USACE-LRL

DRAFT REPORT

EVALUATION OF CHEMICAL RESIDUUM AT THE 40 MM RANGE, RAVENNA ARMY AMMUNITION PLANT, RAVENNA, OHIO

PREPARED FOR

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LIST OF ACRONYMS

ADD	Average Daily Dose
AOC	Area of Concern
ATSDR	Agency for Toxic Substances and Disease Registry
AUF	Area Use Factor
BAF	Bioaccumulation Factor
BGS	Below Ground Surface
BHC	Benzene hexachloride
BHHRA	Baseline Human Health Risk Assessment
BRA	Base-line Risk Assessment
COC	Constituent of Concern
COEC	Constituent of Environmental Concern
COPC	Constituent of Potential Concern
COPEC	Constituent of Potential Environmental Concern
CSF	Cancer Slope Factor
DAD	Daily Adjusted Dose
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	1,1,1-Trichloro-2,2-di(4-chlorophenyl)-ethane
DERR	Division of Emergency and Remedial Response
DQA	Data Quality Assessment
EPA	Environmental Protection Agency
EPC	Exposure Point Concentration
ESL	Ecological Screening Limit
ESV	Ecological Screening Value
EU	Exposure Unit
FBQ	Fuze and Booster Quarry
FWHHRAM	Facility-wide Human health Risk Assessor Manual
GAFs	Gastrointestinal Absorption Factor
HA	Hectares
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HQ	Hazard Quotient
HSDB	Hazardous Substances Data Base
ILCR	Incremental Lifetime Cancer Risk
IRIS	Integrated Risk Information System
LOEC	Lowest Observed Effect Concentration
MDC	Maximum Detected Concentration
MEC	Munitions and Explosives of Concern
MOE	Ministry of Environment
NA	Not Applicable
NOAEL	No Adverse Effect Level

45	NOEC	No Observed Effect Concentration
46	OHARNG	Ohio Army National Guard
47	Ohio EPA	Ohio Environmental Protection Agency
48	OE	Ordnance and Explosive
49	OSWER	Office of Solid Waste Emergency Response
50	PBT	Persistent, Bioavailable, Toxic
51	PCB	Polychlorinated Biphenyls
52	PEF	Particulate Emission Factor
53	PNA	Polynuclear aromatic
54	PPL	Plant Protection Level
55	PRG	Preliminary Remediation Goal
56	PQL	Project Quantitation Limit
57	QC	Quality Control
58	RAGS	Risk Assessment Guidance at Superfund
59	RDA	Recommended daily Allowance
60	RDI	Recommended Daily Intake
61	RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
62	RfC	Reference Concentration
63	RfD	Reference Dose
64	RME	Reasonable Maximum Exposure
65	RTLS	Ravenna Training and Logistics Site
66	RVAAP	Ravenna Army Ammunition Plant
67	SAP	Sampling and Analysis Plan
68	SMDP	Scientific Management Decision Point
69	SRCs	Site Related Compound
70	SVOC	Semi-volatile Organic Compound
71	TRV	Toxicity Reference Value
72	UCL	Upper Confidence Limit
73	USACE	US Army Corps of Engineers
74	UTL	Upper Tolerance Limit
75	USEPA	United States Environmental Protection Agency
76	UXO	Unexploded Ordnance
77	VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

Chemical characterization of the 40 mm Range at RVAAP was completed ~~with~~ by obtaining and analyzing 40 soil samples ~~locations~~. ~~Each sample location uncovered more of the same constituents with organics usually at non-detects and metals at levels spanning the same order of magnitude of each other.~~ Concentrations of chemical constituents identified in each of the 40 samples were similar. Concentrations of organics were low (at or below detection limit). Concentrations of metals were greater than those detected for organic compounds, but were similar in each sample. Data from the 40 sample locations were evaluated to determine presence or absence of Constituents of Potential Concern (COPCs) and Constituents of Potential Environmental Concern (COPECs).

Respective to Human Health screening evaluation and risk analysis chemical data summary statistics are located in Appendix A. The COPC screening results are presented in Appendix B Tables B-1 through B-3 for shallow surface soil (0-1 ft bgs), deep surface soil (0-3 ft bgs), and subsurface soil (1-3 ft bgs). ~~These tables provide summary statistics, including frequency of detection, range of detected concentrations, range of detection limits for non-detects, arithmetic average concentration, and UCL_{95} on the mean concentration; all screening values (PRGs and background concentrations, as appropriate); and final COPC status.~~

The following 12 COPCs were identified in soil including:

- 5 metals retained as COPCs because the maximum detected concentration exceeds the USEPA's Region 9 Residential PRG (arsenic) or 1/10th the USEPA Region 9 Residential PRG [aluminum, chromium, thallium, and vanadium (shallow and deep surface (0-3 ft bgs)soil only)];
- 1 explosive (nitrocellulose) retained because no PRG was available; and
- 6 SVOCs retained because the maximum detection limit exceeds the USEPA Region 9 Residential PRG [benzo(a)pyrene, bis(2-chloroethyl)ether (deep surface and subsurface soil only), dibenz(a,h)anthracene, hexachlorobenzene, and n-nitroso-di-n-propylene] or 1/10th the USEPA Region 9 Residential PRG (2-methyl-4,6-dinitrophenol). All 6 of these SVOCs were non-detect in all soil samples.

Subsequent risk analysis of the 12 COPCs indicated there was no Constituent of Concern (COC) based on receptor direct contact with soil. But, for the Resident Farmer only, risk analysis identified 5 COCs based on indirect contact with soil.

~~Receptor~~	~~ILCR~~	~~COCs~~	~~HI~~	~~COCs~~
~~National Guard Trainee~~	~~6E-06~~	~~Arsenic 5E-06~~	~~0.4~~	~~None~~
~~Resident Farmer—adult~~	~~**3E-05**~~ ~~(**4E-05**)~~	~~Arsenic **2E-05**~~ ~~Benzo(a)pyrene 4E-06~~ ~~Dibenz(a,h)anthracene 4E-06~~ ~~n-Nitroso-di-n-propylamine 3E-06~~	~~0.2~~ ~~(0.2)~~	~~None~~
~~Resident Farmer—child~~	~~**3E-05**~~ ~~(**4E-05**)~~	~~Arsenic **2E-05**~~ ~~Benzo(a)pyrene 2E-06~~ ~~Dibenz(a,h)anthracene 2E-06~~ ~~n-Nitroso-di-n-propylamine 2E-06~~	~~1~~ ~~(1)~~	~~None~~
~~Security Guard/ Maintenance Worker~~	~~**1E-05**~~	~~Arsenic 5E-06~~ ~~Benzo(a)pyrene 2E-06~~ ~~Dibenz(a,h)anthracene 2E-06~~ ~~n-Nitroso-di-n-propylamine 1E-06~~	~~0.05~~	~~None~~
~~Hunter~~	~~8E-08~~	~~None~~	~~0.0004~~	~~None~~

~~ILCR > 1E-05 shown in **bold**.~~
~~Risk/hazard results for surface and (subsurface) soil.~~
~~Note: Background criterion arsenic risk to Resident Farmer (surface soil) = 2E-05 (adult), 3E-05 (child).~~

~~The total HI for all receptors is ≤ 1. The total risk across all COPCs for the anticipated future land-use (National Guard Trainee) exceeds 1E-06, due primarily to arsenic, but is less than Ohio EPA's level of concern of 1E-05. Similarly, the total risk to the Security Guard/Maintenance Worker exceeds 1E-06, due primarily to arsenic, but is equal to 1E-05.~~

~~The calculated ILCRs are compared to the range specified in the National Oil and Hazardous Substances Pollution Contingency Plan of 1E-06 to 1E-04, or 1 in 1 million to 1 in 10,000 exposed persons developing cancer (EPA 1990). ILCRs below 1E-04 are considered acceptable. ILCRs above 1E-04 are considered unacceptable. The range between 1E-06 and 1E-04 is of concern, and any decisions to address ILCRs further in this range, either through additional study or engineered control measures, should account for the uncertainty in the risk estimates. Ohio EPA Division of Emergency and Remedial Response (DERR), uses 1 E-05 as the official target risk goal for development of cleanup goals (Ohio EPA 2004)."~~

The total risk for Resident Farmer receptor exceeds 1E-05 due to arsenic and 3 SVOCs [benzo(a)pyrene, dibenz(a,h)anthracene, and n-nitroso-di-n-propylamine). Individual Incremental Lifetime Cancer Risk (ILCRs) for these SVOCs are each less than 1E-05 and all three of these SVOCs were non-detect in all soil samples.

The exposure point concentrations (EPCs) for arsenic (12 mg/kg in shallow surface soil, 19 mg/kg in subsurface soil) are similar to the background criteria of 15 mg/kg in shallow surface soil and 20 mg/kg in subsurface soil. Thus, the calculated cancer risk related to arsenic at the 40 mm Range does not exceed the cancer risk for arsenic estimated for facility-wide background.

