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# **ECOLOGICAL RISK ASSESSMENT**

## **SCREENING LEVEL ASSESSMENT**

**APRIL 4, 2001**

## SCREENING LEVEL ASSESSMENT ECOLOGICAL RISK ASSESSMENT IOWA ARMY AMMUNITION PLANT

Screening level ecological assessments are conducted during various phases of site assessments. The purpose of such assessments are to select receptors as assessment endpoints, select measurement endpoints, identify contaminated media, identify data gaps, identify chemicals of potential ecological concern (COPEC), and determine need for a full baseline ecological risk assessment (ERA). At the Iowa Army Ammunition Plant (IAAAP), most tasks associated with screening level assessments have already been conducted. The selected assessment and measurement endpoints were presented in Tech Memo No. 1. Contaminated media were identified following various investigations performed at the site. Two rounds of surface water and one round of sediment sampling have been conducted to fill data gaps. The objective of this document is to identify COPECs in each of the watersheds and solid waste management units (SWMU) and Areas of Concern (AOCs). A scientific/management decision point (SMDP) will be made upon review of this document to determine the need for a full ERA.

The procedure for identifying the COPECs was presented in Tech Memo No. 3. The specific steps followed to identify COPECs are discussed below.

### Comparison with Screening Level Benchmarks

In the first step, maximum concentrations of chemicals detected in each watershed, SWMU and AOC, are compared to the screening levels for each media. Results of the comparison are presented in Appendix A. Chemicals detected at concentrations greater than corresponding screening levels are retained for evaluation in the next step (presented in bold face in the tables).

### Determination of Site-specific Impact

Compounds retained in the first step were further evaluated to determine if the presence in the media is attributable to activities at the IAAAP. Inorganics are naturally present in the media. Comparison of inorganic concentrations with media specific concentrations is discussed below.

- Two upgradient surface water locations were identified in Tech Memo No. 4 as not to have been impacted by activities at the IAAAP facility. Surface water concentrations in each of the watersheds were compared to the concentrations detected at the upgradient locations. The range of surface water concentrations for background and the watersheds are presented in Appendix B. Compounds were not selected as COPEC if maximum concentration in a particular watershed was less than its maximum concentration in the upgradient sample. The following inorganics were eliminated from the specific watersheds as listed.

- 8
1. Aluminum, arsenic, iron, magnesium, potassium, and vanadium in Brush Creek
  2. Mercury, silver and thallium in Long Creek
  3. Magnesium in Spring Creek
  4. Aluminum, arsenic, barium, beryllium, chromium, lead, manganese, potassium, sodium, and zinc in Skunk River
- None of the chemicals detected in sediment were eliminated
  - Over 100 soil samples were collected from background locations at the IAAAP. A summary of the inorganics data comprising of minimum, maximum, mean, standard deviation, and mean plus several combinations of standard deviations are presented in Appendix C. The mean plus two standard deviation value (approximately 95<sup>th</sup> percentile) for each inorganic in background soils was compared to the maximum concentration of the inorganic in each SWMU or AOC. None of the inorganics were eliminated from further considerations based on this comparison. Maximum aluminum concentrations at some of the sites were comparable to the approximate 95<sup>th</sup> percentile value in the background soil. Statistical evaluations were conducted at these sites to determine if aluminum levels are elevated compared to background. A non-parametric statistical test, the Mann-Whitney U-Test, was conducted with data from the selected SWMUs, AOCs, and background locations. Results of the statistical tests are presented in Appendix D. Site concentrations are not higher than background levels at 95 % confidence interval at sites where the test statistic (Asymp.Sig) is lower than 0.05. Based on the statistical analysis, aluminum was eliminated from further considerations at the following sites: Line 1 (R01), Line 2 (R02), Line 3 (R03), Line 3A (R04), Line 4A and 4B (R05), Line 7 (R08), Line 8 (R09), Line 800 (R11), Contaminated Waste Processor (R16), Explosive Waste Incinerator (R17), Sewage Treatment Plant (R18), Line 3A Sewage Treatment Plant (R21), and the Fire Training Area (R27).
  - Dicamba, a herbicide, was estimated to have been detected in four of the 60 surface water samples collected at concentrations equal to or less than half its detection limit. Surface water screening value is not available for dicamba. Information on toxicity to birds and aquatic organisms is available in U.S. EPA's ECOTOX and EXTOXNET, a cooperative project involving Cornell University, Oregon State University, the University of Idaho, University of California at Davis, and Michigan State University, and funded by the U.S. Dept. of Agriculture. Dicamba has low toxic effect on birds with an LC50 greater than 10,000 ppm in mallards and bobwhite quail. For aquatic insects and fish, available LC50 values are greater than 10,000 ppm. USACE proposes to eliminate dicamba from consideration as a COPEC because of estimated detection at trace levels not known to be associated with toxic effects.

### **Evaluation of Frequency of Detection**

In the next step, chemicals that were detected infrequently (at a frequency less than 5 percent) at locations not adjacent to each other were eliminated for further evaluations.

- For sediments, toxaphene and 4-methylphenol were detected in one out of 23 and two out of 46 samples, respectively.
- For surface water, several chemicals were eliminated. These include DDT (one in 30), endrin (one in 32), 2,4-D (one in 37), 2,4-DB (one in 37), and pentachlorophenol (one in 66).
- For soils, compounds detected at a frequency less than five percent include, 1,1,2,2-tetrachloroethane (one in 181), gamma-BHC (one in 60), delta-BHC (one in 60), phenol (one in 191), heptachlor (2 in 60), aldrin (4 in 115), dieldrin (5 in 115), and endrin (5 in 115).

### **Essential Nutrients**

Calcium, magnesium, potassium, and sodium were detected in all media. These inorganics are essential nutrients for all receptors. Information regarding adverse impacts from these inorganics is not available. Therefore, USACE proposes to eliminate these essential nutrients from further considerations as COPECs.

### **Laboratory Contaminant**

- Methylene chloride was estimated to be detected in several soil samples during recent sampling at Roundhouse Transformer Storage Yard (R28) at concentrations less than its detection limit. Methylene chloride was not detected during RI sampling at this site. Methylene chloride, a known common laboratory contaminant, has not been detected at other locations within IAAAP. USACE proposes to eliminate methylene chloride from further considerations in this risk assessment.
- Acetone was detected in several soil samples at Line 800. However, only one sample was detected at 8 mg/Kg, a concentration exceeding its screening level of 2.5 mg/Kg. Acetone is a known laboratory contaminant. It was not detected at concentrations exceeding its screening level at any other site. USACE proposes to eliminate acetone from further considerations in this risk assessment.
- Dalapon was detected in two out of 37 surface water samples. The laboratory determined that seven samples had dalapon contamination in laboratory blanks. Concentrations detected in the two samples were lower than a sample identified to

be blank contaminated. USACE proposes to eliminate dalapon from further considerations because of possible blank contamination.

**Radionuclides**

Several radionuclides were analyzed for and detected at Line 1 (R01) and the Firing Site (R22). Background soil samples were analyzed for gross alpha and gross beta. The maximum gross alpha and gross beta concentrations at the site (23.4 and 45.9 pCi/g, respectively) are much higher than the maximum concentrations in the background samples (11.8 and 9.9 pCi/g, respectively). Therefore, these two parameters appear to be present at elevated levels at the site.

Screening values are not readily available for most of the detected radionuclides. U.S. DOE in "A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota," June 2000, developed Biota Concentration Guide (BCG) as benchmark for protection of biota. Cesium-137 and Radium-226 are the only two radionuclides detected at the site for which BCG values are available. The BCG values for Cesium-137 and Radium-226 are 20 and 3 pCi/g, respectively compared to site concentrations of 0.27 and 12 pCi/g, respectively. Therefore, Ra-226 appears to be present at the site at level higher than its BCG.

The approach to be used for evaluating impact of radionuclides on the biota need to be developed. The Tech Memos developed so far only focuses on impact of chemical contamination. Further soil sampling for radionuclides is scheduled at the Firing Site. Data should be further evaluated for developing an approach. The COPEC list developed for R22 currently does not include the radionuclides.

**Remediated Sites**

Contaminated soils have been removed from West Burn Pad (R24), East Burn Pad (R12), North Burn Pad (R25), and North Burn Pad Landfill (IAAP-37). The soils have been replaced with soils excavated from "clean" areas of East Burn Pad, West Burn Pad, and Stump Lake. USACE is currently in the process of collecting data for soils used as fill material. Screening assessments at these sites will be conducted upon review of data. It is unlikely that COPECs will be identified at these sites.

Impoundments at Line 1 and Line 800 are currently being monitored on a monthly basis. Surface water samples are collected and analyzed for explosives. HMX and RDX are the only compounds detected in Line 1 samples. However, HMX has not been detected during the last five rounds. Maximum concentrations detected for each compound were 61 ug/L for RDX and 25 ug/L for HMX. These values are lower than the corresponding screening benchmarks at 190 ug/L and 330 ug/l, for RDX and HMX, respectively. Some of the explosives were detected at trace levels in Line 800 impoundments. None of the explosives were detected during the last two rounds. Maximum concentrations of all explosives are considerably less than their screening benchmarks. Therefore, surface water at these impoundments does not have COPECs.

Sediment samples have also been collected from Line 1 and Line 800. Sediment samples were analyzed for metals, explosives, and volatiles. The new data were evaluated as sediment data within Brush Creek watershed.

The selected COPECs for surface water, sediment, and soil are listed in Table 1 and Table 2. Metals and explosives are the primary COPECs. Pesticides and volatile organic carbons (VOC) are COPECs at selected SWMUs or AOCs.

