides									
No Pesticides detected in analyzed samples.		ND		ND		ND		ND	
Herbicides									
No Herbicides detected in analyzed samples.		ND		ND		ND		ND	
Polychlorinated biphenyls aroclors									
No PCBs detected in analzyed samples.		ND		ND		ND		ND	
Target Analyte List (TAL) Metals									
Aluminum	**77000**	53600		29400		29200		38400	
Antimony	**31**	0.35	U	0.17	U	0.22	J	0.37	U
Arsenic	**11**	4.4		4.8		5.4		5.8	
Barium	**15000**	174		114		117		196	
Beryllium	**160**	0.94	J	0.78		0.95		1.2	
Calcium	**-**	581		672		659		1140	
Chromium	**214**	82.5		92.9		108		120	
Cobalt	**34**	**41.4**		23.3		23.3		**59.8**	
Copper	**3100**	38.9		25		32.3		61.7	
Iron	**74767**	51000		32800		35800		49800	
Lead	**400**	34.4	B	16.8	B	39.8	B	82.4	B
Magnesium	**-**	576		896		851		1000	
Manganese	**2100**	772		578		564		1100	
Nickel	**1500**	27.9		26.6		23.8		52.2	
Potassium	**-**	510		490		407		546	
Selenium	**390**	0.53	J	0.460	J	0.58	J	0.73	J
Thallium	**0.78**	0.14	J	0.14	J	0.16	J	0.18	J
Vanadium	**390**	126		79.5		86.7		115	
Zinc	**23000**	39.6		24.4		37.7		46.1	
Mercury	**11**	0.080		0.057		0.12		0.098	
Chemical									
Cyanide, Total	**23**	0.29	J	0.21	J	0.15	U	0.23	J

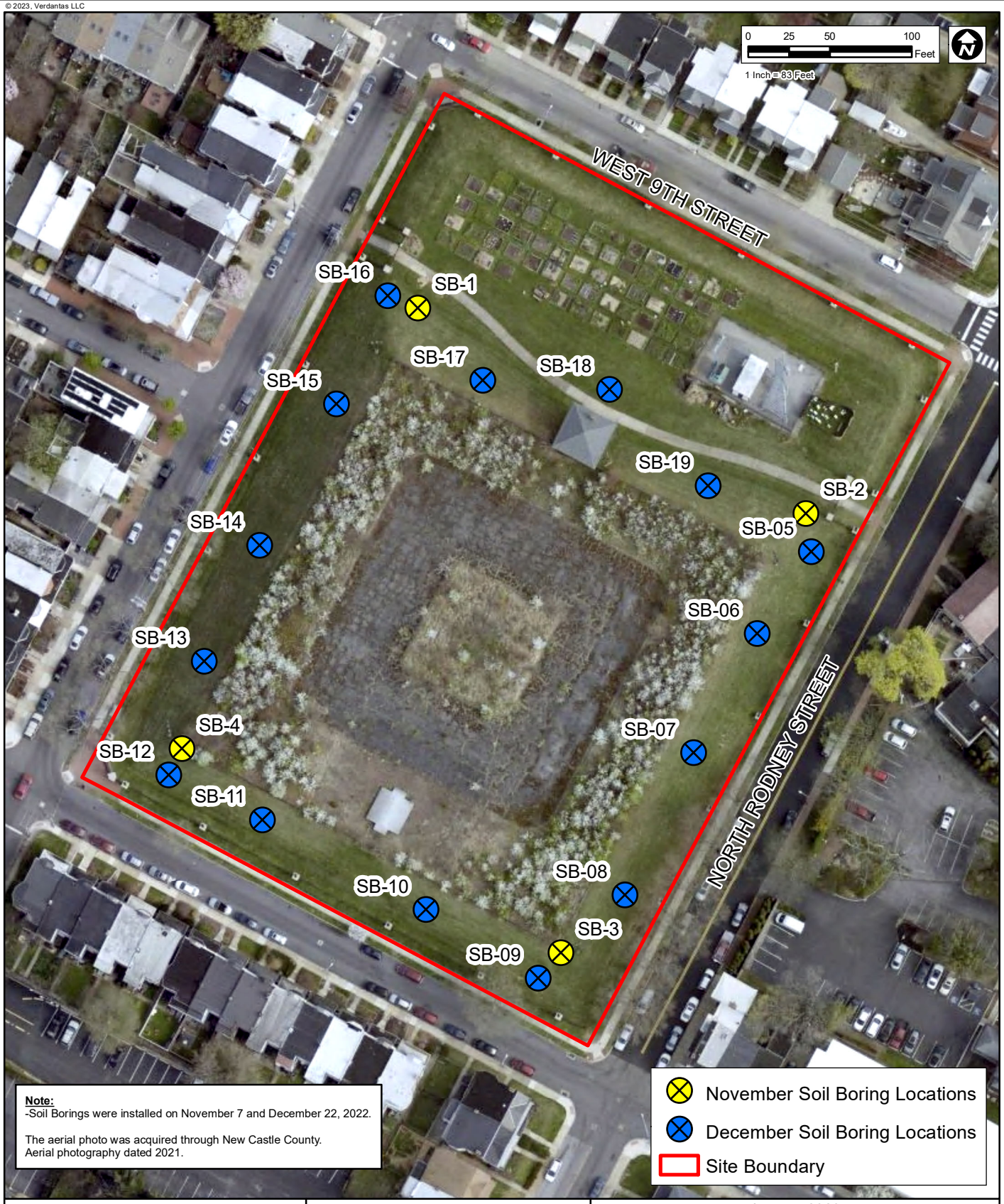
Notes:
1. Reporting Level: DNREC-Remediation Section (RS), February 2022, "Reporting Level Table."
2. mg/kg = milligrams per kilogram.
3. "-" : No applicable DNREC-RS Reporting Level.
4. Bold and highlighted values exceed the applicable DNREC-RS Reporting Level.
5. Soil samples analyzed for TCL VOCs were collected as discrete samples. Samples analyzed for TCL SVOCs, TCL pesticides, herbicides, PCBs, and TAL Metals were collected as composite samples.
6. Laboratory data abbreviations:
   U or ND: Indicates the analyte was analyzed for but not detected.
   J : Result is less than the Reporting Limit but greater than or equal to the Method Detection Limit (MDL) and the concentration is an approximate value.
   B : Compound was found in the blank and sample.