~~**Receptor**~~	~~**ILCR**~~	~~**COCs**~~	~~**HI**~~	~~**COCs**~~
~~Resident Farmer adult~~	~~**5E-03**~~	~~Arsenic **2E-03**~~ ~~Benzo(a)pyrene **4E-04**~~ ~~Dibenz(a,h)anthracene **9E-04**~~ ~~Hexachlorobenzene **5E-05**~~ ~~n-Nitroso-di-n-propylamine**1E-03**~~	~~**24**~~	~~Aluminum 4~~ ~~Arsenic 13~~ ~~Thallium 4~~ ~~2-Methyl-4,6-dinitrophenol 2~~
~~Resident Farmer child~~	~~**5E-03**~~	~~Arsenic 2E-03~~ ~~Benzo(a)pyrene 4E-04~~ ~~Dibenz(a,h)anthracene 1E-03~~ ~~Hexachlorobenzene 5E-05~~ ~~n-Nitroso-di-n-propylamine 1E-03~~	~~**110**~~	~~Aluminum 18~~ ~~Arsenic 61~~ ~~Thallium 19~~ ~~Vanadium 5~~ ~~2-Methyl-4,6-dinitrophenol 12~~

~~ILCR > 1E-05 and HI > 1 shown in **bold**.~~

~~The total HI is > 1 due to four metals and 2-methyl-4,6-dinitrophenol. The EPCs for arsenic and vanadium are less than background criteria. The EPC for chromium exceeds the background criterion. No background criterion is available for thallium. 2-Methyl-4,6-dinitrophenol was non-detect in all soil samples.~~

~~The total risk across all COPCs exceeds 1E-05 due to arsenic and 4 SVOCs [benzo(a)pyrene, dibenz(a,h)anthracene, hexachlorobenzene, and n-nitroso-di-n-propylamine]. All four of these SVOCs were non-detect in all soil samples.~~

~~The EPCs for arsenic (12 mg/kg in shallow surface soil 19 mg/kg in subsurface soil) are similar to the background criteria of 15 mg/kg in shallow surface soil and 20 mg/kg in subsurface soil.. Thus, the cancer risk related to arsenic at the 40 mm Range does not exceed the cancer risk for arsenic estimated for facility-wide background.~~

Twenty-three Site Related Compounds (SRCs) became Constituents of Potential Environmental Concern (COPECs) because they either had a maximum detected concentration or a maximum non-detected concentration above USEPA's Region 5 Ecological Screening Value (ESV) and the background criterion, had no ESV, or were Persistent, Bioavailable or Toxic (PBT) compounds detected above background. ~~Respective to the environment, twenty-three SRCs the analytes below became COPECs because they met the following conditions: 1) had maximum detected or non-detected concentrations exceeding the eco-criteria (i.e., ecological screening value for soil) and background criteria, and were site-related chemicals (SRC) (as indicated by army use records). In addition, detected SRCs above background criteria and that were classified as persistent, bioaccumulative, and toxic (PBT) were also identified as COPECs even if their concentrations were below eco-criteria. The COPECs are summarized below:~~

~~Summary of Soil COPECs Following the ESV Screening Step and COECs Following HQ Calculations for the 40 mm Range, RVAAP~~

~~SRC~~	~~Soil Depth~~					
	~~Shallow Surface~~		~~Subsurface~~		~~Deep Surface~~	
	~~COPEC~~	~~COEC~~	~~COPEC~~	~~COEC~~	~~COPEC~~	~~COEC~~
~~Organics-Explosives~~						-
~~2,6-Dinitrotoluene~~	X	X	X	X	X	X
~~Metals~~	-	-	-	-	-	-
~~Aluminum~~	X	X	X	X	X	X
~~Arsenic~~	X	X	X	X	X	X
~~Cadmium~~	X	...	X	...	X	...
~~Chromium~~	X	X	X	X	X	X
~~Chromium, hexavalent~~	X	X	X	X	X	X
~~Cobalt~~	–	...	X	X	X	X
~~Copper~~	X	...	X	...	X	...
~~Lead~~	X	...	X	...	X	...
~~Mercury~~	X	...	–	...	–	...
~~Nickel~~	–	...	–	...	X	...
~~Thallium~~	X	X	X	X	X	X
~~Vanadium~~	X	X	–	...	X	X
~~Zinc~~	X	X	–	...	X	X
~~Organics-Pesticides/PCBs~~					-	-
~~4,4'-DDE~~	X	X	–	...	X	X
~~Aldrin~~	X	X	–	...	X	X
~~Dieldrin~~	X	X	–	...	X	X
~~Endrin aldehyde~~	X	X	–	...	X	X
~~Heptachlor~~	X	X	–	...	X	X
~~Lindane~~	X	X	–	...	X	X
~~Organics – Semivolatiles~~					-	-
~~3,3'-Dichlorobenzidine~~	–	...	X	X	X	X
~~Bis(2-ethylhexyl)phthalate~~	X	X	–	...	X	X
~~Organics – Volatiles~~					-	-
~~1,2-Dimethylbenzene~~	–	...	X	X	X	X

~~ESV = ecological screening value~~

~~RVAAP = Ravenna Army Ammunition Plant~~

~~COPEC = chemical of potential ecological concern~~

~~"X" = the analyte is a COPEC at this soil depth~~
~~"–" = the analyte was not a COPEC at this soil depth~~

~~"..." = the COPEC was not a COEC at this soil depth~~

~~Five metal COPECs (cadmium, copper, lead, mercury, and nickel) were eliminated from being COECs due to having no HQs greater than 1 for any ecological receptor at any soil depth. There were no COECs based on HQs greater than 1 for any explosives, pesticides/PCBs, SVOCs, or VOCs, nor any HQs greater than 1 for top predators. However~~, Additional evaluation of 23 COPECs resulted in Constituents of Environmental Concern (COECs) that consisted of the following 6 metals ~~were COECs due to having an HQ greater than 1, mostly for either earthworms, plants, or shrews~~, including aluminum, arsenic, chromium, thallium, vanadium, and zinc. Of these metals concentrations of aluminum and vanadium were less than the Upper Confidence Limit (UCL)95 mean background concentrations and were eliminated. The remaining 4 metals were ruled out of being a concern to ecological receptors after being assessed respective to bioavailability and having a proper chronic reproductive toxicity metric. ~~Aluminum had the highest HQs (861 for shrews and 272 for plants), followed by the HQ for chromium (110) for earthworms.~~ Several COECs were based on an absence of having a Toxicity Reference Value (TRV) for at least one receptor, including one explosive (2,6-dinitrotoluene), one metal (chromium, hexavalent), 6 pesticides, two SVOCs [3,3'–dichlorobenzidine and bis(2-ethylhexyl)phthalate], and one VOC (1,2-dimethylbenzene) ~~(the uncertainties due to lacking a TRV for at least one receptor are discussed further in Section 2.4.2.4). Thus,~~ Ecological risks of the 6 metals are limited to receptors such as plants, earthworms, and shrews and are caused by the 6 metals in the soil depths.

In summary, the calculated ILCRs are compared to the range specified in the National Oil and Hazardous Substances Pollution Contingency Plan of 1E-06 to 1E-04, or 1 in 1 million to 1 in 10,000 exposed persons developing cancer (EPA 1990). ILCRs below 1E-04 are considered acceptable. ILCRs above 1E-04 are considered unacceptable. The range between 1E-06 and 1E-04 is of concern, and any decisions to address ILCRs further in this range, either through additional study or engineered control measures, should account for the uncertainty in the risk estimates. Ohio EPA Division of Emergency and Remedial Response (DERR), uses 1 E-05 as the official target risk goal for development of cleanup goals (Ohio EPA 2004)."

Several organics and inorganics were retained as COCs and COECs. Figures 1 through 4 (pp 62 - 65 in text) show that detected COPCs and COPECs (and, by inclusion, COCs and COECs) are distributed rather uniformly in surface and subsurface soil. The concentrations shown in these figures do not indicate any "hot spots" where risks would be much higher at other locations. Therefore, conclusions reached for RME concentrations are valid for any particular location as well as for the entire 40 mm Range. Calculated human health non-cancer HIs for direct contact exposure pathways are less than 1 for all human health receptors. Calculated ILCRs are less than or equal to 1E-05 for the representative National Guard Receptors (National Guard Trainee and Security Guard/Maintenance Worker) and the recreational Hunter. Calculated ILCRs exceed 1E-05 for the Resident Farmer scenario; however, risks are driven by background concentrations of arsenic and the detection limits for 3 SVOCs not detected in any soil sample at the 40 mm Range. As discussed in the uncertainty analysis, these estimated risks are more likely to be overestimates than underestimates of actual risk at the site.