**Contaminants of Potential Ecological Concern (COPECs)  
IAAAP Surface Water and Sediment**

<b>Brush Creek Sediment</b>	<b>Brush Creek Surface Water</b>	<b>Long Creek Surface Water</b>	<b>Spring Creek Sediment</b>	<b>Spring Creek Surface Water</b>	<b>Skunk River Surface Water</b>
1,3,5-Trinitrobenzene 2,4,6-Trinitrotoluene 2,4-Dinitrotoluene 2-Amino-4,6-Dinitrotoluene 4-Amino-2,6-Dinitrotoluene HMX RDX	2-Amino-4,6-Dinitrotoluene 4-Amino-2,6-Dinitrotoluene Barium Beryllium Bis(2-Ethylhexyl) Phthalate Cadmium Chromium Cobalt Copper Lead Manganese Mercury Selenium Silver Sulfate Thallium Zinc	2-Amino-4,6-Dinitrotoluene 4-Amino-2,6-Dinitrotoluene Aluminum Arsenic Barium Beryllium Bis(2-Ethylhexyl) Phthalate Chromium Cobalt Copper Iron Lead Manganese Nickel Selenium Sulfate Vanadium Zinc	Bis(2-Ethylhexyl) Phthalate Mercury  Long Creek Sediment  RDX	Aluminum Arsenic Barium Beryllium Chromium Cobalt Copper Iron Lead Manganese Selenium Silver Vanadium Zinc	Copper Selenium

Note: No COPECs were identified in Skunk River Sediment



**Table 2**  
**Contaminants of Potential Ecological Concern (COPECs)**  
**IAAAP Surface Soils**

R01	R02	R03	R04	R05	R06	R07
1,3,5-Trinitrobenzene	1,3,5-Trinitrobenzene	1,3,5-Trinitrobenzene	1,3,5-Trinitrobenzene	2,4,6-Trinitrotoluene	1,3,5-Trinitrobenzene	2,4,6-Trinitrotoluene
1,3-Dinitrobenzene	1,3-Dinitrobenzene	1,3-Dinitrobenzene	2,4,6-Trinitrotoluene	Arsenic	1,3-Dinitrobenzene	Aluminum
2,4,6-Trinitrotoluene	2,4,6-Trinitrotoluene	2,4,6-Trinitrotoluene	2,4-Dinitrotoluene	Barium	2,4,6-Trinitrotoluene	Antimony
2,4-Dinitrotoluene	2,4-Dinitrotoluene	2,4-Dinitrotoluene	Antimony	Cadmium	2,4-Dinitrotoluene	Arsenic
2,6-Dinitrotoluene	Anthracene	2,6-Dinitrotoluene	Arsenic	Chromium	Aluminum	Barium
2-Amino-4,6-Dinitrotoluene	Antimony	4,4'-DDT	Bis(2-Ethylhexyl) Phthalate	Cobalt	Antimony	Cadmium
4-Amino-2,6-Dinitrotoluene	Arsenic	Anthracene	Cadmium	Copper	Arsenic	Chromium
1,2,4-Trimethylbenzene	Barium	Antimony	Chromium	Iron	Cadmium	Copper
Anthracene	Benzo(a)anthracene	Arsenic	Copper	Lead	Chromium	HMX
Antimony	Benzo(a)pyrene	Barium	HMX	Manganese	Cobalt	Iron
Arochlor 1260	Bis(2-Ethylhexyl) Phthalate	Benzo(a)anthracene	Iron	Mercury	Copper	Lead
Arsenic	Cadmium	Benzo(a)pyrene	Lead	Nickel	HMX	Manganese
Barium	Carbazole	Bis(2-Ethylhexyl) Phthalate	Manganese	Thallium	Iron	Mercury
Benzo(a)anthracene	Chromium	Cadmium	Mercury	Vanadium	Lead	Nickel
Benzo(a)pyrene	Chrysene	Carbazole	Nickel	Zinc	Manganese	RDX
Benzo(b)fluoranthene	Cobalt	Chromium	Niobium		Mercury	Silver
Benzyl Butyl Phthalate	Copper	Chrysene	RDX		Nickel	Thallium
Bis(2-Ethylhexyl) Phthalate	Dibenzofuran	Cobalt	Selenium		RDX	Vanadium
Cadmium	Fluoranthene	Copper	Silver		Selenium	Zinc
Carbazole	HMX	Dibenzofuran	Thallium		Silver	
Chromium	Indeno(1,2,3-cd)pyrene	Fluoranthene	Vanadium		Tetryl	
Chrysene	Iron	HMX	Zinc		Thallium	
Cobalt	Lead	Indeno(1,2,3-cd)pyrene			Vanadium	
Copper	Manganese	Iron			Zinc	
Dibenzofuran	Mercury	Lead				
Fluoranthene	Naphthalene	Manganese				
HMX	Nickel	Mercury				
Indeno(1,2,3-cd)pyrene	Niobium	Naphthalene				
Iron	Phenanthrene	Nickel				
Lead	Pyrene	Niobium				
Manganese	RDX	Phenanthrene				
Mercury	Selenium	Pyrene				
Naphthalene	Silver	RDX				
Nickel	Tetryl	Selenium				
Niobium	Thallium	Silver				
Phenanthrene	Toluene	Thallium				
Pyrene	Vanadium	Vanadium				
RDX	Zinc	Zinc				
Selenium						
Silver						
Thallium						
Toluene						
Vanadium						
Zinc						

**Table 2**  
**Contaminants of Potential Ecological Concern (COPECs)**  
**IAAAP Surface Soils**

R08	R09	R10	R11	R13	R15	R16	R17
2,4,6-Trinitrotoluene	Antimony	Aluminum	1,1,1-Trichloroethane	1,4-Dichlorobenzene	1,3-Dinitrobenzene	2,4,6-Trinitrotoluene	1,3,5-Trinitrobenzene
4,4'-DDD	Arochlor 1254	Antimony	1,3,5-Trinitrobenzene	2-Methylnaphthalene	Aluminum	Arsenic	Chromium
4,4'-DDT	Arsenic	Arsenic	1,3-Dinitrobenzene	4,4'-DDD	Antimony	Chromium	HMX
Antimony	Bis(2-Ethylhexyl) Phthalate	Beryllium	2,4,6-Trinitrotoluene	4,4'-DDE	Arsenic	Copper	Iron
Arochlor 1260	Cadmium	Cadmium	4-Amino-2,6-Dinitrotoluene	4,4'-DDT	Barium	HMX	Manganese
Cadmium	Chromium	Chromium	2,4-Dinitrotoluene	alpha-Chlordane	Cadmium	Iron	Mercury
Chromium	Copper	Copper	2,6-Dinitrotoluene	Aluminum	Chromium	Lead	Naphthalene
Copper	Fluoranthene	Iron	4,4'-DDE	Antimony	Copper	Manganese	RDX
Fluoranthene	Iron	Lead	4,4'-DDT	Cadmium	Iron	Mercury	Vanadium
Iron	Lead	Manganese	Antimony	Chromium	Lead	RDX	Zinc
Lead	Manganese	Mercury	Arsenic	Copper	Manganese	Vanadium	
Manganese	Mercury	Nickel	Barium	Dibenzofuran	Mercury	Zinc	
Mercury	Nickel	Thallium	Bis(2-Ethylhexyl) Phthalate	Fluoranthene	Nickel		
Nickel	Pyrene	Vanadium	Cadmium	gamma-Chlordane	Selenium		
Phenanthrene	Thallium	Zinc	Chromium	Iron	Silver		
Pyrene	Vanadium		Cobalt	Lead	Thallium		
RDX	Zinc		Copper	Manganese	Vanadium		
Thallium			Fluoranthene	Mercury	Zinc		
Toluene			HMX	Naphthalene			
Vanadium			Iron	Nickel			
Zinc			Lead	Phenanthrene			
			Manganese	Pyrene			
			Mercury	Silver			
			Nickel	Thallium			
			Pyrene	Vanadium			
			RDX	Zinc			
			Thallium				
			Vanadium				
			Zinc				

**Table 2**  
**Contaminants of Potential Ecological Concern (COPECs)**  
**IAAAP Surface Soils**

R18	R19	R20	R21	R22	R26	R27	R28	R30
4,4'-DDT	Arsenic	1,3-Dinitrobenzene	4,4'-DDT	Aluminum	Aluminum	1,1,1-Trichloroethane	4,4'-DDD	Arsenic
Arochlor 1260	Chromium	4,4'-DDD	Chromium	Arsenic	Cadmium	1,1-Dichloroethane	4,4'-DDE	Cadmium
Cadmium	Copper	4,4'-DDE	Iron	Barium	Chromium	1,2-Dichloroethene (total)	4,4'-DDT	Chromium
Chromium	Lead	4,4'-DDT	Lead	Cadmium	Fluoranthene	2-Methylnaphthalene	Arochlor 1260	Copper
Iron	Mercury	alpha-Chlordane	Manganese	Chromium	Iron	Antimony	Fluoranthene	Lead
Manganese	Nickel	Arochlor 1254	Mercury	Copper	Manganese	Arsenic	Pyrene	Mercury
Mercury	Nitrogen, Nitrate-Nitrite	Chromium	Silver	HMX	Mercury	Barium		Nickel
Silver	Selenium	gamma-Chlordane	Vanadium	Iron	Phenanthrene	Bis(2-Ethylhexyl) Phthalate		Nitrogen, Nitrate-Nitrite
Vanadium	Sulfate	HMX	Zinc	Lead	Vanadium	Cadmium		Sulfate
Zinc	Zinc	Zinc		Manganese	Zinc	Chromium		Zinc
				Mercury		Cobalt		
				Nickel		Copper		
				RDX		Ethylbenzene		
				Silver		Iron		
				Thallium		Lead		
				Vanadium		Manganese		
				Zinc		Mercury		
						Nickel		
						Silver		
						Tetrachloroethene		
						Thallium		
						Toluene		
						Trichloroethene		
						Vanadium		
						Zinc		

15

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Brush Creek Surface Water**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
2-Amino-4,6-Dinitrotoluene	mg/L	0.0004	
4-Amino-2,6-Dinitrotoluene	mg/L	0.00073	
Aluminum	mg/L	6.02	0.087
Antimony	mg/L	0.0178	0.03
Arsenic	mg/L	0.008	0.0031
Barium	mg/L	0.224	0.0039
Beryllium	mg/L	0.0022	0.00053
Bis(2-Ethylhexyl) Phthalate	mg/L	0.028	0.00012
Cadmium	mg/L	0.0013	0.00066
Calcium	mg/L	67.3	
Chromium	mg/L	0.0104	
Cobalt	mg/L	0.0058	0.003
Copper	mg/L	0.0105	0.0031
Dalapon	mg/L	0.0031	
Dicamba	mg/L	0.000055	
HMX	mg/L	0.014	0.33
Iron	mg/L	6.11	1
Lead	mg/L	0.0271	0.00132
Magnesium	mg/L	23.2	
Manganese	mg/L	0.352	0.08
Mercury	mg/L	0.00029	0.000012
Nickel	mg/L	0.0304	0.052
Potassium	mg/L	4.91	
RDX	mg/L	0.015	0.19
Selenium	mg/L	0.009	0.00039
Silver	mg/L	0.0087	0.000012
Sodium	mg/L	51.9	
Sulfate	mg/L	41.6	
Thallium	mg/L	0.0116	0.004
Vanadium	mg/L	0.0134	0.019
Zinc	mg/L	0.0323	0.0052

17

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Long Creek Sediment**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
Mercury	mg/Kg	0.13	0.13
<b>RDX</b>	<b>mg/Kg</b>	<b>0.5</b>	<b>0.02</b>