Table 2 - Confirmatory Analytical Detections for Cobalt
November and December 2022 Sampling Events
Rodney Reservoir Site, Wilmington, Delaware

Client ID	DNREC-RS	SB-1		SB-2		SB-3		SB-4		SB-5		SB-6		SB-7		SB-8		SB-9		SB-10		SB-11		SB-12		SB-13		SB-14		SB-15		SB-16		SB-17		SB-18		SB-19	
Lab Sample ID	Reporting Levels	460-269445-1		460-269445-2		460-269445-3		460-269445-4		460-271751-1		460-271751-2		460-271751-3		460-271751-4		460-271751-5		460-271751-6		460-271751-7		460-271751-8		460-271751-9		460-271751-10		460-271751-11		460-271751-12		460-271751-13		460-271751-14		460-271751-15	
Sampling Date	Soil	11/7/2022		11/7/2022		11/7/2022		11/7/2022		12/19/2022		12/19/2022		12/19/2022		12/19/2022		12/19/2022		12/19/2022		12/19/2022		12/19/2022		12/19/2022		12/19/2022		12/19/2022		12/19/2022		12/19/2022		12/19/2022		12/19/2022	
Matrix	February 2022	Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil		Soil	
Unit	mg/kg	mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg		mg/kg	
		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	Result	Q	Result	Q	Result	Q	Result	Q
Cobalt	34	**41.4**		23.3		23.3		**59.8**		28.8		27.0		23.5		**38.4**		19.3		26.6		**53.3**		27.2		18.5		24.1		**39.5**		32.3		31.6		9.0		0.18	U

Notes:
1. Reporting Level: DNREC-Remediation Section (RS), February 2022, "Reporting Level Table."
2. mg/kg = milligrams per kilogram.
3. U: Indicates that the analyte was analyzed for but not detected.
4. Bold and highlighted values exceed the applicable DNREC-RS Reporting Level.

Figures



Note:
-Soil Borings were installed on November 7 and December 22, 2022.