~~Based on these results, there is no unacceptable human health risk at the 40 mm Range, and it is recommended for no further action.~~

The ecological uncertainty discussion led to the conclusion that sources of exposure were greatly limited at the 40 mm Range because of low bioavailability of chemicals in the soil. Because the COPECs were not readily available to organisms that utilize this range, ecological risk are not likely. ~~This later assumption about low to no risk is supported by the facts that the terrestrial ecosystem has abundant vegetation and animal life. that looks healthy and functioning~~. Most of the HQs calculated for organisms at 40 mm Range were less than 1. Only HQs for a few metals for plants, earthworms, shrews, and rabbits exceeded 1. None of the HQs calculated for upper level consumers such as foxes and hawks exceeded 1. The greatest HQs were for aluminum (as high as 861 to shrews), but the soil pH at RVAAP remains much higher than the low pHs assumed in the biological uptake numbers and in the laboratory experiments with toxicity measures that were used in the HQ estimates. This resulted in HQs for aluminum that were greatly overestimated. The rest of the few HQs were below one hundred and the 4 metals (arsenic, chromium, thallium, and zinc) remaining after the first four steps of the uncertainty analysis also have bioavailability issues and toxicity validity issues that show that they too are greatly over-estimated. Another potential source of risks to ecological receptors is the nearby Fuze and Booster Ponds (down gradient and within 500 feet). This study did not identify any chemical impacts based upon results of field assessments conducted by Ohio EPA and USACE studies that indicated the ponds contained healthy and functioning fish and other aquatic organisms. 1 ~~Thus, there is no unacceptable risk at the 40 mm Range, and it is recommended that the 40 mm Range be a no further action location.~~

In summary the 40 mm Range is recommended as a "no further action location". This recommendation is based on the following:

- Land Use Controls (e.g., no digging nor use of groundwater) will be institutionalized for the site and will reduce the potential for contact with low levels of chemicals identified at the site.
- Results of the human health and ecological risk characterization performed on the relatively low concentrations of chemicals present, and the depth at which these analytes were found (0-3 ft bgs), indicate that there is no unacceptable risk likely to occur.
    - Initial sampling evidenced no subsurface action from prior use (such as soil discoloration, trenches, buried debris that made its way to the surface, foul odors once surface was broken, and the like). Shallow rock is close to the surface with refusal (0-1 ft bgs) occurring at sample locations 69, 70, 72, 76, 78, 80, 81, 84, 89, 90, 91, 92, 93, and 99. Further surface detects did not evidence residuum, nor source release to subsurface (below 3').

- Further, groundwater is addressed facility-wide and developed to allow an exit strategy permitting a cyclic review of the 'no-use' groundwater control.

1.0 AOC DESCRIPTION

The 40 mm Range area of concern (AOC), Ravenna Army Ammunition Plant (RVAAP)-32, was used as a test firing range for 40 mm projectiles during the late 1960s and early 1970s. This AOC was reported by former workers at RVAAP to have been a test firing range for munitions. The dates of this operation were from 1969-71. No original file documentation exists for the operation. Munitions and Explosives of Concern (MEC) is suspected at this ~2-acre site.

The site is partially covered; i.e., the impact area, with pole timber. Soil samples were collected by US Army Center for Health Promotion and Preventive Medicine (USACHPPM) in 1996 detected arsenic and cadmium above the Relative Risk Site Evaluation screening concentrations. Additional samples were collected by SpecPro in fall 2003. A site characterization report was submitted in January 2005 (SpecPro Jan 2004).

2.0 SITE CHARACTERIZATION

The planned reuse for the 40 mm Range property will be training by the Ohio Army National Guard (OHARNG). The OHARNG will conduct mounted training and will not include digging. Because training involves minimal disturbance on the 40 mm Range (reducing the opportunity of OHARNG soldiers to contact site contaminants) soil was considered the primary exposure pathway. However other media of interest include impacts from the soil at the 40 mm Range. Surface water is not present at the 40 mm range, but does drain to the ponded areas of the Fuze and Booster Quarry Landfill/Ponds area of concern (AOC). Specifically, surface water flow, based upon the existing topographic maps, is expected to be radial in nature~~.surface water drainage at the 40 mm Range flows radially~~ toward the southern pond, the ditch south of the AOC, after which drainage occurs at Hinkley Creek. Ponds that receive drainage from the 40 mm AOC are hydraulically connected to the groundwater table, however, that was not investigated as part of the Fuze and Booster Quarry Landfill/Ponds effort. "Chemical residuum in the soil does not favor impact to groundwater at the 40 mm Range area, however, that was not investigated as part of the Fuze and Booster Quarry Landfill/Ponds effort."

Therefore, soil was the primary media for site-characterization at the 40 mm Range. Nature and extent of chemical contamination at the 40 mm Range (RVAAP-32) was characterized during the remedial investigation for Fuze and Booster Quarry Landfill/Ponds at RVAAP. Soil analytical data for the 40mm Range is reported in the Draft Phase I/PhaseII Remedial Investigation of the Fuze and Booster Quarry landfill/Ponds Report prepared for US Army Corps of Engineers (USACE) by Spec Pro, Inc. dated January 2004.

Sampling strategy for soil characterization at the 40 mm Range was presented in the 2002 USACE, *Work Plan and Sampling and Analysis Plan Addenda for the Phase I/Phase II RI at the Fuze and Booster Quarry Landfill/Ponds at RVAAP, Ravenna, Ohio* (SAP Addendum). Specifically, surface and subsurface soil medium were aggregated on the basis of depth: surface soil from 0 to 0. 914 meter (0 to 3 feet) and subsurface soil defined as the soil interval of 0.3 to 0.914 meters (1 to 3 feet). For surface and subsurface soil, the geographic area of the Fuze and Booster Quarry Pond AOC was separated into two aggregates: (1) The Fuze and Booster Quarry Ponds sample stations FBQ-1 through FBQ-60; and, (2) sample stations FBQ-61 through FBQ-100 for 40 mm Firing Range.

2.1 OE AVOIDANCE AND FIELD RECONNAISSANCE

Ordnance and explosives (OE) avoidance support staff were present during all field operations. The OE Team leader led an initial safety briefing on OE to train all field personnel to recognize and stay away from propellants and OE. Daily tailgate safety briefings included reminders regarding OE avoidance. Site visitors were briefed on OE avoidance before they were allowed access to the AOC. Prior to beginning sampling activities, access routes into areas from which samples were to be collected were assessed for potential OE using visual surveys and hand-held magnetometers. The OE Team leader, USACE technical representative, and SpecPro project manager located proposed sampling stations and monitoring wells within the AOC using pin flags of wooden stakes marked with the sample station identification number. The pin flag or stake was placed at a point approved by the OE technician. An OE technician remained with the sampling crews as work progressed. At stations where subsurface soil samples were to be collected from 0.3 to 0.9 meter (1 to 3 feet) bgs, a magnetometer was lowered into the borehole to screen for subsurface magnetic anomalies at the top of the subsurface interval. For monitoring well borings, OE technicians screened the locations by hand auguring to a minimum depth of at least 0.6 meters (2 feet) or original undisturbed native soil or bedrock encounter, whichever was greater. The OE technician remained onsite as drilling was performed to visually examine drill cuttings for any unusual materials indicative of potential OE.

3.0 HUMAN HEALTH RISK ASSESSMENT APPROACH

The Human Health Risk Assessment (HHRA) and associated documents presents risks calculated to humans that were exposed to chemicals detected in soil at the 40 mm Range. Detection limits of chemicals are also provided in these documents.

The HHRA is based on methods from the *RVAAP's Facility-wide Human Health Risk Assessor Manual* (FWHHRAM) (USACE 2004). Inorganic and organic COPCs identified in this HHRA are quantitatively analyzed (when possible) to characterize potential risks to human health from exposure to these chemicals. Results of the HHRA are used to (1) document and evaluate risks to human health; (2) determine the need, if any, for remedial action; and (3) identify COCs that may require the development of chemical-specific remediation levels.

3.1 DATA EVALUATION/CHEMICAL OF POTENTIAL CONCERN SCREENING FOR HHRA

In the data evaluation a set of chemical data suitable for use in the HHRA is developed. This Section provides a description of the data evaluation process used to identify COPCs for the 40 mm Range.

Soil data collected at the 40 mm Range were assessed based on sample depth. A description of the soil depth aggregates for which human receptors are potentially exposed follows:

- Shallow surface soil was defined as soil from 0- to 1-ft BGS (shallow surface soil) for all receptors except the National Guard Trainee. Deep surface soil is defined as 0- to 4-ft BGS (deep surface soil) for the National Guard Trainee; however, soil samples were taken to a maximum depth of 3 ft BGS.

- Subsurface soil was defined as soil from 1- to 13-ft BGS for the Resident Subsistence Farmer. No samples are available below 3-ft BGS; therefore, soil samples collected from 1- to 3-ft BGS are evaluated for the Resident Subsistence Farmer. Proposed land-use at the 40 mm Range is mounted training/no digging; therefore, subsurface soil is not evaluated for the National Guard Trainee.

The 40 mm Range encompasses approximately 2 acres and is evaluated as a single exposure unit (EU) in this HHRA for surface and subsurface soil. Evaluation as a single EU is appropriate for the potential current and future exposures at this site (i.e., National Guard mounted training with possible occasional use by hunters).