18

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Long Creek Surface Water**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>	<b>Flag</b>
1,3-Dinitrobenzene	mg/L	0.00015		0.02
2,4,6-Trinitrotoluene	mg/L	0.00082		0.09
2,4-Dinitrotoluene	mg/L	0.008		0.02
<b>2-Amino-4,6-Dinitrotoluene</b>	<b>mg/L</b>	<b>0.008</b>		
<b>4-Amino-2,6-Dinitrotoluene</b>	<b>mg/L</b>	<b>0.021</b>		
<b>Aluminum</b>	<b>mg/L</b>	<b>62</b>		<b>0.087</b>
Antimony	mg/L	0.0096		0.03
<b>Arsenic</b>	<b>mg/L</b>	<b>0.0237</b>		<b>0.0031</b>
<b>Barium</b>	<b>mg/L</b>	<b>0.893</b>		<b>0.0039</b>
<b>Beryllium</b>	<b>mg/L</b>	<b>0.0026</b>		<b>0.00053</b>
<b>Bis(2-Ethylhexyl) Phthalate</b>	<b>mg/L</b>	<b>0.02</b>		<b>0:00012</b>
Cadmium	mg/L	0.00035		0.00066
<b>Calcium</b>	<b>mg/L</b>	<b>121</b>		
<b>Chromium</b>	<b>mg/L</b>	<b>0.0727</b>		
<b>Cobalt</b>	<b>mg/L</b>	<b>0.0398</b>		<b>0.003</b>
<b>Copper</b>	<b>mg/L</b>	<b>0.0606</b>		<b>0.0031</b>
<b>Dalapon</b>	<b>mg/L</b>	<b>0.0024</b>		
HMX	mg/L	0.0017		0.33
<b>Iron</b>	<b>mg/L</b>	<b>76.5</b>		<b>1</b>
<b>Lead</b>	<b>mg/L</b>	<b>0.0464</b>		<b>0.00132</b>
<b>Magnesium</b>	<b>mg/L</b>	<b>44.9</b>		
<b>Manganese</b>	<b>mg/L</b>	<b>4.82</b>		<b>0.08</b>
<b>Mercury</b>	<b>mg/L</b>	<b>0.00011</b>		<b>0.000012</b>
<b>Nickel</b>	<b>mg/L</b>	<b>0.067</b>		<b>0.052</b>
Nitrobenzene	mg/L	0.008		0.27
<b>Pentachlorophenol</b>	<b>mg/L</b>	<b>0.039</b>		<b>0.005</b>
<b>Potassium</b>	<b>mg/L</b>	<b>11.5</b>		
RDX	mg/L	0.0091		0.19
<b>Selenium</b>	<b>mg/L</b>	<b>0.0052</b>		<b>0.00039</b>
<b>Silver</b>	<b>mg/L</b>	<b>0.002</b>		<b>0.000012</b>
<b>Sodium</b>	<b>mg/L</b>	<b>37.2</b>		
<b>Sulfate</b>	<b>mg/L</b>	<b>155</b>		
<b>Thallium</b>	<b>mg/L</b>	<b>0.0044</b>		<b>0.004</b>
<b>Vanadium</b>	<b>mg/L</b>	<b>0.173</b>		<b>0.019</b>
<b>Zinc</b>	<b>mg/L</b>	<b>0.219</b>		<b>0.0052</b>

19

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Spring Creek Sediment**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
4-Methylphenol	mg/Kg	6.4	0.012
Bis(2-Ethylhexyl) Phthalate	mg/Kg	1.2	0.18
Mercury	mg/Kg	0.31	0.13

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Spring Creek Surface Water**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
1,3,5-Trinitrobenzene	mg/L	0.000105	0.011
<b>2,4 DB</b>	<b>mg/L</b>	<b>0.00055</b>	
2,4,6-Trinitrotoluene	mg/L	0.00027	0.09
2-Nitrotoluene	mg/L	0.0018	4.4
<b>Aluminum</b>	<b>mg/L</b>	<b>34.5</b>	<b>0.087</b>
Antimony	mg/L	0.0065	0.03
<b>Arsenic</b>	<b>mg/L</b>	<b>0.0116</b>	<b>0.0031</b>
<b>Barium</b>	<b>mg/L</b>	<b>0.728</b>	<b>0.0039</b>
<b>Beryllium</b>	<b>mg/L</b>	<b>0.0016</b>	<b>0.00053</b>
<b>Calcium</b>	<b>mg/L</b>	<b>83.6</b>	
<b>Chromium</b>	<b>mg/L</b>	<b>0.0486</b>	
<b>Cobalt</b>	<b>mg/L</b>	<b>0.009</b>	<b>0.003</b>
<b>Copper</b>	<b>mg/L</b>	<b>0.0551</b>	<b>0.0031</b>
<b>Dalapon</b>	<b>mg/L</b>	<b>0.0029</b>	
<b>Dicamba</b>	<b>mg/L</b>	<b>0.000051</b>	
HMX	mg/L	0.0012	0.33
<b>Iron</b>	<b>mg/L</b>	<b>48.4</b>	<b>1</b>
<b>Lead</b>	<b>mg/L</b>	<b>0.0198</b>	<b>0.00132</b>
<b>Magnesium</b>	<b>mg/L</b>	<b>25.4</b>	
<b>Manganese</b>	<b>mg/L</b>	<b>2.25</b>	<b>0.08</b>
Nickel	mg/L	0.0302	0.052
<b>Potassium</b>	<b>mg/L</b>	<b>18.9</b>	
RDX	mg/L	0.0089	0.19
<b>Selenium</b>	<b>mg/L</b>	<b>0.0078</b>	<b>0.00039</b>
<b>Silver</b>	<b>mg/L</b>	<b>0.007</b>	<b>0.000012</b>
<b>Sodium</b>	<b>mg/L</b>	<b>82.4</b>	
<b>Vanadium</b>	<b>mg/L</b>	<b>0.0702</b>	<b>0.019</b>
<b>Zinc</b>	<b>mg/L</b>	<b>0.135</b>	<b>0.0052</b>



**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Skunk River Surface Water**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
<b>Aluminum</b>	mg/L	<b>0.267</b>	<b>0.087</b>
<b>Arsenic</b>	mg/L	<b>0.0045</b>	<b>0.0031</b>
<b>Barium</b>	mg/L	<b>0.0786</b>	<b>0.0039</b>
<b>Beryllium</b>	mg/L	<b>0.0007</b>	<b>0.00053</b>
Cadmium	mg/L	0.00035	0.00066
<b>Calcium</b>	mg/L	<b>88</b>	
<b>Chromium</b>	mg/L	<b>0.002</b>	
<b>Copper</b>	mg/L	<b>0.03</b>	<b>0.0031</b>
HMX	mg/L	0.0026	0.33
Iron	mg/L	0.248	1
<b>Lead</b>	mg/L	<b>0.003</b>	<b>0.00132</b>
<b>Magnesium</b>	mg/L	<b>31</b>	
<b>Manganese</b>	mg/L	<b>0.123</b>	<b>0.08</b>
Nickel	mg/L	0.0029	0.052
<b>Potassium</b>	mg/L	<b>6.19</b>	
RDX	mg/L	0.0088	0.19
<b>Selenium</b>	mg/L	<b>0.0063</b>	<b>0.00039</b>
<b>Sodium</b>	mg/L	<b>28.1</b>	
Vanadium	mg/L	0.0051	0.019
<b>Zinc</b>	mg/L	<b>0.0206</b>	<b>0.0052</b>

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Line 1 (R01) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
1,3,5-Trinitrobenzene	mg/Kg	110	0.01
1,3-Dinitrobenzene	mg/Kg	2.77	0.6547
2,4,6-Trinitrotoluene	mg/Kg	200	0.4
2,4-Dinitrotoluene	mg/Kg	7.45	1.28
2,6-Dinitrotoluene	mg/Kg	1.38	0.032
2-Amino-4,6-Dinitrotoluene	mg/Kg	2.5	
4-Amino-2,6-Dinitrotoluene	mg/Kg	0.805	
2-Methylnaphthalene	mg/Kg	1	3.24
Acenaphthene	mg/Kg	3	20
Acenaphthylene	mg/Kg	1	682
Acetone	mg/Kg	1.65	2.5
Actinium 228	pci/g	1.6	
Alpha, Gross	pci/g	3.4	
Aluminum	mg/Kg	17700	50
Anthracene	mg/Kg	20	0.1
Antimony	mg/Kg	43.2	5
Arochlor 1260	mg/Kg	100	0.02
Arsenic	mg/Kg	49	10
Barium	mg/Kg	13000	500
Benzene	mg/Kg	0.05	0.05
Benzo(a)anthracene	mg/Kg	80	5.21
Benzo(a)pyrene	mg/Kg	100	0.1
Benzo(b)fluoranthene	mg/Kg	100	59.8
Benzo(g,h,i)perylene	mg/Kg	10	119
Benzo(k)fluoranthene	mg/Kg	30	148
Benzyl Butyl Phthalate	mg/Kg	10	0.23889
Beryllium	mg/Kg	3.15	10
Beta, Gross	pci/g	5.3	
Bis(2-Ethylhexyl) Phthalate	mg/Kg	15	0.92594
Bismuth-214	pci/g	1.43	
Cadmium	mg/Kg	60.8	1
Calcium	mg/Kg	300000	
Carbazole	mg/Kg	20	
Chromium	mg/Kg	1530	
Chrysene	mg/Kg	100	4.73
Cobalt	mg/Kg	58.6	20
Copper	mg/Kg	2800	40
Di-N-Butyl Phthalate	mg/Kg	1.5	200
Dibenz(a,h)Anthracene	mg/Kg	5	18.4
Dibenzofuran	mg/Kg	1	
Ethylbenzene	mg/Kg	0.0025	5.16
Fluoranthene	mg/Kg	200	0.1
Fluorene	mg/Kg	3	122
HMX	mg/Kg	1600	
Indeno(1,2,3-cd)pyrene	mg/Kg	30	
Iron	mg/Kg	94000	200

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Line 1 (R01) Surface Soil**

Lead	mg/Kg	13000	28
Lead-212	pci/g	1.2	
Lead-214	pci/g	0.62	
Magnesium	mg/Kg	28900	
Manganese	mg/Kg	7000	100
Mercury	mg/Kg	2000	0.1
Naphthalene	mg/Kg	2	0.1
Nickel	mg/Kg	116	30
Niobium	mg/Kg	68	
Phenanthrene	mg/Kg	60	0.1
Potassium	mg/Kg	2600	
Pyrene	mg/Kg	100	0.1
Radium-226	pci/g	1.01	
RDX	mg/Kg	3700	
Selenium	mg/Kg	1.86	1
Silver	mg/Kg	100	2
Sodium	mg/Kg	772	
Thallium	mg/Kg	43	1
Thallium-208	pci/g	0.7	
Toluene	mg/Kg	0.8	0.05
1,2,4-Trimethylbenzene	mg/Kg	0.0028	
Vanadium	mg/Kg	302	2
Xylenes	mg/Kg	0.0062	10
Zinc	mg/Kg	2680	50