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

- November Soil Boring Locations
- December Soil Boring Locations
- Site Boundary

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PEOPLE FOCUSED FUTURE

January 2023

Earthen Berm Soil Borings and Sampling
Rodney Reservoir Site

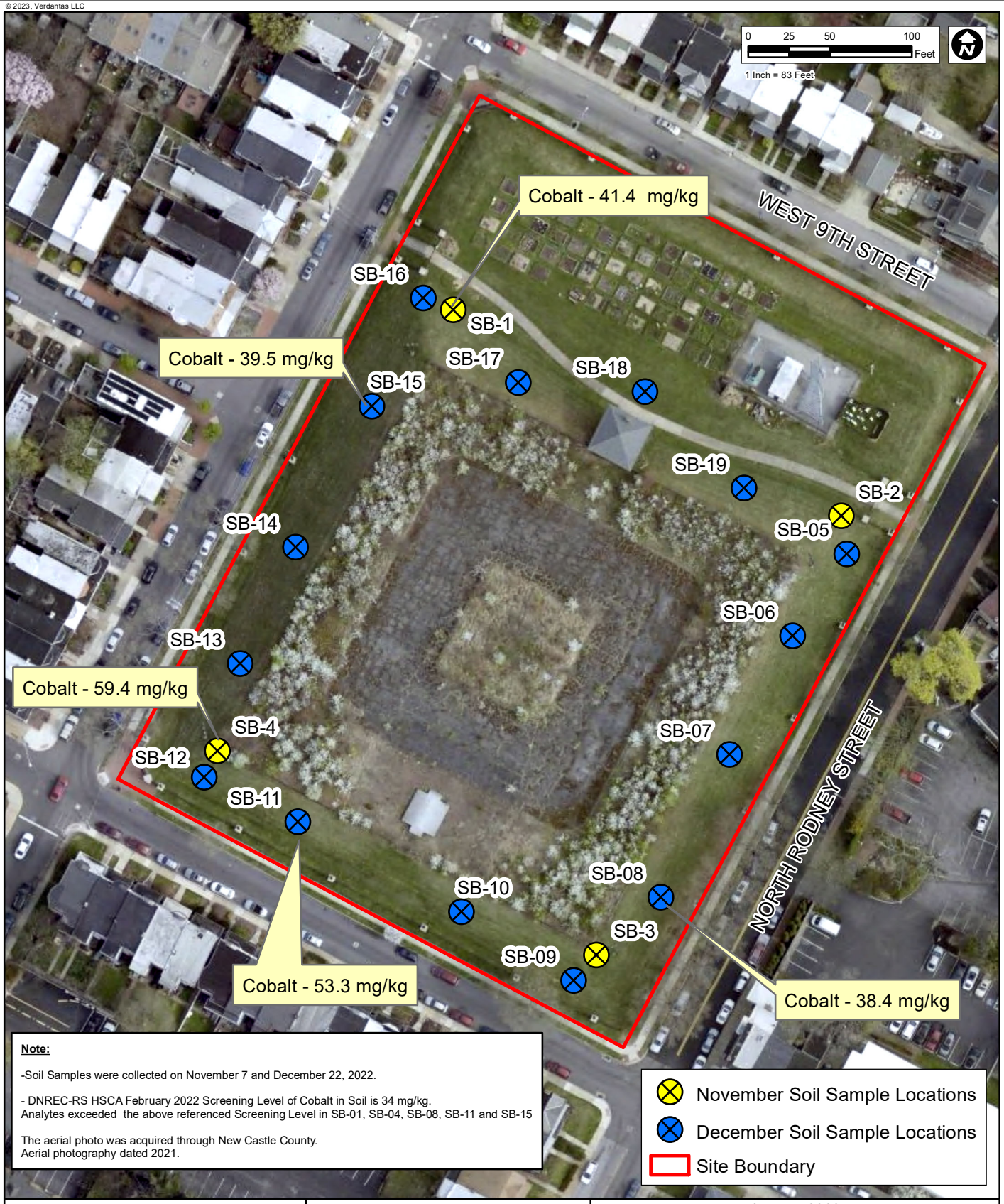
Soil Boring Locations

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

Figure
1

Produced Using Esri's ArcGIS Software

File Location: N:\Projects\11000\11139\EL\GIS\16530_Fig1_Soil Boring Locations.mxd Edited: 1/6/2023 User: efayaz



Note:

-Soil Samples were collected on November 7 and December 22, 2022.