The COPC screening process followed the method outlined in the FWHHRAM (USACE, 2004) with one exception – no frequency of detection screen was completed for soil data at the 40 mm Range, rather, all chemicals analyzed for were carried through the COPC screen and risk assessment regardless of their frequency of detection. This approach results in several chemicals that were never detected being carried through the risk assessment.

COPCs are identified for shallow and deep surface soil and subsurface soil. This data evaluation consists of the following four steps:

1. **Data Quality Assessment** – Analytical results were reported by the laboratory in electronic form and loaded into a 40 mm Range database. Site data were then extracted from the database so that only one result is used for each station and depth sampled. QC data, such as sample splits and duplicates, and laboratory re-analyses and dilutions were not included in the determination of COPCs for this risk assessment. Samples rejected in the validation process are excluded from the risk assessment. The percentage of rejected data is 3.4%. A complete summary of data is presented in Appendix A.

2. **Essential Nutrients** – Chemicals that are considered essential nutrients (e.g.., calcium, chloride, iodine, iron, magnesium, potassium, phosphorus, and sodium) are an integral part of the human food supply and are often added to foods as supplements. EPA recommends that these chemicals not be evaluated as COPCs as long as they meet the following criteria:
   - Present at low concentrations (i.e., only slightly elevated above naturally occurring levels)
   - and toxic at very high doses (i.e., much higher than those that could be associated with contact at the site) (EPA 1989).

Recommended daily allowance (RDA) and recommended daily intake (RDI) values are available for seven of these metals. Based on these RDA/RDI values, a receptor ingesting 100 mg of soil per day would receive less than the RDA/RDI of calcium, magnesium, phosphorous, potassium, and sodium, even if the soil consisted of the pure mineral (i.e., soil concentrations > 1,000,000 mg/kg). Receptors ingesting 100 mg of soil per day would require soil concentrations of 1,500 mg/kg of iodine and 100,000 to 180,000 mg/kg of iron to meet their RDA/RDI for these metals. Concentrations of essential nutrients do not exceed these levels at the 40 mm Range; thus, these constituents are not addressed as COPCs in this HHRA.

3. **Risk-based Screen** – The objective of this evaluation is to identify COPCs that may pose a potentially significant risk to human health. The risk-based screening values are conservative values published by USEPA. The Maximum Detected Concentration (MDC) of each chemical in each exposure medium was compared against the appropriate risk-based screening value. Chemicals detected below these concentrations are screened for further consideration. Detected chemicals without risk-based screening values are not eliminated from the COPC list. The risk-based screening values are the most current residential preliminary remediation goals (PRGs) published by EPA Region 9. To account for the potential effects of multiple chemicals, PRGs based on non-cancer endpoints were divided by 10. These screening values are very conservative [based on a 10^{-6} risk level and a hazard quotient (HQ) of 0.1]. Region 9 Residential PRGs can be found on the EPA Region 9 World Wide Web site (http://www.epa.gov/region09/waste/sfund/prg/index.htm).

4. **Background Screen** – For each inorganic constituent detected, concentrations in the 40 mm Range samples were screened against site specific background levels, naturally occurring background levels. This screening step, which applies only to the naturally occurring inorganics, is used to determine if concentrations of detected inorganics were site related or naturally occurring. If the MDC of a constituent exceeds the background value, the constituent is considered AOC-related. All detected organic compounds are considered to be above background. Inorganic chemicals with MDCs that were less than background levels were eliminated from the COPC list. Background screening values are the final facility-wide background values for RVAAP and were published in the Final Phase II RI Report for WBG (USACE 2001). Background values for soil are available for two soil depths: shallow surface (0- to 1-ft bgs) and subsurface (>1 ft bgs). Soil data at the 40 mm Range are aggregated into three depth intervals: shallow surface soil (0- to 1-ft bgs), deep surface soil (0- to 3-ft bgs), and subsurface soil (1- to 3-ft BGS). The following background depth intervals are used for identifying COPCs in 40 mm Range AOC soil.

   - For shallow surface soil (0- to 1-ft bgs) the background screen is performed using background values for shallow surface soil (0- to 1-ft bgs).

   - For deep surface soil (0- to 3-ft BGS) the background screen is performed using background values for either shallow surface soil (0- to 1-ft BGS) or subsurface soil (1- to 12-ft BGS), whichever is lower.

- For subsurface soil (1- to 3-ft BGS) the background screen is performed using background values for subsurface soil (1- to 12-ft BGS).

Note - total chromium was evaluated conservatively by screening against the USEPA Region 9 Residential PRG for hexavalent chromium. This is a conservative assumption because that sample analysis included total chromium as hexavalent chromium. Hexavalent chromium is more toxic than trivalent chromium (the only other valence of chromium with screening values), and hexavalent chromium is a less commonly occurring form of the metal.

3.1.1 CHEMICALS OF POTENTIAL CONCERN SCREENING ASSUMPTIONS

The following assumptions were used in the development of COPCs for this study:

- Chemicals not detected in a medium were not considered to be COPCs.
- Physical chemical data (e.g., alkalinity, pH, etc.) were not considered to be COPCs for WBG.
- Alpha-chlordane and gamma-chlordane were evaluated by screening against the EPA Region 9 PRGs for chlordane.
- Endosulfan I, endosulfan II, and endosulfan sulfate were evaluated by comparing 40 mm data against screening values (i.e., based on EPA Region 9 PRGs) for endosulfan.
- Endrin aldehyde and endrin ketone were evaluated by comparing 40 mm data against screening values (i.e., based on EPA Region 9 PRGs) for endrin.
- 1,2-Dichloroethene (DCE) was evaluated by comparing 40 mm data against screening values (i.e., based on EPA Region 9 PRGs) for *cis*-1,2-DCE.
- *cis*-1,3-Dichloropropene and *trans*-1,3-dichloropropene were evaluated by comparing 40 mm data against screening values (i.e., based on EPA Region 9 PRGs) for 1,3-dichloropropene.
- Total chromium and hexavalent chromium were evaluated by comparing 40 mm data against screening values (i.e., based on EPA Region 9 PRGs) for hexavalent chromium.

3.1.2 HUMAN HEALTH CHEMICAL OF POTENTIAL CONCERN SCREENING RESULTS

The COPC screening results are presented in Appendix B Tables B-1 through B-3 for shallow surface soil (0-1 ft bgs), deep surface soil (0-3 ft bgs), and subsurface soil (1-3 ft bgs). These tables provide summary statistics, including frequency of detection, range of detected concentrations, range of detection limits for non-detects, arithmetic average concentration, and UCL_{95} on the mean concentration; all screening values (PRGs and background concentrations, as appropriate); and final COPC status.
COPC screening results are summarized in Table 1.

Table 1. Summary of COPCs in Soil at 40 mm Range

	Soil Depth Aggregate		
COPC	**Shallow Surface (0-1 ft bgs)**	**Deep Surface (0-3 ft bgs)**	**Subsurface (1-3 ft bgs)**
Metals			
Aluminum	X	X	X
Arsenic	X	X	X
Chromium	X	X	X
Thallium	X	X	X
Vanadium	X	X	--
Soil Depth Aggregate			
COPC	**Shallow Surface (0-1 ft bgs)**	**Deep Surface (0-3 ft bgs)**	**Subsurface (1-3 ft bgs)**
Explosives			
Nitrocellulose	X	X	X
Organics			
Benzo(a)pyrene	X[a]	X[a]	X[a]
Bis(2-chloroethyl)ether	--	X[a]	X[a]
Dibenz(a,h)anthracene	X[a]	X[a]	X[a]
Hexachlorobenzene	X[a]	X[a]	X[a]
2-Methyl-4,6-dinitrophenol	X[a]	X[a]	X[a]
n-Nitroso-di-n-propylene	X[a]	X[a]	X[a]

[a]Chemical is non-detect in all samples, retained because maximum detection limit exceeds screening value.
COPC = chemical of potential concern

Twelve COPCs were identified in soil including:

- 1 metal was retained as COPC because the maximum detected concentration exceeded USEPA Region 9 Residential PRG (arsenic).
- 4 metals were retained as COPCs because the maximum detected concentrations exceeded $1/10^{th}$ the USEPA Region 9 Residential PRG [aluminum, chromium, thallium, and vanadium (shallow and deep surface (0-3 ft bgs) soil only)];
- 1 explosive (nitrocellulose) retained because no PRG was available; and,
- 6 SVOCs retained because the maximum detection limit exceeds the USEPA Region 9 Residential PRG [benzo(a)pyrene, bis(2-chloroethyl)ether (deep surface and subsurface soil only), dibenz(a,h)anthracene, hexachlorobenzene, and n-nitroso-di-n-propylene] or $1/10^{th}$ the USEPA Region 9 Residential PRG (2-methyl-4,6-dinitrophenol). All 6 of these SVOCs were non-detect in all soil samples.

3.2 RISK CHARACTERIZATION

3.2.1 EXPOSURE ASSESSMENT

The objectives of the exposure assessment are to estimate the magnitude, frequency, and duration of potential human exposure to COPCs. The four primary steps of the exposure assessment are as follows:

1. identify current and future land-use;
2. identify potentially exposed populations, exposure media, and exposure pathways;
3. calculate exposure point concentrations (EPCs); and
4. estimate each receptor's potential intake of each COPC.