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**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Line 2 (R02) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
1,3,5-Trinitrobenzene	mg/Kg	350	0.01
1,3-Dinitrobenzene	mg/Kg	2.56	0.6547
2,4,6-Trinitrotoluene	mg/Kg	6700	0.4
2,4-Dinitrotoluene	mg/Kg	17.4	1.28
2-Methylnaphthalene	mg/Kg	3	3.24
Acenaphthene	mg/Kg	9	20
Acetone	mg/Kg	1.65	2.5
Aluminum	mg/Kg	21800	50
Anthracene	mg/Kg	10	0.1
Antimony	mg/Kg	16.5	5
Arsenic	mg/Kg	33	10
Barium	mg/Kg	2330	500
Benzo(a)anthracene	mg/Kg	20	5.21
Benzo(a)pyrene	mg/Kg	30	0.1
Benzo(b)fluoranthene	mg/Kg	30	59.8
Benzo(g,h,i)perylene	mg/Kg	10	119
Benzo(k)fluoranthene	mg/Kg	8	148
Beryllium	mg/Kg	5.46	10
Bis(2-Ethylhexyl) Phthalate	mg/Kg	15	0.92594
Cadmium	mg/Kg	26.5	1
Calcium	mg/Kg	310000	
Carbazole	mg/Kg	10	
Chromium	mg/Kg	257	
Chrysene	mg/Kg	30	4.73
Cobalt	mg/Kg	55.2	20
Copper	mg/Kg	469	40
Di-N-Butyl Phthalate	mg/Kg	6.2	200
Dibenz(a,h)Anthracene	mg/Kg	5	18.4
Dibenzofuran	mg/Kg	7	
Fluoranthene	mg/Kg	60	0.1
Fluorene	mg/Kg	10	122
HMX	mg/Kg	6700	
Indeno(1,2,3-cd)pyrene	mg/Kg	30	
Iron	mg/Kg	70100	200
Lead	mg/Kg	4380	28
Magnesium	mg/Kg	29700	
Manganese	mg/Kg	7700	100
Mercury	mg/Kg	160	0.1
Naphthalene	mg/Kg	7	0.1
Nickel	mg/Kg	66.7	30
Niobium	mg/Kg	6.7	
Phenanthrene	mg/Kg	50	0.1
Potassium	mg/Kg	2200	
Pyrene	mg/Kg	40	0.1
RDX	mg/Kg	7200	
Selenium	mg/Kg	3.29	1

25

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Line 2 (R02) Surface Soil**

<b>Silver</b>	<b>mg/Kg</b>	<b>67</b>	<b>2</b>
<b>Sodium</b>	<b>mg/Kg</b>	<b>498</b>	
<b>Tetryl</b>	<b>mg/Kg</b>	<b>8300</b>	
<b>Thallium</b>	<b>mg/Kg</b>	<b>59.9</b>	<b>1</b>
<b>Toluene</b>	<b>mg/Kg</b>	<b>0.72</b>	<b>0.05</b>
<b>Vanadium</b>	<b>mg/Kg</b>	<b>62.8</b>	<b>2</b>
<b>Zinc</b>	<b>mg/Kg</b>	<b>5240</b>	<b>50</b>

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**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Line 3 (R03) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
Chromium	mg/Kg	1460	
Chrysene	mg/Kg	12	4.73
Cobalt	mg/Kg	48.6	20
Copper	mg/Kg	12000	40
Di-N-Butyl Phthalate	mg/Kg	4.3	200
Dibenz(a,h)Anthracene	mg/Kg	3.8	18.4
Dibenzofuran	mg/Kg	2	
Dieldrin	mg/Kg	0.0395	0.0005
Endrin	mg/Kg	0.65	0.001
Fluoranthene	mg/Kg	6.2	0.1
Fluorene	mg/Kg	6.3	122
gamma-BHC	mg/Kg	0.05	
1,3,5-Trinitrobenzene	mg/Kg	23000	0.01
1,3-Dinitrobenzene	mg/Kg	12.5	0.6547
2,4,6-Trinitrotoluene	mg/Kg	100000	0.4
2,4-Dinitrotoluene	mg/Kg	210	1.28
2,6-Dinitrotoluene	mg/Kg	13	0.03283
2-Methylnaphthalene	mg/Kg	0.5	3.24
4,4'-DDT	mg/Kg	0.1	0.0025
Acenaphthene	mg/Kg	5.1	20
Acenaphthylene	mg/Kg	0.4	682
Acetone	mg/Kg	1.65	2.5
Aldrin	mg/Kg	0.65	0.0025
Aluminum	mg/Kg	18800	50
Anthracene	mg/Kg	11	0.1
Antimony	mg/Kg	2820	5
Arsenic	mg/Kg	79	10
Barium	mg/Kg	679	500
Benzo(a)anthracene	mg/Kg	12	5.21
Benzo(a)pyrene	mg/Kg	6.2	0.1
Benzo(b)fluoranthene	mg/Kg	12	59.8
Benzo(g,h,i)perylene	mg/Kg	21	119
Benzo(k)fluoranthene	mg/Kg	20	148
Beryllium	mg/Kg	3.62	10
Bis(2-Ethylhexyl) Phthalate	mg/Kg	10	0.92594
Cadmium	mg/Kg	31.6	1
Calcium	mg/Kg	350000	
Carbazole	mg/Kg	0.081	
HMX	mg/Kg	610	
Indeno(1,2,3-cd)pyrene	mg/Kg	12	
Iron	mg/Kg	37700	200
Lead	mg/Kg	5790	28
Magnesium	mg/Kg	25800	
Manganese	mg/Kg	2530	100
Mercury	mg/Kg	10	0.1
Naphthalene	mg/Kg	2.6	0.1

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Line 3 (R03) Surface Soil**

<b>Nickel</b>	<b>mg/Kg</b>	<b>193</b>	<b>30</b>
<b>Niobium</b>	<b>mg/Kg</b>	<b>60</b>	
<b>Phenanthrene</b>	<b>mg/Kg</b>	<b>12</b>	<b>0.1</b>
<b>Phenol</b>	<b>mg/Kg</b>	<b>1.5</b>	<b>30</b>
<b>Potassium</b>	<b>mg/Kg</b>	<b>2230</b>	
<b>Pyrene</b>	<b>mg/Kg</b>	<b>6.2</b>	<b>0.1</b>
<b>RDX</b>	<b>mg/Kg</b>	<b>2400</b>	
<b>Selenium</b>	<b>mg/Kg</b>	<b>2.13</b>	<b>1</b>
<b>Silver</b>	<b>mg/Kg</b>	<b>260</b>	<b>2</b>
<b>Sodium</b>	<b>mg/Kg</b>	<b>624</b>	
<b>Thallium</b>	<b>mg/Kg</b>	<b>67.3</b>	<b>1</b>
<b>Toluene</b>	<b>mg/Kg</b>	<b>0.05</b>	<b>0.05</b>
<b>Vanadium</b>	<b>mg/Kg</b>	<b>55.2</b>	<b>2</b>
<b>Zinc</b>	<b>mg/Kg</b>	<b>5600</b>	<b>50</b>

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**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Line 3A (R04) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
1,3,5-Trinitrobenzene	mg/Kg	21	0.01
1,3-Dinitrobenzene	mg/Kg	0.327	0.6547
2,4,6-Trinitrotoluene	mg/Kg	19000	0.4
2,4-Dinitrotoluene	mg/Kg	13.2	1.28
Aluminum	mg/Kg	19300	50
Antimony	mg/Kg	13.2	5
Arsenic	mg/Kg	15	10
Barium	mg/Kg	341	500
Beryllium	mg/Kg	2.27	10
Bis(2-Ethylhexyl) Phthalate	mg/Kg	6.2	0.92594
Cadmium	mg/Kg	8.42	1
Calcium	mg/Kg	270000	
Chromium	mg/Kg	223	
Cobalt	mg/Kg	17.1	20
Copper	mg/Kg	976	40
HMX	mg/Kg	1700	
Iron	mg/Kg	23500	200
Lead	mg/Kg	1710	28
Magnesium	mg/Kg	34700	
Manganese	mg/Kg	2460	100
Mercury	mg/Kg	4	0.1
Nickel	mg/Kg	57.8	30
Niobium	mg/Kg	1.205	
Potassium	mg/Kg	1810	
RDX	mg/Kg	11000	
Selenium	mg/Kg	1.4	1
Silver	mg/Kg	370	2
Sodium	mg/Kg	454	
Thallium	mg/Kg	22.3	1
Vanadium	mg/Kg	49.2	2
Zinc	mg/Kg	1180	50



29

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Lines 4A and 4B (R05) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
2,4,6-Trinitrotoluene	mg/Kg	1.66	0.4
Aluminum	mg/Kg	15300	50
Arsenic	mg/Kg	11	10
Barium	mg/Kg	526	500
Beryllium	mg/Kg	1.64	10
Cadmium	mg/Kg	1.88	1
Calcium	mg/Kg	43800	
Chromium	mg/Kg	39.8	
Cobalt	mg/Kg	41.2	20
Copper	mg/Kg	155	40
Iron	mg/Kg	23600	200
Lead	mg/Kg	1160	28
Magnesium	mg/Kg	8970	
Manganese	mg/Kg	2800	100
Mercury	mg/Kg	0.184	0.1
Nickel	mg/Kg	68.5	30
Potassium	mg/Kg	1380	
Selenium	mg/Kg	0.497	1
Silver	mg/Kg	1.31	2
Sodium	mg/Kg	375	
Thallium	mg/Kg	22.3	1
Vanadium	mg/Kg	45.8	2
Zinc	mg/Kg	456	50

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Lines 5A and 5B (R06) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
1,3,5-Trinitrobenzene	mg/Kg	11	0.01
1,3-Dinitrobenzene	mg/Kg	6.6	0.6547
2,4,6-Trinitrotoluene	mg/Kg	25000	0.4
2,4-Dinitrotoluene	mg/Kg	2.1	1.28
Aluminum	mg/Kg	32200	50
Antimony	mg/Kg	9.8	5
Arsenic	mg/Kg	92	10
Barium	mg/Kg	441	500
Beryllium	mg/Kg	3.41	10
Cadmium	mg/Kg	801	1
Calcium	mg/Kg	230000	
Chromium	mg/Kg	106	
Cobalt	mg/Kg	31.6	20
Copper	mg/Kg	1210	40
HMX	mg/Kg	13000	
Iron	mg/Kg	35800	200
Lead	mg/Kg	1050	28
Magnesium	mg/Kg	7340	
Manganese	mg/Kg	2760	100
Mercury	mg/Kg	0.751	0.1
Nickel	mg/Kg	69	30
Potassium	mg/Kg	1810	
RDX	mg/Kg	75000	
Selenium	mg/Kg	1.3	1
Silver	mg/Kg	2.95	2
Sodium	mg/Kg	345	
Tetryl	mg/Kg	14000	
Thallium	mg/Kg	20.6	1
Vanadium	mg/Kg	44.5	2
Zinc	mg/Kg	1460	50