- DNREC-RS HSCA February 2022 Screening Level of Cobalt in Soil is 34 mg/kg.
Analytes exceeded the above referenced Screening Level in SB-01, SB-04, SB-08, SB-11 and SB-15

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

November Soil Sample Locations
December Soil Sample Locations
Site Boundary

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January 2023

Earthen Berm Soil Borings and Sampling
Rodney Reservoir Site

Soil Sample Exceedances

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

Figure 2

Produced Using Esri's ArcGIS Software

File Location: N:\Projects\11000\11139\EL\GIS\16530_Fig2_Soil Sample Exceedances Map.mxd Edited: 1/6/2023 User: efayaz

February 7, 2023
Mr. Craig Murray
Project Number: 16530

Attachment A

ProUCL Input and Output

	A	B	C	D	E	F
1	Cobalt	D_Cobalt				
2	41.4	1				
3	23.3	1				
4	23.3	1				
5	59.8	1				
6	28.8	1				
7	27	1				
8	23.5	1				
9	38.4	1				
10	19.3	1				
11	26.6	1				
12	53.3	1				
13	27.2	1				
14	18.5	1				
15	24.1	1				
16	39.5	1				
17	32.3	1				
18	31.6	1				
19	9	1				
20	0.18	0				
21						
22						

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.2 1/3/2023 1:31:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	19	Number of Distinct Observations	18
Number of Detects	18	Number of Non-Detects	1
Number of Distinct Detects	17	Number of Distinct Non-Detects	1
Minimum Detect	9	Minimum Non-Detect	0.18
Maximum Detect	59.8	Maximum Non-Detect	0.18
Variance Detects	153.6	Percent Non-Detects	5.263%
Mean Detects	30.38	SD Detects	12.39
Median Detects	27.1	CV Detects	0.408
Skewness Detects	0.9	Kurtosis Detects	1.019
Mean of Logged Detects	3.333	SD of Logged Detects	0.428

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**
1% Shapiro Wilk Critical Value	0.858	Detected Data appear Normal at 1% Significance Level
Lilliefors Test Statistic	0.162	**Lilliefors GOF Test**
1% Lilliefors Critical Value	0.235	Detected Data appear Normal at 1% Significance Level

Detected Data appear Normal at 1% Significance Level

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

KM Mean	28.79	KM Standard Error of Mean	3.193
90KM SD	13.52	95% KM (BCA) UCL	34.04
95% KM (t) UCL	34.33	95% KM (Percentile Bootstrap) UCL	33.98
95% KM (z) UCL	34.05	95% KM Bootstrap t UCL	34.74
90% KM Chebyshev UCL	38.37	95% KM Chebyshev UCL	42.71
97.5% KM Chebyshev UCL	48.73	99% KM Chebyshev UCL	60.56

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.357	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.742	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.14	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.204	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.344	k star (bias corrected MLE)	5.324
Theta hat (MLE)	4.789	Theta star (bias corrected MLE)	5.707
nu hat (MLE)	228.4	nu star (bias corrected)	191.7
Mean (detects)	30.38		