Current and Future Land-use

Land-use within the RVAAP/RTLS is restricted access. Personnel from OHARNG may occasionally travel through AOCs but training is and will continue to be restricted to areas outside of the AOCs. No training exercises are currently conducted within the 40 mm Range. This HHRA study focuses on the future land-use at the 40 mm Range, which is mounted training/no digging (OHARNG, March 2003; USACE 2004). The 40 mm Range may contain munitions and explosives of concern (MEC).

Potentially Exposed Populations, Exposure Media, and Exposure Pathways

Given the intended future land-use, the 40 mm Range may be used in the future by three receptor populations:

1. National Guard personnel for training (National Guard Trainee).
2. National Guard Security Guard/Maintenance Worker.
3. Recreational users involved in deer hunting.

Hunting is not currently allowed at the 40 mm Range. Hunters are not allowed at areas that are restricted for environmental reasons (i.e., due to known contamination hazards or during the RI process). Hunting at RVAAP/RTLS is also restricted for reasons other than environmental – including logistics, general safety, security, and military operations. Military and training site employees are occasionally allowed hunting access to some restricted areas under direct supervision of someone knowledgeable about the site and the security and safety issues associated with it. If hunting is allowed at the 40 mm Range in the future, hunters will be restricted under RVAAP/RTLS general hunting regulations. Under these regulations, hunters are instructed where they can and cannot hunt. The installation utilizes volunteers to ensure hunters know the boundaries of hunting areas and to patrol the perimeter of hunting areas. All hunters are briefed before they are allowed to hunt. They are also required to stay within their assigned areas and to keep vehicles on the roads. These three receptors are evaluated as outlined in Table 5 of the Facility-Wide Human Health Risk Assessment Manual (FWHHRAM) (USACE 2004) and exposure assumptions are summarized below.

National Guard Trainee – National Guard Trainees may be present at the site up to 24 hr/day for 24 day/year on inactive duty training and/or 24 hr/day for 15 day/year during annual training. As a conservative estimate for this study, the same individual was assumed to be present at the 40 mm Range for both inactive duty training (24 day/year) and annual training (15 day/year) for a total exposure frequency of 39 day/year. Because of the small size of 40 mm Range (approximately 2 acres), this is a very conservative assumption. This receptor is assumed to as an active Guardsman for 25 years (default worker exposure duration) and to train exclusively at the 40 mm Range for training every year of his/her enlistment. The 40 mm Range will be used for mounted training. Activities such as digging and/or occupying fighting positions, tank defilade positions, tank ditches, and battle positions that extend below ground surface will be prohibited. Because tracked and wheeled operations may result in maneuver damage up to 4-ft bgs. Because of this maneuver damage, as deep as 4 ft bgs, the National Guard Trainee is assumed to be exposed to deep surface soil defined as 0-to 3-ft bgs. This receptor is exposed to soil via incidental ingestion, dermal contact, and inhalation of vapors and fugitive dust.

National Guard Security Guard/Maintenance Worker – Current government activities at the 40 mm Range are limited to maintenance activities and environmental remediation activities. A 10 foot by 10 foot fixture that was previously used for munition storage remains to this day at the AOC. At the time of the sampling event the area was on a twice a year schedule for mowing. Security patrols occur daily across the installation, but not within the 40 mm Range; patrolmen usually remain within their vehicles during these patrols. Although the security guard is not currently exposed to contaminated media at the 40 mm Range on a daily basis, the potential exposure of this receptor is evaluated in this study. Therefore, as a worst-case assumption, it is assumed that a security guard leaves his or her vehicle on a daily basis and is exposed to surface soil. This scenario assumes a Security Guard/Maintenance Worker patrols the 40 mm Range every day for 1 hr. Given that the 40 mm Range is only approximately 2 acres, this is a very conservative assumption. The Security Guard/Maintenance Worker is assumed to be exposed to shallow surface soil (0- to 1-ft bgs) incidental ingestion, dermal contact, and inhalation of vapors and fugitive dust. Subsurface soil was not evaluated for this receptor because they do not engage in intrusive activities and are not exposed to this medium (FWHHRAM,USACE 2004).

Recreational Hunter – The 40 mm Range does not include any aquatic habitat; therefore, trapping and fishing were not evaluated for this receptor in this study. It was assumed that hunting is conducted annually for 6 hr/day for 2 days. The Hunter is assumed to visit the 40 mm Range every year that they live in the area (i.e., residential exposure duration of 30 years). The Hunter may be exposed to shallow surface soil (0 to 1 ft bgs) via incidental ingestion, dermal contact, and inhalation of vapors and fugitive dust. Subsurface soil was not evaluated for this receptor because they do not engage in intrusive activities and are not exposed to this medium (FWHHRAM, USACE 2004).

In addition to the representative receptors described above, a Resident Subsistence Farmer (adult and child)] is evaluated to provide a baseline for evaluating this site with respect to unrestricted release. Residential land-use is not anticipated due to physical constraints (e.g., potential MEC) and intended future land-use by OHARNG. The Resident Subsistence Farmer is assumed to be exposed to COPCs in shallow surface soil (0 to 1 ft bgs) and subsurface soil (1-3 ft bgs) via incidental ingestion, dermal contact, and inhalation of vapors and fugitive dust. This receptor is also exposed via ingestion of beef, milk, vegetables, and venison exposed to COPCs in surface soil.

The fifth receptor described in the FWHHRAM (Fire/Dust Suppression Worker) is not evaluated for the 40 mm Range because no surface water is available at this AOC.

Exposure Point Concentrations

This HHRA evaluates the reasonable maximum exposure (RME). The RME is an estimate of the greatest exposure reasonably expected to occur at the site. Because of the uncertainty associated with any estimate of exposure concentration, the 95th % UCL_{95} for either a normal or lognormal distribution is the recommended statistic for evaluating the RME. Instances where the UCL_{95} exceeds the maximum detected concentration (MDC) is used as an estimate of the RME.

EPCs in soil are calculated using equations from EPA guidance, *Supplemental Guidance to RAGS: Calculating the Concentration Term* (EPA 1992). The data are tested using the Shapiro-Wilk test to determine distribution, normal or lognormal, of the concentrations. This guidance notes that environmental data are often lognormally distributed but does not give specific guidance for data sets with unknown distributions.

For the 40 mm Range, the UCL_{95} on the mean is calculated using the normal distribution equation (see Equation 2-1) when the concentrations are normally distributed, when concentrations are not judged to be normally or lognormally distributed, when the data set contains fewer than five detections, or when the frequency of detection is less than 50%. For these situations, the UCL_{95} on the mean is calculated using the following equation:

$$UCL_{95}(normal) = \overline{x_n} + \frac{(t)(s_x)}{\sqrt{n}}, \qquad \textbf{(2-1)}$$

where

$\overline{x}_n$ = mean of the untransformed data,
t = student-t statistic,
s_x = standard deviation of the untransformed data,
n = number of sample results available.

EPA guidance *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites* (EPA 2002) provides several methods for calculating the UCL_{95} for data sets that are neither normally nor log-normally distributed. All of the methods in this guidance are based on the assumption of random sampling. Sampling at the 40 mm Range was biased toward areas with the greatest potential for contamination.

The t-distribution (i.e., assumption of normality) is used as a default when the distribution cannot be determined because it is simple and robust. Instances where the underlying distribution is assumed to be normal but is not, the UCL_{95} is still reasonably close to the true value.

For lognormally distributed concentrations, the UCL_{95} on the mean is calculated using the following equation:

$$UCL_{95}(lognormal) = e^{\left(\overline{x_l} + 0.5(s_l^2) + \frac{(S_l)(H)}{\sqrt{n-1}}\right)}, \quad \textbf{(2-2)}$$

where
- e = constant (base of the natural log, equal to 2.718),
- $\overline{x}_l$ = mean of the transformed data [l = log (x)],
- s_l = standard deviation of the transformed data,
- H = H-statistic,
- N = number of sample results available.

EPA guidance (EPA 2002) suggests use of the H statistic may result in overestimating the true UCL_{95} on the mean if the data are not lognormal. Even small deviations from lognormal can greatly influence the results using the H-statistic, yielding upper bounds that are much too large (Singh et al. 1997). EPCs for shallow surface soil (0-1 ft bgs), deep surface soil (0-3 ft bgs), and subsurface soil (1-3 ft BGS) are provided in Appendix B, Tables B-1 through B-3.

Direct sampling results are not available for the evaluation of ingestion of foodstuffs (i.e., beef, milk, venison, and vegetables). Exposure concentrations were modeled for these media using the equations presented below. The initial concentration of COPCs in soil is equal to the EPC calculated for direct exposure pathways as described earlier. Other parameter values are provided in Table 2.