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Line 6 (R07) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
2,4,6-Trinitrotoluene	mg/Kg	0.96	0.4
Aluminum	mg/Kg	18500	50
Antimony	mg/Kg	329	5
Arsenic	mg/Kg	16.9	10
Barium	mg/Kg	860	500
Beryllium	mg/Kg	2.91	10
Cadmium	mg/Kg	1.81	1
Calcium	mg/Kg	7640	
Chromium	mg/Kg	214	
Cobalt	mg/Kg	14.1	20
Copper	mg/Kg	120	40
HMX	mg/Kg	0.765	
Iron	mg/Kg	26400	200
Lead	mg/Kg	13000	28
Magnesium	mg/Kg	12700	
Manganese	mg/Kg	544	100
Mercury	mg/Kg	130	0.1
Nickel	mg/Kg	128	30
Potassium	mg/Kg	3060	
RDX	mg/Kg	1.81	
Selenium	mg/Kg	0.657	1
Silver	mg/Kg	137	2
Sodium	mg/Kg	945	
Thallium	mg/Kg	22.2	1
Vanadium	mg/Kg	46.8	2
Zinc	mg/Kg	623	50

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Line 7 (R08) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
2,4,6-Trinitrotoluene	mg/Kg	4.13	0.4
2-Methylnaphthalene	mg/Kg	0.46	3.24
4,4'-DDD	mg/Kg	1.9	0.0025
4,4'-DDT	mg/Kg	0.1	0.0025
Aldrin	mg/Kg	0.65	0.0025
Aluminum	mg/Kg	12300	50
Antimony	mg/Kg	11.2	5
Arochlor 1260	mg/Kg	2.06	0.02
Arsenic	mg/Kg	8.8	10
Barium	mg/Kg	242	500
Benzo(a)anthracene	mg/Kg	0.31	5.21
Beryllium	mg/Kg	2.24	10
Cadmium	mg/Kg	2.73	1
Calcium	mg/Kg	170000	
Chromium	mg/Kg	499	
Chrysene	mg/Kg	0.48	4.73
Cobalt	mg/Kg	17.6	20
Copper	mg/Kg	5200	40
Di-N-Butyl Phthalate	mg/Kg	4.7	200
Dieldrin	mg/Kg	0.0448	0.0005
Fluoranthene	mg/Kg	0.14	0.1
Iron	mg/Kg	21700	200
Lead	mg/Kg	302	28
Magnesium	mg/Kg	11300	
Manganese	mg/Kg	1690	100
Mercury	mg/Kg	2.3	0.1
Nickel	mg/Kg	31.9	30
Phenanthrene	mg/Kg	0.76	0.1
Potassium	mg/Kg	1670	
Pyrene	mg/Kg	0.28	0.1
RDX	mg/Kg	0.89	
Selenium	mg/Kg	0.694	1
Silver	mg/Kg	1.26	2
Sodium	mg/Kg	311	
Thallium	mg/Kg	25.9	1
Toluene	mg/Kg	0.49	0.05
Vanadium	mg/Kg	35	2
Zinc	mg/Kg	3270	50

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Line 8 (R09) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
Aluminum	mg/Kg	12600	50
Antimony	mg/Kg	16.2	5
Arochlor 1254	mg/Kg	0.28	0.02
Arsenic	mg/Kg	15	10
Barium	mg/Kg	177	500
Benzo(g,h,i)perylene	mg/Kg	5	119
Beryllium	mg/Kg	1.64	10
Bis(2-Ethylhexyl) Phthalate	mg/Kg	15	0.92594
Cadmium	mg/Kg	5.18	1
Calcium	mg/Kg	250000	
Chromium	mg/Kg	38	
Chrysene	mg/Kg	3	4.73
Cobalt	mg/Kg	12	20
Copper	mg/Kg	82.1	40
Fluoranthene	mg/Kg	1.5	0.1
Iron	mg/Kg	39400	200
Lead	mg/Kg	2270	28
Magnesium	mg/Kg	15100	
Manganese	mg/Kg	1520	100
Mercury	mg/Kg	1.3	0.1
Nickel	mg/Kg	30.4	30
Potassium	mg/Kg	916	
Pyrene	mg/Kg	2	0.1
Selenium	mg/Kg	0.51	1
Sodium	mg/Kg	349	
Thallium	mg/Kg	36.4	1
Vanadium	mg/Kg	37.7	2
Zinc	mg/Kg	656	50

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Line 9 (R10) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
Aluminum	mg/Kg	19300	50
Antimony	mg/Kg	13	5
Arsenic	mg/Kg	20.3	10
Barium	mg/Kg	421	500
Beryllium	mg/Kg	100	10
Cadmium	mg/Kg	2.96	1
Calcium	mg/Kg	190000	
Chromium	mg/Kg	67.9	
Cobalt	mg/Kg	17.3	20
Copper	mg/Kg	130	40
Iron	mg/Kg	29300	200
Lead	mg/Kg	833	28
Magnesium	mg/Kg	12200	
Manganese	mg/Kg	1830	100
Mercury	mg/Kg	10	0.1
Nickel	mg/Kg	43.3	30
Potassium	mg/Kg	1660	
Selenium	mg/Kg	0.68	1
Sodium	mg/Kg	1730	
Thallium	mg/Kg	19.6	1
Vanadium	mg/Kg	56.6	2
Zinc	mg/Kg	337	50

25

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Line 800 (R11) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
1,1,1-Trichloroethane	mg/Kg	0.83	0.1
1,3,5-Trinitrobenzene	mg/Kg	20.2	0.01
1,3-Dinitrobenzene	mg/Kg	1.4	0.6547
2,4,6-Trinitrotoluene	mg/Kg	2000	0.4
2,4-Dinitrotoluene	mg/Kg	7.91	1.28
2,6-Dinitrotoluene	mg/Kg	0.87	0.03283
4,4'-DDE	mg/Kg	0.034	0.0025
4,4'-DDT	mg/Kg	0.05	0.0025
Acetone	mg/Kg	8	2.5
Aluminum	mg/Kg	21300	50
2-Amino-4,6-Dinitrotoluene	mg/Kg	5.15	
Antimony	mg/Kg	14.3	5
Arsenic	mg/Kg	18	10
Barium	mg/Kg	639	500
Benzo(k)fluoranthene	mg/Kg	0.1	148
Beryllium	mg/Kg	2.85	10
Bis(2-Ethylhexyl) Phthalate	mg/Kg	4.6	0.92594
Cadmium	mg/Kg	757	1
Calcium	mg/Kg	260000	
Chromium	mg/Kg	161	
Chrysene	mg/Kg	0.13	4.73
Cobalt	mg/Kg	27.7	20
Copper	mg/Kg	1900	40
Di-N-Butyl Phthalate	mg/Kg	6.2	200
Fluoranthene	mg/Kg	0.23	0.1
HMX	mg/Kg	86	
Iron	mg/Kg	33100	200
Lead	mg/Kg	1650	28
Magnesium	mg/Kg	23700	
Manganese	mg/Kg	3290	100
Mercury	mg/Kg	7.8	0.1
Nickel	mg/Kg	57.5	30
Phenanthrene	mg/Kg	0.1	0.1
Phenol	mg/Kg	0.28	30
Potassium	mg/Kg	1950	
Pyrene	mg/Kg	0.17	0.1
RDX	mg/Kg	360	
Selenium	mg/Kg	0.528	1
Silver	mg/Kg	1.39	2
Sodium	mg/Kg	401	
Thallium	mg/Kg	41.5	1
Vanadium	mg/Kg	44.1	2
Zinc	mg/Kg	10000	50

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Pesticide Pit (R13) Surface Soil**

Analyte Name	Units	Max Value	Screening Value
1,4-Dichlorobenzene	mg/Kg	10	0.01
2-Methylnaphthalene	mg/Kg	200	3.24
4,4'-DDD	mg/Kg	1200	0.0025
4,4'-DDE	mg/Kg	21000	0.0025
4,4'-DDT	mg/Kg	77	0.0025
Acetone	mg/Kg	0.056	2.5
alpha-Chlordane	mg/Kg	880	
Aluminum	mg/Kg	13600	50
Antimony	mg/Kg	25.1	5
Arsenic	mg/Kg	9.67	10
Barium	mg/Kg	482	500
Cadmium	mg/Kg	4.15	1
Calcium	mg/Kg	240000	
Chromium	mg/Kg	62.9	
Cobalt	mg/Kg	14.3	20
Copper	mg/Kg	564	40
Dibenzofuran	mg/Kg	30	
Endrin	mg/Kg	1400	0.001
Fluoranthene	mg/Kg	0.35	0.1
gamma-Chlordane	mg/Kg	640	
Heptachlor	mg/Kg	290	0.1
Iron	mg/Kg	34700	200
Lead	mg/Kg	742	28
Magnesium	mg/Kg	12800	
Manganese	mg/Kg	2190	100
Mercury	mg/Kg	0.24	0.1
Naphthalene	mg/Kg	20	0.1
Nickel	mg/Kg	43.8	30
Phenanthrene	mg/Kg	10	0.1
Potassium	mg/Kg	929	
Pyrene	mg/Kg	0.15	0.1
Silver	mg/Kg	6.37	2
Sodium	mg/Kg	371	
Thallium	mg/Kg	9.12	1
Vanadium	mg/Kg	42.9	2
Zinc	mg/Kg	1290	50



**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Demolition Area (R15) Surface Soil**

Analyte Name	Units	Max Value	Screening Value
1,3-Dinitrobenzene	mg/Kg	24.9	0.6547
Aluminum	mg/Kg	17000	50
Antimony	mg/Kg	64.7	5
Arsenic	mg/Kg	13	10
Barium	mg/Kg	5100	500
Beryllium	mg/Kg	2.15	10
Cadmium	mg/Kg	180	1
Calcium	mg/Kg	240000	
Chromium	mg/Kg	613	
Cobalt	mg/Kg	14.4	20
Copper	mg/Kg	5100	40
Iron	mg/Kg	24200	200
Lead	mg/Kg	6400	28
Magnesium	mg/Kg	9690	
Manganese	mg/Kg	1590	100
Mercury	mg/Kg	0.91	0.1
Nickel	mg/Kg	147	30
Potassium	mg/Kg	1600	
Selenium	mg/Kg	2.06	1
Silver	mg/Kg	20	2
Sodium	mg/Kg	392	
Thallium	mg/Kg	23.2	1
Vanadium	mg/Kg	48.4	2
Zinc	mg/Kg	15000	50