Gamma ROS Statistics using Imputed Non-Detects

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

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

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	7.155			Mean	29.16	
59					Maximum	59.8			Median	27	
60					SD	13.17			CV	0.452	
61					k hat (MLE)	4.638			k star (bias corrected MLE)	3.941	
62					Theta hat (MLE)	6.287			Theta star (bias corrected MLE)	7.399	
63					nu hat (MLE)	176.3			nu star (bias corrected)	149.8	
64					Adjusted Level of Significance (β)	0.0369					
65					Approximate Chi Square Value (149.76, α)	122.5			Adjusted Chi Square Value (149.76, β)	120.3	
66					95% Gamma Approximate UCL	35.66			95% Gamma Adjusted UCL	36.3	
67											
68	**Estimates of Gamma Parameters using KM Estimates**										
69					Mean (KM)	28.79			SD (KM)	13.52	
70					Variance (KM)	182.9			SE of Mean (KM)	3.193	
71					k hat (KM)	4.532			k star (KM)	3.852	
72					nu hat (KM)	172.2			nu star (KM)	146.4	
73					theta hat (KM)	6.353			theta star (KM)	7.475	
74					80% gamma percentile (KM)	39.87			90% gamma percentile (KM)	48.46	
75					95% gamma percentile (KM)	56.38			99% gamma percentile (KM)	73.32	
76											
77	**Gamma Kaplan-Meier (KM) Statistics**										
78					Approximate Chi Square Value (146.37, α)	119.4			Adjusted Chi Square Value (146.37, β)	117.3	
79					95% KM Approximate Gamma UCL	35.29			95% KM Adjusted Gamma UCL	35.94	
80											
81	**Lognormal GOF Test on Detected Observations Only**										
82					Shapiro Wilk Test Statistic	0.943			**Shapiro Wilk GOF Test**		
83					10% Shapiro Wilk Critical Value	0.914			Detected Data appear Lognormal at 10% Significance Level		
84					Lilliefors Test Statistic	0.167			**Lilliefors GOF Test**		
85					10% Lilliefors Critical Value	0.185			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	29.32			Mean in Log Scale	3.28	
90					SD in Original Scale	12.91			SD in Log Scale	0.477	
91					95% t UCL (assumes normality of ROS data)	34.45			95% Percentile Bootstrap UCL	34.15	
92					95% BCA Bootstrap UCL	34.55			95% Bootstrap t UCL	34.95	
93					95% H-UCL (Log ROS)	37.22					
94											
95	**Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution**										
96					KM Mean (logged)	3.067			KM Geo Mean	21.48	
97					KM SD (logged)	1.198			95% Critical H Value (KM-Log)	2.903	
98					KM Standard Error of Mean (logged)	0.283			95% H-UCL (KM -Log)	99.92	
99					KM SD (logged)	1.198			95% Critical H Value (KM-Log)	2.903	
100					KM Standard Error of Mean (logged)	0.283					
101											
102	**DL/2 Statistics**										
103	**DL/2 Normal**								**DL/2 Log-Transformed**		
104					Mean in Original Scale	28.79			Mean in Log Scale	3.031	
105					SD in Original Scale	13.91			SD in Log Scale	1.381	
106					95% t UCL (Assumes normality)	34.32			95% H-Stat UCL	152.1	
107	**DL/2 is not a recommended method, provided for comparisons and historical reasons**										
108											

	A	B	C	D	E	F	G	H	I	J	K	L
109	**Nonparametric Distribution Free UCL Statistics**											
110	**Detected Data appear Normal Distributed at 1% Significance Level**											
111												
112	**Suggested UCL to Use**											
113					95% KM (t) UCL	34.33						
114												
115	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
116	Recommendations are based upon data size, data distribution, and skewness using results from simulation studies.											
117	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
118												
119												
120												
121												
122												

February 7, 2023
Mr. Craig Murray
Project Number: 16530

Attachment B

Risk Assessment DERAC Output

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

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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

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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}	Volatilization Factor Unlimited Reservoir (m^3/kg)
Cobalt	7440-48-4	No	No	3.00E-04	PPRTV Current	6.00E-06	PPRTV Current	-		9.00E-03	PPRTV Current	1	-	-
*Total Risk/HI				-		-		-		-		-	-	-

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Site-specific Risk
Resident for Soil

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	Critical Temperature T_c\ (K)	T_c\ Ref
-	-	-	1.36E+09	-	1	-	-		-	3.20E+03	CRC	7.40E+03	YAWS
-	-	-	-	-	-	-	-		-	-		-	

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Site-specific Risk
Resident for Soil

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)	Adult Inhalation Noncarcinogenic CDI (mg/m^3)
-	-	34.33	4.39E-04	-	2.42E-08	4.11E-05	-	2.42E-08
-	-	-	-	-	-	-	-	-

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Site-specific Risk
Resident for Soil

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	Child Total HI
1.33E-04	-	2.42E-08	4.94E-05	-	8.99E-06	**1.46E+00**	-	4.04E-03	**1.47E+00**
-	-	-	-	-	-	***1.46E+00***	-	*4.04E-03*	***1.47E+00***

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Site-specific Risk
Resident for Soil

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
1.37E-01	-	4.04E-03	1.41E-01	4.43E-01	-	4.04E-03	4.47E-01	-	-	8.10E-08	8.10E-08
1.37E-01	*-*	*4.04E-03*	*1.41E-01*	*4.43E-01*	*-*	*4.04E-03*	*4.47E-01*	*-*	*-*	*8.10E-08*	*8.10E-08*

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