Beef concentrations are calculated from the concentration in the cattle's food sources due to soil contamination. The contaminant levels in pastures are estimated by the equation:

$$C_p = C_s \times (R_{upp} + R_{es}), \quad \textbf{(2-3)}$$

where
- C_p = concentration of contaminant in pasture (mg/kg, calculated),
- C_s = concentration of contaminant in soil (mg/kg),
- R_{upp} = multiplier for dry root uptake for pasture (unitless),
- R_{es} = resuspension multiplier (unitless).

The multiplier for dry root uptake for pasture, R_{upp}, is chemical-specific and is estimated as:

$$R_{upp} = Bv_{dry}, \quad \textbf{(2-4)}$$

where
- R_{upp} = multiplier for dry root uptake for pasture (unitless),
- Bv_{dry} = soil-to-plant uptake, dry weight (kg/kg, chemical-specific, or $38 \times K_{ow}^{-0.58}$; see Table B-4),
- K_{ow} = octanol-water partitioning coefficient (unitless, chemical-specific).

Table 2 Parameters Used to Quantify Exposures for Each Medium and Receptor at the 40 mm Range[a]

Exposure Pathway and Parameter	Units	Potential Receptor				
		National Guard Personnel[b]			Resident Subsistence Farmer	
		Security Guard/ Maintenance Worker	Trainee	Hunter[b, c]	Adult	Child
Shallow Surface Soil[d] (0-1 ft bgs)						
Incidental Ingestion						
Soil ingestion rate	kg/d	0.0001	0.0001	0.0001	0.0001	0.0002
Exposure time	hr/d	1	24	6[e]	24	24
Exposure frequency	d/year	250	39	2[e]	350	350
Exposure duration	years	25	25	30	30	6
Body weight	kg	70	70	70	70	15
Carcinogen averaging time	d	25,550	25,550	25,550	25,550	25,550
Non-carcinogen averaging time	d	9,125	9,125	10,950	10,950	2,190
Fraction ingested	unitless	1	1	1	1	1
Conversion factor	d/hr	0.042	0.042	0.042	0.042	0.042
Dermal Contact						
Skin area	m^2/event	0.33	0.33	0.52[f]	0.57	0.22
Adherence factor	mg/cm^2	0.7	0.3	0.3	0.4	0.2
Absorption fraction	unitless	Chemical Specific – See Table B-4				
Exposure frequency	events/year	250	39	2[e]	350	350
Exposure duration	years	25	25	30	30	6
Body weight	kg	70	70	70	70	15
Carcinogen averaging time	d	25,550	25,550	25,550	25,550	25,550
Non-carcinogen averaging time	d	9,125	9,125	10,950	10,950	2,190
Conversion factor	$(kg\text{-}cm^2)/(mg\text{-}m^2)$	0.01	0.01	0.01	0.01	0.01
Inhalation of VOCs and Dust						
Inhalation rate	m^3/d	20	44.4	20	20	10
Exposure time	hr/d	1	24	6[e]	24	24
Exposure frequency	d/year	250	39	2[e]	350	350
Exposure duration	years	25	25	30	30	6
Body weight	kg	70	70	70	70	15
Carcinogen averaging time	d	25,550	25,550	25,550	25,550	25,550
Non-carcinogen averaging time	d	9,125	9,125	10,950	10,950	2,190
Conversion factor	d/hr	0.042	0.042	0.042	0.042	0.042

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Table 2 Parameters Used to Quantify Exposures for Each Medium and Receptor at the 40 mm Range[a] (continued)

Exposure Pathway and Parameter	Units	National Guard Personnel[b] Security Guard/ Maintenance Worker	National Guard Personnel[b] Trainee	Potential Receptor Hunter[b, c]	Resident Subsistence Farmer Adult	Resident Subsistence Farmer Child
Subsurface Soil (1-3 ft bgs)						
Incidental Ingestion						
Soil ingestion rate	kg/d	NA	NA	NA	0.0001	0.0002
Exposure time	hr/d	NA	NA	NA	24	24
Exposure frequency	d/year	NA	NA	NA	350	350
Exposure duration	years	NA	NA	NA	30	6
Body weight	kg	NA	NA	NA	70	15
Carcinogen averaging time	d	NA	NA	NA	25,550	25,550
Non-carcinogen averaging time	d	NA	NA	NA	10,950	2,190
Fraction ingested	Unitless	NA	NA	NA	1	1
Conversion factor	d/hr	NA	NA	NA	0.042	0.042
Dermal Contact						
Skin area	m^2/event	NA	NA	NA	0.57	0.22
Adherence factor	mg/cm^2	NA	NA	NA	0.4	0.2
Absorption fraction	Unitless	NA	NA	NA	Chem. Spec. See Table B-4	
Exposure frequency	events/year	NA	NA	NA	350	350
Exposure duration	years	NA	NA	NA	30	6
Body weight	kg	NA	NA	NA	70	15
Carcinogen averaging time	d	NA	NA	NA	25,550	25,550
Non-carcinogen averaging time	d	NA	NA	NA	10,950	2,190
Conversion factor	$(kg\text{-}cm^2)/(mg\text{-}m^2)$	NA	NA	NA	0.01	0.01
Inhalation of VOCs and Dust						
Inhalation rate	m^3/d	NA	NA	NA	20	10
Exposure time	hr/d	NA	NA	NA	24	24
Exposure frequency	d/year	NA	NA	NA	350	350
Exposure duration	years	NA	NA	NA	30	6
Body weight	kg	NA	NA	NA	70	15
Carcinogen averaging time	d	NA	NA	NA	25,550	25,550
Non-carcinogen averaging time	d	NA	NA	NA	10,950	2,190
Conversion factor	d/hr	NA	NA	NA	0.042	0.042

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Table 2 Parameters Used to Quantify Exposures for Each Medium and Receptor at the 40 mm Range[a] (continued)

Exposure Pathway and Parameter	Units	National Guard Personnel[b] Security Guard/ Maintenance Worker	National Guard Personnel[b] Trainee	Potential Receptor Hunter[b, c]	Resident Subsistence Farmer Adult	Resident Subsistence Farmer Child
Foodstuffs						
Ingestion of Waterfowl						
Waterfowl ingestion rate	kg/d	NA	NA	0.0132	NA	NA
Fraction ingested	Unitless	NA	NA	1	NA	NA
Exposure frequency	d/year	NA	NA	365	NA	NA
Exposure duration	Years	NA	NA	30	NA	NA
Body weight	Kg	NA	NA	70	NA	NA
Carcinogen averaging time	D	NA	NA	25,550	NA	NA
Non-carcinogen averaging time	D	NA	NA	10,950	NA	NA
Ingestion of Venison						
Conversion factor	Unitless	NA	NA	NA	1.25	1.25
Browse ingestion rate	kg dry weight/day	NA	NA	NA	0.87	0.87
Fraction browse ingested from site	Unitless	NA	NA	NA	0.08[g]	0.08[g]
Fat ratio (venison to beef)	Unitless	NA	NA	NA	0.2	0.2
Venison ingestion rate	kg/day	NA	NA	NA	0.03	0.03
Fraction ingested	Unitless	NA	NA	NA	1	1
Exposure frequency	days/year	NA	NA	NA	365	365
Exposure duration	Years	NA	NA	NA	30	6
Body weight	Kg	NA	NA	NA	70	15
Carcinogen averaging time	Days	NA	NA	NA	25,550	25,550
Non-carcinogen averaging time	Days	NA	NA	NA	10,950	2,190
Ingestion of beef, pork						
Resuspension multiplier	Unitless	NA	NA	NA	0.25	0.25
Quantity of pasture ingested	kg dry weight/day	NA	NA	NA	7.2	7.2
Fraction of year cow is on-site	Unitless	NA	NA	NA	1	1
Fraction of cow's food from on-site	Unitless	NA	NA	NA	0.9	0.9
Quantity of soil ingested by cow	kg/day	NA	NA	NA	1	1
Beef ingestion rate	kg/day	NA	NA	NA	0.075	0.075

Table 2 Parameters Used to Quantify Exposures for Each Medium and Receptor at the 40 mm Range[a] (continued)

		Potential Receptor				
		National Guard Personnel[b]			Resident Subsistence Farmer	
Exposure Pathway and Parameter	Units	Security Guard/ Maintenance Worker	Trainee	Hunter[b, c]	Adult	Child
Fraction ingested	Unitless	NA	NA	NA	1	1
Exposure frequency	days/year	NA	NA	NA	365	365
Exposure duration	Years	NA	NA	NA	30	6
Body weight	Kg	NA	NA	NA	70	15
Carcinogen averaging time	Days	NA	NA	NA	25,550	25,550
Non-carcinogen averaging time	Days	NA	NA	NA	10,950	2,190
		Ingestion of milk products				
Resuspension multiplier	Unitless	NA	NA	NA	0.25	0.25
Quantity of pasture ingested	kg dry weight/day	NA	NA	NA	16.1	16.1
Fraction of year cow is on-site	Unitless	NA	NA	NA	1	1
Fraction of cow's food from on-site	Unitless	NA	NA	NA	0.6	0.6
Quantity of soil ingested by cow	kg/day	NA	NA	NA	1	1
Milk ingestion rate	kg/day	NA	NA	NA	0.305	0.509
Fraction ingested	Unitless	NA	NA	NA	1	1
Exposure frequency	days/year	NA	NA	NA	365	365
Exposure duration	Years	NA	NA	NA	30	6
Body weight	Kg	NA	NA	NA	70	15
Carcinogen averaging time	Days	NA	NA	NA	25,550	25,550
Non-carcinogen averaging time	Days	NA	NA	NA	10,950	2,190
		Ingestion of vegetables				
Resuspension multiplier	Unitless	NA	NA	NA	0.26	0.26
Vegetable ingestion rate	kg/day	NA	NA	NA	0.2	0.2
Fraction ingested	Unitless	NA	NA	NA	0.4	0.4
Exposure frequency	days/year	NA	NA	NA	365	365
Exposure duration	Years	NA	NA	NA	30	6
Body weight	Kg	NA	NA	NA	70	15
Carcinogen averaging time	Days	NA	NA	NA	25,550	25,550
Non-carcinogen averaging time	Days	NA	NA	NA	10,950	2,190