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**

**Contaminated Waste Processor (R16) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
<b>2,4,6-Trinitrotoluene</b>	mg/Kg	2.3	0.4
<b>Aluminum</b>	mg/Kg	11900	50
<b>Arsenic</b>	mg/Kg	13	10
Barium	mg/Kg	371	500
Beryllium	mg/Kg	1.64	10
<b>Calcium</b>	mg/Kg	4070	
<b>Chromium</b>	mg/Kg	24.6	
Cobalt	mg/Kg	13.9	20
<b>Copper</b>	mg/Kg	93.5	40
<b>HMX</b>	mg/Kg	11.6	
<b>Iron</b>	mg/Kg	17500	200
<b>Lead</b>	mg/Kg	160	28
<b>Magnesium</b>	mg/Kg	3450	
<b>Manganese</b>	mg/Kg	1450	100
<b>Mercury</b>	mg/Kg	0.104	0.1
Nickel	mg/Kg	25	30
<b>Potassium</b>	mg/Kg	1500	
<b>RDX</b>	mg/Kg	2.26	
Selenium	mg/Kg	0.47	1
<b>Sodium</b>	mg/Kg	224	
<b>Vanadium</b>	mg/Kg	38.3	2
<b>Zinc</b>	mg/Kg	105	50

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Explosive Waste Incinerator (R17) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
2-Methylnaphthalene	mg/Kg	0.46	3.24
1,1,2,2-Tetrachloroethane	mg/Kg	0.26	0.1
1,3,5-Trinitrobenzene	mg/Kg	1.06	0.01
<b>Aluminum</b>	<b>mg/Kg</b>	<b>5980</b>	<b>50</b>
Arsenic	mg/Kg	6.06	10
Barium	mg/Kg	192	500
Beryllium	mg/Kg	0.994	10
<b>Calcium</b>	<b>mg/Kg</b>	<b>160000</b>	
<b>Chromium</b>	<b>mg/Kg</b>	<b>29.4</b>	
Cobalt	mg/Kg	3.88	20
Copper	mg/Kg	36	40
<b>HMX</b>	<b>mg/Kg</b>	<b>4.8</b>	
<b>Iron</b>	<b>mg/Kg</b>	<b>7990</b>	<b>200</b>
Lead	mg/Kg	27	28
<b>Magnesium</b>	<b>mg/Kg</b>	<b>20800</b>	
<b>Manganese</b>	<b>mg/Kg</b>	<b>604</b>	<b>100</b>
<b>Mercury</b>	<b>mg/Kg</b>	<b>0.239</b>	<b>0.1</b>
<b>Naphthalene</b>	<b>mg/Kg</b>	<b>0.37</b>	<b>0.1</b>
Nickel	mg/Kg	18.3	30
<b>Potassium</b>	<b>mg/Kg</b>	<b>645</b>	
<b>RDX</b>	<b>mg/Kg</b>	<b>7.07</b>	
<b>Sodium</b>	<b>mg/Kg</b>	<b>498</b>	
Toluene	mg/Kg	0.05	0.05
<b>Vanadium</b>	<b>mg/Kg</b>	<b>13.8</b>	<b>2</b>
<b>Zinc</b>	<b>mg/Kg</b>	<b>98</b>	<b>50</b>

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Sewage Treatment Plant (R18) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
<b>4,4'-DDT</b>	mg/Kg	0.0839	0.0025
<b>Aldrin</b>	mg/Kg	0.00301	0.0025
<b>Aluminum</b>	mg/Kg	2800	50
<b>Arochlor 1260</b>	mg/Kg	0.288	0.02
Arsenic	mg/Kg	6.34	10
Barium	mg/Kg	202	500
Beryllium	mg/Kg	0.7	10
<b>Cadmium</b>	mg/Kg	1.04	1
<b>Calcium</b>	mg/Kg	6780	
<b>Chromium</b>	mg/Kg	90.6	
Cobalt	mg/Kg	4.33	20
Copper	mg/Kg	33	40
<b>Dieldrin</b>	mg/Kg	0.00609	0.0005
<b>Endrin</b>	mg/Kg	0.0113	0.001
<b>Iron</b>	mg/Kg	7370	200
Lead	mg/Kg	28	28
<b>Magnesium</b>	mg/Kg	1640	
<b>Manganese</b>	mg/Kg	241	100
<b>Mercury</b>	mg/Kg	5.6	0.1
Nickel	mg/Kg	16.8	30
<b>Potassium</b>	mg/Kg	263	
Selenium	mg/Kg	0.753	1
<b>Silver</b>	mg/Kg	139	2
<b>Sodium</b>	mg/Kg	302	
<b>Vanadium</b>	mg/Kg	14.9	2
<b>Zinc</b>	mg/Kg	275	50

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Flyash Landfill (R19) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
<b>Arsenic</b>	mg/Kg	99	10
<b>Barium</b>	mg/Kg	250	500
<b>Beryllium</b>	mg/Kg	5.6	10
<b>Chromium</b>	mg/Kg	33.3	
<b>Copper</b>	mg/Kg	137	40
<b>Lead</b>	mg/Kg	97	28
<b>Mercury</b>	mg/Kg	0.131	0.1
<b>Nickel</b>	mg/Kg	51.2	30
<b>Selenium</b>	mg/Kg	13.5	1
<b>Zinc</b>	mg/Kg	74.2	50

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Construction Debris Landfill (R20) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
<b>1,3-Dinitrobenzene</b>	mg/Kg	<b>0.966</b>	<b>0.6547</b>
<b>4,4'-DDD</b>	mg/Kg	<b>0.0159</b>	<b>0.0025</b>
<b>4,4'-DDE</b>	mg/Kg	<b>0.00947</b>	<b>0.0025</b>
<b>4,4'-DDT</b>	mg/Kg	<b>0.0242</b>	<b>0.0025</b>
<b>alpha-Chlordane</b>	mg/Kg	<b>0.0144</b>	
<b>Arochlor 1254</b>	mg/Kg	<b>0.365</b>	<b>0.02</b>
Arsenic	mg/Kg	7.12	10
Barium	mg/Kg	323	500
Beryllium	mg/Kg	0.717	10
<b>Chromium</b>	<b>mg/Kg</b>	<b>24.5</b>	
Copper	mg/Kg	17.4	40
<b>Dieldrin</b>	<b>mg/Kg</b>	<b>0.00939</b>	<b>0.0005</b>
<b>gamma-Chlordane</b>	<b>mg/Kg</b>	<b>0.0186</b>	
<b>HMX</b>	<b>mg/Kg</b>	<b>0.746</b>	
Lead	mg/Kg	23	28
Nickel	mg/Kg	24.1	30
<b>Zinc</b>	<b>mg/Kg</b>	<b>64</b>	<b>50</b>

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**

**Line 3A Sewage Treatment Plant (R21) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
<b>4,4'-DDT</b>	<b>mg/Kg</b>	<b>0.0473</b>	<b>0.0025</b>
<b>Aluminum</b>	<b>mg/Kg</b>	<b>4700</b>	<b>50</b>
Arsenic	mg/Kg	8.47	10
Barium	mg/Kg	206	500
<b>Calcium</b>	<b>mg/Kg</b>	<b>20900</b>	
<b>Chromium</b>	<b>mg/Kg</b>	<b>20.2</b>	
Cobalt	mg/Kg	6.5	20
Copper	mg/Kg	14	40
<b>delta-BHC</b>	<b>mg/Kg</b>	<b>0.0353</b>	
<b>Endrin</b>	<b>mg/Kg</b>	<b>0.0109</b>	<b>0.001</b>
<b>Iron</b>	<b>mg/Kg</b>	<b>16300</b>	<b>200</b>
<b>Lead</b>	<b>mg/Kg</b>	<b>36</b>	<b>28</b>
<b>Magnesium</b>	<b>mg/Kg</b>	<b>5210</b>	
<b>Manganese</b>	<b>mg/Kg</b>	<b>508</b>	<b>100</b>
<b>Mercury</b>	<b>mg/Kg</b>	<b>0.109</b>	<b>0.1</b>
Naphthalene	mg/Kg	0.004	0.1
Nickel	mg/Kg	17.9	30
<b>Potassium</b>	<b>mg/Kg</b>	<b>738</b>	
<b>Silver</b>	<b>mg/Kg</b>	<b>15.5</b>	<b>2</b>
<b>Sodium</b>	<b>mg/Kg</b>	<b>269</b>	
<b>Vanadium</b>	<b>mg/Kg</b>	<b>21.2</b>	<b>2</b>
<b>Zinc</b>	<b>mg/Kg</b>	<b>270</b>	<b>50</b>

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Firing Site (R22) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
Actinium 228	pci/g	1.7	
Alpha, Gross	pci/g	23.4	
Aluminum	mg/Kg	18700	50
Arsenic	mg/Kg	21.3	10
Barium	mg/Kg	722	500
Beryllium	mg/Kg	2.36	10
Beta, Gross	pci/g	45.9	
Bismuth-212	pci/g	1.1	
Bismuth-214	pci/g	1.52	
Cadmium	mg/Kg	3.32	1
Calcium	mg/Kg	110000	
Cesium-137	pci/g	0.27	
Chromium	mg/Kg	2800	
Cobalt	mg/Kg	12.2	20
Copper	mg/Kg	8200	40
HMX	mg/Kg	2.16	
Iron	mg/Kg	22700	200
Lead	mg/Kg	260	28
Lead-212	pci/g	1.1	
Lead-214	pci/g	0.84	
Magnesium	mg/Kg	8530	
Manganese	mg/Kg	847	100
Mercury	mg/Kg	0.253	0.1
Nickel	mg/Kg	1900	30
Potassium	mg/Kg	1740	
Potassium-40	pci/g	19	
Radium-226	pci/g	12	
RDX	mg/Kg	15.6	
Selenium	mg/Kg	0.681	1
Silver	mg/Kg	4.72	2
Sodium	mg/Kg	269	
Thallium	mg/Kg	20.3	1
Thallium-208	pci/g	0.76	
Thorium-234	pci/g	38	
Vanadium	mg/Kg	46.7	2
Zinc	mg/Kg	3900	50



65

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Building 600-86 Septic System (R26) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
<b>Aluminum</b>	<b>mg/Kg</b>	<b>13300</b>	<b>50</b>
Arsenic	mg/Kg	6.21	10
Barium	mg/Kg	220	500
Benzo(a)anthracene	mg/Kg	0.11	5.21
Beryllium	mg/Kg	1.02	10
<b>Cadmium</b>	<b>mg/Kg</b>	<b>6.46</b>	<b>1</b>
<b>Calcium</b>	<b>mg/Kg</b>	<b>6400</b>	
<b>Chromium</b>	<b>mg/Kg</b>	<b>88.4</b>	
Chrysene	mg/Kg	0.1	4.73
Cobalt	mg/Kg	8.16	20
Copper	mg/Kg	31.5	40
<b>Fluoranthene</b>	<b>mg/Kg</b>	<b>0.15</b>	<b>0.1</b>
<b>Iron</b>	<b>mg/Kg</b>	<b>18300</b>	<b>200</b>
Lead	mg/Kg	28	28
<b>Magnesium</b>	<b>mg/Kg</b>	<b>3040</b>	
<b>Manganese</b>	<b>mg/Kg</b>	<b>464</b>	<b>100</b>
<b>Mercury</b>	<b>mg/Kg</b>	<b>4.8</b>	<b>0.1</b>
Nickel	mg/Kg	26	30
<b>Phenanthrene</b>	<b>mg/Kg</b>	<b>0.14</b>	<b>0.1</b>
<b>Potassium</b>	<b>mg/Kg</b>	<b>1130</b>	
Selenium	mg/Kg	0.825	1
<b>Sodium</b>	<b>mg/Kg</b>	<b>404</b>	
Toluene	mg/Kg	0.05	0.05
<b>Vanadium</b>	<b>mg/Kg</b>	<b>33.7</b>	<b>2</b>
<b>Zinc</b>	<b>mg/Kg</b>	<b>87.1</b>	<b>50</b>