[a] All parameters are from Table 5 of *RVAAP's Facility-wide Human Health Risk Assessor Manual* (FWHHRAM) (USACE 2004), unless otherwise noted.
[b] National Guard Trainee, Security Maintenance Worker, and Hunter are representative receptors at the 40 mm Range.
[c]No surface water is present at the 40 mm Range; therefore, the Hunter/Trapper/Fisher receptor is evaluated as a Hunter only.
[d]Surface soil is defined as 0 to 1 ft below ground surface (bgs) (shallow surface soil) for all receptors except the National Guard Trainee. Surface soil is defined as 0 to 4 ft bgs (deep surface soil) for the National Guard Trainee; however, at the 40 mm Range, samples were collected to a maximum depth of 3 ft bgs.
[e] Per the FWHHRAM the Hunter is assumed to be on-site 6 hrs/day for 2 days/year.
[f]Exposure Factor Handbook (EPA 1997a) Dermal Contact for Hunter/ZFisher during wading is 0.52 based on head, hands, forearms and lower legs.
[g] Fraction browse for the 2 acres (0.8 ha) at the 40 mm Range is 0.0046 (0.8 ha/175 ha) based on a 175-ha home range for deer
NA = Not applicable for this scenario.
VOC = Volatile organic compound.

The concentration of contaminants in beef cattle from ingestion of contaminated pasture and soil was estimated using the following equation:

$$C_b = BTF_{beef} \times [(C_p \times Q_{pb} \times f_{pb} \times f_{sb}) + (C_s \times Q_{sb} \times f_{pb})], \qquad \textbf{(2-5)}$$

where

- C_b = concentration of contaminant in beef (mg/kg dry weight),
- BTF_{beef} = beef transfer coefficient (day/kg; see Table B-4),
- C_p = concentration of contaminant in pasture (mg/kg, calculated),
- Q_{pb} = quantity of pasture ingested by beef cattle (kg/day),
- f_{pb} = fraction of year beef cattle is on-site (unitless),
- f_{sb} = fraction of beef cattle's food that is from the site (unitless),
- C_s = concentration of contaminant in soil (mg/kg),
- Q_{sb} = quantity of soil ingested by beef cattle (kg/day).

The BTF_{beef} for metals is taken from available literature. The BTF_{beef} for SVOCs is calculated as $2.5 \times 10^{-8} \times K_{ow}$. No VOCs were identified as COPCs in soil at the 40 mm Range.

Milk concentrations from dairy cattle were calculated from the concentration in the cattle's food sources due to soil contamination. The contaminant levels in pastures are estimated in the same fashion as for beef cattle. The concentration of contaminants in dairy cattle's milk, from ingestion of contaminated pasture and soil is estimated using the following equation:

$$C_m = BTF_{milk} \times [(C_p \times Q_{pd} \times f_{pd} \times f_{sd}) + (C_s \times Q_{sd} \times f_{pd})], \qquad \textbf{(2-6)}$$

where

- C_m = concentration of contaminant in milk (mg/kg),
- BTF_{milk} = milk transfer coefficient (day/kg; see Table B-4),
- C_p = concentration of contaminant in pasture (mg/kg, calculated),
- Q_{pd} = quantity of pasture ingested by dairy cattle (kg/day),
- f_{pd} = fraction of year dairy cattle is on-site (unitless),
- f_{sd} = fraction of dairy cattle's food that is from the site (unitless),
- C_s = concentration of contaminant in soil (mg/kg),
- Q_{sd} = quantity of soil ingested by dairy cattle (kg/day).

The BTF_{milk} for metals is taken from available literature. The BTF_{milk} for SVOCs is calculated as $7.5 \times 10^{-9} \times K_{ow}$. No VOCs were identified as COPCs in soil at the 40 mm Range.

Venison concentrations were estimated by calculating the concentration in venison food sources due to soil contamination. The contaminant levels in forage were estimated using the following:

$$C_p = (CF)(C_s)(B_p) \qquad \textbf{(2-7)}$$

where

- C_p = concentration of contaminant in forage (mg/kg dry weight),
- CF = conversion factor to adjust for soil containing 20% moisture (1.25 unitless),
- C_s = concentration of contaminant in soil (mg/kg),
- B_p = soil-to-forage biotransfer factor (mg chemical per kg of dry plant/mg of chemical per kg or dry soil)(chemical-specific; see Bv_{dry} in Table B-4).

The B_p for metals is available in literature. The B_p for SVOCs was calculated using the following formula:

$$\log B_p = 1.588 - 0.578 \log K_{ow} \qquad \textbf{(2-8)}$$

where

B_p = soil-to-forage biotransfer factor (mg chemical per kg of dry plant/mg of chemical per kg or dry soil)(chemical-specific; see Bv_{dry} in Table B-4),
K_{ow} = octanol-water partitioning coefficient (unitless, chemical-specific).

No VOCs were identified as COPCs in soil at the 40 mm Range. The concentration of contaminants in venison from ingestion of contaminated forage was estimated using the following equation:

$$C_v = (Q_p)(C_p)(FI_e)(B_v) \qquad \textbf{(2-9)}$$

where

C_v = contaminant concentration in venison (mg/kg),
Q_p = browse ingestion rate (0.87 kg dry weight/day),
C_p = contaminant concentration in browse (mg/kg dry weight),
FI_e = fraction browse ingested from the contaminated site (site area/home range),
B_v = biotransfer factor for venison (days/kg).

The B_v for beef was used for deer due to a lack of available literature values for deer. Both of these animals are ruminants; therefore, the uptake and bioaccumulation of contaminants is similar. The meat of deer contains less fat than commercial beef — 14.4% fat for beef, compared to 2.9% for venison. Organic chemicals have a greater affinity to fat and thus would not accumulate as much in venison. Therefore, the beef biotransfer factors for organics are adjusted by 2.9/14.4 (0.20) to reflect this lower accumulation rate. The fraction browse ingested from the contaminated site is exposure unit-specific. The fraction browse for the 2 acres (0.8 ha) at the 40 mm Range is 0.0046 (0.8 ha/175 ha) based on a 175 ha home range for deer.

The B_v values for metals were developed from published values. The B_v values for organics are calculated as follows:

$$B_v = R_f \times 10^{-7.6+\log K_{ow}}, \qquad \textbf{(2-10)}$$

where

B_v = biotransfer factor for venison (days/kg),
R_f = ratio of the fat content in venison to the fat content of beef (0.20),
K_{ow} = octanol-water partitioning coefficient (unitless, chemical-specific).

Homegrown vegetable concentration was estimated with the equation:

$$C_{veg} = C_s \times (Bv_{wet} + MLF), \qquad \textbf{(2-11)}$$

where

C_{veg} = contaminant concentration in homegrown vegetable (mg/kg),
C_s = concentration of contaminant in soil (mg/kg),
Bv_{wet} = soil-to-plant uptake, wet weight (kg/kg, chemical-specific, or $7.7 \times K_{ow}^{-0.58}$; see Table B-4),
K_{ow} = octanol-water partitioning coefficient (unitless, chemical-specific),
MLF = plant mass loading factor (unitless, 0.26 for vegetables).

No VOCs were identified as COPCs in soil at the 40 mm Range.

Exposure Parameters and Calculations for Estimating Intakes

Standard intake equations from EPA guidance (EPA 1989) for ingestion, dermal contact, and inhalation of chemicals in soil (shown below) are used along with the exposure parameters shown in Table 1. Exposure parameters and intake equations are provided in FWHHRAM (USACE 2005).

Incidental ingestion of soil was estimated using Equation 2-14:

$$\textit{Chemical Intake (mg/kg-day)} = \frac{C_S \times IR_S \times EF \times ED \times FI \times ET \times CF}{BW \times AT}, \qquad \textbf{(2-14)}$$

where

- C_s = chemical concentration in soil or sediment (mg/kg),
- IR_s = ingestion rate (kg/day),
- EF = exposure frequency (days/year),
- ED = exposure duration (years),
- FI = fraction ingested (value of 1, unitless),
- ET = exposure time (hr/day),
- CF = conversion factor for ET (day/hr),
- BW = body weight (kg),
- AT = averaging time (days) for carcinogens or non-carcinogens.