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Fire Traing Area (R27) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
1,1,1-Trichloroethane	mg/Kg	10	0.1
1,1-Dichloroethane	mg/Kg	6.1	0.1
1,1-Dichloroethene	mg/Kg	1.7	8.28
1,2-Dichloroethene (total)	mg/Kg	1.1	
2-Methylnaphthalene	mg/Kg	6	3.24
Aluminum	mg/Kg	17400	50
Antimony	mg/Kg	49.7	5
Arsenic	mg/Kg	15	10
Barium	mg/Kg	4500	500
Beryllium	mg/Kg	3.4	10
Bis(2-Ethylhexyl) Phthalate	mg/Kg	60	0.92594
Cadmium	mg/Kg	62	1
Calcium	mg/Kg	270000	
Chromium	mg/Kg	823	
Cobalt	mg/Kg	55.3	20
Copper	mg/Kg	596	40
Di-N-Butyl Phthalate	mg/Kg	6.3	200
Ethylbenzene	mg/Kg	1.4	0.05
Iron	mg/Kg	30400	200
Lead	mg/Kg	16000	28
Magnesium	mg/Kg	16200	
Manganese	mg/Kg	1560	100
Mercury	mg/Kg	0.684	0.1
Nickel	mg/Kg	52.5	30
Potassium	mg/Kg	2080	
Selenium	mg/Kg	0.34	1
Silver	mg/Kg	19	2
Sodium	mg/Kg	2810	
Tetrachloroethene	mg/Kg	0.59	0.01
Thallium	mg/Kg	29.3	1
Toluene	mg/Kg	10	0.05
Trichloroethene	mg/Kg	0.45	0.001
Vanadium	mg/Kg	44.7	2
Zinc	mg/Kg	5250	50

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Roundhouse Transformer Storage Yard (R28) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
4,4'-DDD	mg/Kg	0.032	0.0025
4,4'-DDE	mg/Kg	0.073	0.0025
4,4'-DDT	mg/Kg	0.0329	0.0025
Aldrin	mg/Kg	0.003645	0.0025
Arochlor 1260	mg/Kg	60	0.02
Benzo(a)anthracene	mg/Kg	0.3	5.21
Benzo(b)fluoranthene	mg/Kg	1.3	59.8
Chrysene	mg/Kg	0.71	4.73
Dieldrin	mg/Kg	0.0169	0.0005
Endrin	mg/Kg	0.00562	0.001
Fluoranthene	mg/Kg	0.42	0.1
Pyrene	mg/Kg	0.83	0.1

**Appendix A**  
**IAAAP Ecological Risk Assessment**  
**Screening Value Exceedances**  
**Flyash Disposal Area (R30) Surface Soil**

<b>Analyte Name</b>	<b>Units</b>	<b>Max Value</b>	<b>Screening Value</b>
<b>Arsenic</b>	mg/Kg	<b>10.8</b>	<b>10</b>
Barium	mg/Kg	220	500
Beryllium	mg/Kg	2.96	10
<b>Cadmium</b>	mg/Kg	<b>1.89</b>	<b>1</b>
<b>Chromium</b>	mg/Kg	<b>28.7</b>	
<b>Copper</b>	mg/Kg	<b>44.6</b>	<b>40</b>
<b>Lead</b>	mg/Kg	<b>29</b>	<b>28</b>
<b>Mercury</b>	mg/Kg	<b>0.217</b>	<b>0.1</b>
<b>Nickel</b>	mg/Kg	<b>41.2</b>	<b>30</b>
Selenium	mg/Kg	0.997	1
<b>Zinc</b>	mg/Kg	<b>236</b>	<b>50</b>

**Appendix B**  
**Comparison of Brush Creek Surface Water Values with Background Levels**

<b>Analyte Name</b>	<b>Units</b>	<b>Brush Creek Min Value</b>	<b>Brush Creek Max Value</b>	<b>Minimum of Background</b>	<b>Maximum of Background</b>
Aluminum	MG/L	0.0194	6.02	0.0194	7.07
Arsenic	MG/L	0.002	0.008	0.0022	0.0076
Barium	MG/L	0.0714	0.224	0.106	0.183
Beryllium	MG/L	0.0002	0.0022	0.0003	0.0008
Cadmium	MG/L	0.0002	0.0013	0.0002	0.0007
Calcium	MG/L	35.3	67.3	48.5	63.7
Chromium	MG/L	0.0007	0.0104	0.0007	0.0075
Cobalt	MG/L	0.001	0.0058	0.001	0.003
Copper	MG/L	0.0011	0.0105	0.0013	0.0082
Iron	MG/L	0.0233	6.11	0.0233	6.91
Lead	MG/L	0.0012	0.0271	0.0013	0.0028
Magnesium	MG/L	10.8	23.2	17.9	25.7
Manganese	MG/L	0.001	0.352	0.0066	0.15
Mercury	MG/L	0.0001	0.00029	0.0001	0.0001
Potassium	MG/L	0.486	4.91	1.05	7.23
Selenium	MG/L	0.0026	0.009	0.0033	0.0044
Silver	MG/L	0.0006	0.0087	0.0006	0.0028
Sodium	MG/L	6.41	51.9	13.5	32.3
Thallium	MG/L	0.0034	0.0116	0.0034	0.0063
Zinc	MG/L	0.0007	0.0323	0.002	0.0234

**Appendix B**  
**Comparison of Long Creek Surface Water Values with Background Levels**

<b>Analyte Name</b>	<b>Units</b>	<b>Long Creek Min Value</b>	<b>Long Creek Max Value</b>	<b>Minimum of Background</b>	<b>Maximum of Background</b>
Aluminum	MG/L	0.0194	62	0.0194	7.07
Arsenic	MG/L	0.0022	0.0237	0.0022	0.0076
Barium	MG/L	0.0486	0.893	0.106	0.183
Beryllium	MG/L	0.0003	0.0026	0.0003	0.0008
Calcium	MG/L	27.1	121	48.5	63.7
Chromium	MG/L	0.0007	0.0727	0.0007	0.0075
Cobalt	MG/L	0.001	0.0398	0.001	0.003
Copper	MG/L	0.0011	0.0606	0.0013	0.0082
Iron	MG/L	0.0233	76.5	0.0233	6.91
Lead	MG/L	0.0013	0.0464	0.0013	0.0028
Magnesium	MG/L	11.6	44.9	17.9	25.7
Manganese	MG/L	0.0014	4.82	0.0066	0.15
Mercury	MG/L	0.0001	0.00011	0.0001	0.0001
Nickel	MG/L	0.001	0.067	0.001	0.0071
Potassium	MG/L	0.388	11.5	1.05	7.23
Selenium	MG/L	0.0026	0.0052	0.0033	0.0044
Silver	MG/L	0.0006	0.0028	0.0006	0.0028
Sodium	MG/L	1.64	37.2	13.5	32.3
Thallium	MG/L	0.0034	0.0063	0.0034	0.0063
Vanadium	MG/L	0.0015	0.173	0.0015	0.0163
Zinc	MG/L	0.0008	0.219	0.002	0.0234

**Appendix B**  
**Comparison of Spring Creek Surface Water Values with Background Levels**

Analyte Name	Units	Spring Creek Min Value	Spring Creek Max Value	Minimum of Background	Maximum of Background
Aluminum	MG/L	0.0727	34.5	0.0194	7.07
Arsenic	MG/L	0.0021	0.0116	0.0022	0.0076
Barium	MG/L	0.0322	0.728	0.106	0.183
Beryllium	MG/L	0.0002	0.0016	0.0003	0.0008
Calcium	MG/L	25.5	83.6	48.5	63.7
Chromium	MG/L	0.0007	0.0486	0.0007	0.0075
Cobalt	MG/L	0.001	0.009	0.001	0.003
Copper	MG/L	0.0013	0.0551	0.0013	0.0082
Iron	MG/L	0.0233	48.4	0.0233	6.91
Lead	MG/L	0.0013	0.0198	0.0013	0.0028
Magnesium	MG/L	9.15	25.4	17.9	25.7
Manganese	MG/L	0.0045	2.25	0.0066	0.15
Potassium	MG/L	1.1	18.9	1.05	7.23
Selenium	MG/L	0.0027	0.0078	0.0033	0.0044
Silver	MG/L	0.0006	0.007	0.0006	0.0028
Sodium	MG/L	11	82.4	13.5	32.3
Vanadium	MG/L	0.0015	0.0702	0.0015	0.0163
Zinc	MG/L	0.0003	0.135	0.002	0.0234

**Appendix B****Comparison of Skunk River Surface Water Values with Background Levels**

<b>Analyte Name</b>	<b>Units</b>	<b>Skunk River Min Value</b>	<b>Skunk River Max Value</b>	<b>Minimum of Background</b>	<b>Maximum of Background</b>
Aluminum	MG/L	0.0209	0.267	0.0194	7.07
Arsenic	MG/L	0.0022	0.0045	0.0022	0.0076
Barium	MG/L	0.0708	0.0786	0.106	0.183
Beryllium	MG/L	0.0003	0.0007	0.0003	0.0008
Calcium	MG/L	63.2	88	48.5	63.7
Chromium	MG/L	0.0007	0.002	0.0007	0.0075
Copper	MG/L	0.0011	0.03	0.0013	0.0082
Lead	MG/L	0.0013	0.003	0.0013	0.0028
Magnesium	MG/L	20.7	31	17.9	25.7
Manganese	MG/L	0.0213	0.123	0.0066	0.15
Potassium	MG/L	1.51	6.19	1.05	7.23
Selenium	MG/L	0.0033	0.0063	0.0033	0.0044
Sodium	MG/L	4.87	28.1	13.5	32.3
Zinc	MG/L	0.001	0.0206	0.002	0.0234



**APPENDIX C**  
**BACKGROUND SOIL RESULTS**

	A	B	C	D	E
1		NUMBER OF			
2		SAMPLES	MIN	MAX	AVERAGE
3	GROSS ALPHA	92	1.600	11.800	6.326
4	GROSS BETA	92	2.150	9.900	5.878
5					

55

	F	G	H	I	J
1	STANDARD				
2	DEVIATION	AVE + 1STD	AVE + 2STD	AVE + 3STD	
3	1.773	8.099	9.872	11.644	
4	1.847	7.725	9.572	11.419	
5					

	A	B	C	D	E
1		NUMBER OF			
2		SAMPLES	MINIMUM	MAXIMUM	AVERAGE
3	ALUMINUM	103	3,990.000	22,100.000	12,432.718
4	ANTIMONY	107	7.140	,122.000	8.743
5	ARSENIC	107	0.500	30.000	7.327
6	BARIUM	107	39.900	,649.000	,200.557
7	BERYLLIUM	107	0.500	2.100	1.043
8	CADMIUM	107	0.700	1.490	0.728
9	CHROMIUM	107	7.710	74.200	19.342
10	COBALT	103	2.710	58.000	11.749
11	COPPER	107	6.390	12,000.000	,127.538
12	IRON	103	5,110.000	72,000.000	19,742.816
13	LEAD	107	6.860	5,900.000	72.659
14	MANGANESE	103	39.600	2,790.000	,742.984
15	MERCURY	107	0.050	0.495	0.055
16	NICKEL	107	7.160	,279.000	24.185
17	SELENIUM	106	0.250	1.650	0.335
18	SILVER	107	0.589	1.650	0.607
19	THALLIUM	107	6.620	34.300	8.097
20	VANADIUM	103	13.600	74.000	33.361
21	ZINC	107	24.600	8,000.000	,134.950
22					

	F	G	H	I	J
1	STANDARD				
2	DEVIATION	AVE + 1STD	AVE + 2STD	AVE + 3STD	
3	4,242.304	16,675.022	20,917.326	25,159.629	
4	11.321	20.064	31.386	42.707	
5	4.020	11.347	15.368	19.388	
6	83.908	,284.465	,368.372	,452.280	
7	0.325	1.368	1.693	2.019	
8	0.122	0.850	0.972	1.094	
9	7.944	27.286	35.231	43.175	
10	7.327	19.076	26.403	33.730	
11	1,158.594	1,286.132	2,444.726	3,603.320	
12	8,376.420	28,119.235	36,495.655	44,872.075	
13	,568.713	,641.372	1,210.085	1,778.798	
14	,594.882	1,337.867	1,932.749	2,527.631	
15	0.044	0.100	0.144	0.188	
16	27.405	51.590	78.994	,106.399	
17	0.190	0.525	0.715	0.905	
18	0.110	0.717	0.826	0.936	
19	5.476	13.573	19.048	24.524	
20	10.241	43.602	53.842	64.083	
21	,767.753	,902.702	1,670.455	2,438.208	
22					

**APPENDIX D**  
**RESULTS OF MANN-WHITNEY TEST**

# NPar Tests

## Mann-Whitney Test

### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	158.76	16352.50
	1	153	108.13	16543.50
	Total	256		

### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	4762.500
Wilcoxon W	16543.500
Z	-5.366
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: SITE

# NPar Tests

## Mann-Whitney Test

### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	152.66	15723.50
	2	147	106.47	15651.50
	Total	250		

### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	4773.500
Wilcoxon W	15651.500
Z	-4.970
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: SITE



## NPar Tests

### Mann-Whitney Test

#### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	118.63	12219.00
	3	101	86.05	8691.00
	Total	204		

#### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	3540.000
Wilcoxon W	8691.000
Z	-3.942
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: SITE

# NPar Tests

## Mann-Whitney Test

### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	71.53	7367.50
	4	27	42.50	1147.50
	Total	130		

### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	769.500
Wilcoxon W	1147.500
Z	-3.564
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: SITE

**NPar Tests**

**Mann-Whitney Test**

**Ranks**

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	77.46	7978.50
	5	37	51.12	1891.50
	Total	140		

**Test Statistics<sup>a</sup>**

	ALUMINUM
Mann-Whitney U	1188.500
Wilcoxon W	1891.500
Z	-3.389
Asymp. Sig. (2-tailed)	.001

a. Grouping Variable: SITE

## NPar Tests

### Mann-Whitney Test

#### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	76.50	7879.00
	6	51	79.53	4056.00
	Total	154		

#### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	2523.000
Wilcoxon W	7879.000
Z	-.397
Asymp. Sig. (2-tailed)	.691

a. Grouping Variable: SITE

## NPar Tests

### Mann-Whitney Test

#### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	56.47	5816.50
	7	12	71.13	853.50
	Total	115		

#### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	460.500
Wilcoxon W	5816.500
Z	-1.441
Asymp. Sig. (2-tailed)	.150

a. Grouping Variable: SITE

# NPar Tests

## Mann-Whitney Test

### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	61.29	6312.50
	8	13	36.42	473.50
	Total	116		

### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	382.500
Wilcoxon W	473.500
Z	-2.512
Asymp. Sig. (2-tailed)	.012

a. Grouping Variable: SITE

# NPar Tests

## Mann-Whitney Test

### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	62.10	6396.00
	9	11	14.45	159.00
	Total	114		

### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	93.000
Wilcoxon W	159.000
Z	-4.545
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: SITE

## NPar Tests

### Mann-Whitney Test

#### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	61.06	6289.00
	10	15	48.80	732.00
	Total	118		

#### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	612.000
Wilcoxon W	732.000
Z	-1.297
Asymp. Sig. (2-tailed)	.195

a. Grouping Variable: SITE



## NPar Tests

### Mann-Whitney Test

#### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	75.96	7824.00
	11	34	47.91	1629.00
	Total	137		

#### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	1034.000
Wilcoxon W	1629.000
Z	-3.573
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: SITE

## NPar Tests

70

### Mann-Whitney Test

#### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	77.66	7998.50
	12	38	52.96	2012.50
	Total	141		

#### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	1271.500
Wilcoxon W	2012.500
Z	-3.186
Asymp. Sig. (2-tailed)	.001

a. Grouping Variable: SITE

# NPar Tests

## Mann-Whitney Test

### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	53.80	5541.50
	13	3	43.17	129.50
	Total	106		

### Test Statistics<sup>b</sup>

	ALUMINUM
Mann-Whitney U	123.500
Wilcoxon W	129.500
Z	-.591
Asymp. Sig. (2-tailed)	.555
Exact Sig. [2*(1-tailed Sig.)]	.574 <sup>a</sup>

a. Not corrected for ties.

b. Grouping Variable: SITE

**NPar Tests**

**Mann-Whitney Test**

**Ranks**

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	60.31	6212.00
	14	14	49.36	691.00
	Total	117		

**Test Statistics<sup>a</sup>**

	ALUMINUM
Mann-Whitney U	586.000
Wilcoxon W	691.000
Z	-1.134
Asymp. Sig. (2-tailed)	.257

a. Grouping Variable: SITE

# NPar Tests

## Mann-Whitney Test

### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	57.39	5911.00
	15	9	46.33	417.00
	Total	112		

### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	372.000
Wilcoxon W	417.000
Z	-.979
Asymp. Sig. (2-tailed)	.327

a. Grouping Variable: SITE

# NPar Tests

74

## Mann-Whitney Test

### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	56.71	5841.50
	16	6	25.58	153.50
	Total	109		

### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	132.500
Wilcoxon W	153.500
Z	-2.345
Asymp. Sig. (2-tailed)	.019

a. Grouping Variable: SITE

# NPar Tests

75

## Mann-Whitney Test

### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	56.94	5864.50
	17	5	4.30	21.50
	Total	108		

### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	6.500
Wilcoxon W	21.500
Z	-3.670
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: SITE

## NPar Tests

### Mann-Whitney Test

#### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	55.00	5665.00
	18	3	2.00	6.00
	Total	106		

#### Test Statistics<sup>b</sup>

	ALUMINUM
Mann-Whitney U	.000
Wilcoxon W	6.000
Z	-2.944
Asymp. Sig. (2-tailed)	.003
Exact Sig. [2*(1-tailed Sig.)]	.000 <sup>a</sup>

a. Not corrected for ties.

b. Grouping Variable: SITE



# NPar Tests

## Mann-Whitney Test

### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	54.98	5663.00
	21	3	2.67	8.00
	Total	106		

### Test Statistics<sup>b</sup>

	ALUMINUM
Mann-Whitney U	2.000
Wilcoxon W	8.000
Z	-2.906
Asymp. Sig. (2-tailed)	.004
Exact Sig. [2*(1-tailed Sig.)]	.000 <sup>a</sup>

a. Not corrected for ties.

b. Grouping Variable: SITE

# NPar Tests

78

## Mann-Whitney Test

### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	53.06	5465.00
	22	3	68.67	206.00
	Total	106		

### Test Statistics<sup>b</sup>

	ALUMINUM
Mann-Whitney U	109.000
Wilcoxon W	5465.000
Z	-.867
Asymp. Sig. (2-tailed)	.386
Exact Sig. [2*(1-tailed Sig.)]	.410 <sup>a</sup>

a. Not corrected for ties.

b. Grouping Variable: SITE

# NPar Tests

79

## Mann-Whitney Test

### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	56.65	5834.50
	24	8	47.69	381.50
	Total	111		

### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	345.500
Wilcoxon W	381.500
Z	-.758
Asymp. Sig. (2-tailed)	.448

a. Grouping Variable: SITE

# NPar Tests

80

## Mann-Whitney Test

### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	54.67	5631.00
	25	3	13.33	40.00
	Total	106		

### Test Statistics<sup>b</sup>

	ALUMINUM
Mann-Whitney U	34.000
Wilcoxon W	40.000
Z	-2.296
Asymp. Sig. (2-tailed)	.022
Exact Sig. [2*(1-tailed Sig.)]	.015 <sup>a</sup>

a. Not corrected for ties.

b. Grouping Variable: SITE

# NPar Tests

81

## Mann-Whitney Test

### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	53.45	5505.00
	26	3	55.33	166.00
	Total	106		

### Test Statistics<sup>b</sup>

	ALUMINUM
Mann-Whitney U	149.000
Wilcoxon W	5505.000
Z	-.105
Asymp. Sig. (2-tailed)	.917
Exact Sig. [2*(1-tailed Sig.)]	.929 <sup>a</sup>

a. Not corrected for ties.

b. Grouping Variable: SITE

# NPar Tests

82

## Mann-Whitney Test

### Ranks

	SITE	N	Mean Rank	Sum of Ranks
ALUMINUM	0	103	60.37	6218.50
	27	12	37.63	451.50
	Total	115		

### Test Statistics<sup>a</sup>

	ALUMINUM
Mann-Whitney U	373.500
Wilcoxon W	451.500
Z	-2.237
Asymp. Sig. (2-tailed)	.025

a. Grouping Variable: SITE