The dermally absorbed dose (DAD) from chemicals in soil is calculated using Equation 2-15:

$$\textit{Chemical DAD (mg/kg-day)} = \frac{C_S \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}, \qquad \textbf{(2-15)}$$

where

- C_s = chemical concentration in soil or sediment (mg/kg),
- CF = conversion factor $[(10^{-6}\ \text{kg/mg}) \times (10^{4}\ \text{cm}^2/\text{m}^2)]$,
- SA = skin surface area exposed to soil (m^2/event),
- AF = soil to skin adherence factor (mg/cm^2),
- ABS = chemical-specific dermal absorption factor (unitless; see Table B-4),
- EF = exposure frequency (events/year),
- ED = exposure duration (years),
- BW = body weight (kg),
- AT = averaging time (days) for carcinogens or non-carcinogens.

Inhalation of soil or sediment was calculated using Equation 2-16:

$$\textit{Chemical Intake (mg/kg-day)} = \frac{C_S \times IR_a \times EF \times ED \times \left(VF^{-1} + PEF^{-1}\right) \times ET \times CF}{BW \times AT}, \qquad \textbf{(2-16)}$$

where

- C_s = chemical concentration in soil or sediment (mg/kg),
- IR_a = inhalation rate (m^3/day),
- EF = exposure frequency (days/year),
- ED = exposure duration (years),

VF = chemical-specific volatilization factor (m^3/kg; see Table B-4),
PEF = particulate emission factor (m^3/kg),
ET = exposure time (hr/day)
CF = conversion factor for ET (day/hr),
BW = body weight (kg),
AT = averaging time (days) for carcinogens or non-carcinogens.

Per the FWHHRAM (USACE, 2005) the general PEF value of 9.24 E+08 m^3/kg (for Cleveland, Ohio) was used for all receptors, except the National Guard Trainee, (USEPA Soil Screening Guidance on-line at http://risk.lsd.ornl.gov/epa/ssl1.htm). A smaller PEF value (1.67 E+06 m^3/kg) is used for the National Guard Trainee receptor because they generate more dust during training. This PEF value was calculated from a dust-loading factor (DLF) of 600 $\mu g/m^3$ (DOE 1983) as:

$$PEF = 1/(DLF \times \text{Conversion Factor}) = 1/(600\ \mu g/m^3 \times 1E\text{-}09\ kg/\mu g) = 1.67E{+}06\ m^3/kg.$$

Ingestion of foodstuffs (beef, milk, vegetables, and venison) is estimated using Equation 2-17:

$$\textit{Chemical Intake (mg/kg-day)} = \frac{Cf \times IRf \times EF \times ED \times FI}{BW \times AT}, \qquad \textbf{(2-17)}$$

where
C_f = chemical-specific concentration in food product (mg/kg),
IR_f = ingestion rate of food product (kg/day),
EF = exposure frequency (days/year),
ED = exposure duration (years),
FI = fraction ingested (value of 1, unitless),
BW = body weight (kg),
AT = averaging time (days) for carcinogens or non-carcinogens.

3.2.2 TOXICITY ASSESSMENT

The potential for COPCs to cause adverse health effects in exposed individuals is evaluated in this Toxicity Assessment. Generally, an estimate is made between the intake (dose) of a COPC and the likelihood of adverse health effects to a receptor as a result of the exposure. The USEPA have evaluated toxic effects extensively. This section provides the results of the evaluation of potential toxic effects of COPCs at the 40 mm Range.

The primary source of toxicity information is Integrated Risk Information System (IRIS) which has information for numerous chemicals. The U.S. EPA - OSWER Directive (2003) and Ohio EPA DERR Technical Decision Compendium (2004), recommend the following additional sources for chemicals without values in IRIS:

- Aluminum and 2-methyl-4,6-dinitrophenol - provisional values from EPA Superfund Health Risk Technical Support Center were used.
- Vanadium - values from the Health Effects Assessment Summary Tables (HEAST) (EPA 1997) were used.

Toxicity Information and U. S. Environmental Protection Agency Guidance for Non-carcinogens

Non-carcinogenic effects are evaluated by comparing an exposure or intake/dose with a reference dose (RfD) or reference concentration (RfC). The RfD and RfCs are determined using available dose-response data for individual chemicals. The exposure concentration or intake/dose below which no adverse effects occur are adjusted by the application of safety factors (from 10 to 1,000) to determine the RfD or RfC. The RfDs and RfCs are peered reviewed. The RfDs available for the COPCs present in the exposure media at the 40 mm Range are listed in Table B-5 (EPA 1997, 2005). In this HHRA, RfCs, measured in mg/m^3, were converted to RfDs expressed in units of mg/kg body weight per day by using the default adult inhalation rate and body weight [i.e., (RfC × 20 m^3/d)/70 kg = RfD] (EPA 1989).

Chronic RfDs are developed for protection from long-term exposure to a chemical (from 7 years to a lifetime); subchronic RfDs are used to evaluate short-term exposure (from 2 weeks to 7 years) (EPA 1989). Only chronic RfDs are used in this HHRA because receptors were assumed to have life-long exposure. Toxic effects are diverse and measured in various target body organs (e.g., they range from eye irritation to kidney or liver damage). EPA is currently reviewing methods for accounting for the difference in severity of effects; however, existing RfDs do not address this issue.

Toxicity Information and U. S. Environmental Protection Agency Guidance for Carcinogens

The additional or excess risk from carcinogens at the site is the probability that an individual will develop cancer over a lifetime as a result of exposure to the carcinogen. Cancer risk in HHRA is expressed as excess or incremental cancer risk, which is cancer occurrence in addition to normally expected rates of cancer development. Excess cancer risk is estimated using a cancer slope factor (CSF). The CSF is defined as a plausible upper-bound estimate of the probability of a response (i.e., cancer) per unit intake of a chemical over a lifetime (EPA 1989).

EPA expresses inhalation cancer potency as the unit risk based on the chemical concentration in air [i.e., risk per microgram (μg) of chemical per cubic meter (m^3) of ambient air]. These unit risks were converted to CSFs expressed in units of risk per mg of chemical per kg body weight per day by using the default adult inhalation rate and body weight [i.e., (Unit Risk × 70 kg × 1,000 μg/mg)/20 m^3/day]. CSFs used in the evaluation of risk from carcinogenic COPCs are listed in Table B-6 (EPA 1997, 2005).

Estimated Toxicity Values for Dermal Exposure

Oral and inhalation RfDs and CSFs are currently available however; dermal RfDs and CSFs are often not available. If dermal values were estimated from oral toxicity values, the gastrointestinal absorption factors (GAFs) specific for a chemical was used to calculate total absorbed dose (Equations 2-18 and 2-19). Dermal toxicity factors are calculated from oral toxicity factors as shown below (EPA 2004):

$$RfD_{dermal} = RfD_{oral} \times GAF \tag{2-18}$$

$$CSF_{dermal} = CSF_{oral}/GAF \tag{2-19}$$

Not all COPCs have specific GAF values. A default GAF value of 1.0 for organic and inorganic chemicals was used (EPA 2004) when quantitative data are insufficient. The GAF and resulting dermal toxicity values used in this HHRA are listed in Tables B-5 and B-6.

Chemicals Without U. S. Environmental Protection Agency Toxicity Values

Only one COPC (nitrocellulose) did not have available toxicity values. ~~Although~~ Nitrocellulose ~~may contribute to health effects from exposure to contaminated media at the 40 mm Range it's~~ effects cannot be quantified at the present time; however, nitrocellulose is generally considered to have low toxicity to mammals and relatively non-toxic to wildlife when administered in low doses..

3.2.3 RISK CHARACTERIZATION

The risk characterization phase provides an evaluation of information obtained in the exposure and toxicity assessments to estimate potential risks and hazards. Potential carcinogenic effects are characterized by using estimated intakes and chemical-specific, dose-response data (i.e., CSFs) to estimate the probability that an individual may have an additional chance to develop cancer over their lifetime if they are exposed to the COPC as assumed in the exposure assessment. Potential non-carcinogenic effects are characterized by comparing estimated intakes of COPCs (as assumed in the exposure assessment) to toxicity values (i.e., RfDs). The risk and hazard estimates should be interpreted in context of the uncertainties and assumptions associated with each estimate and calculation completed in the risk assessment process.

Risk Characterization for Carcinogens

For carcinogens, risk is expressed as the probability that an individual will develop cancer over a lifetime as a result of exposure to the carcinogen. Cancer risk from exposure to contamination is expressed as the incremental lifetime cancer risk (ILCR), or the increased chance of cancer above the normal background rate of cancer. In the United States, the background chance of contracting cancer is a little more than 3 in 10, or 3×10^{-1} (American Cancer Society 2003). The calculated ILCRs are compared to the range specified in the National Oil and Hazardous Substances Pollution Contingency Plan of 10^{-6} to 10^{-4}, or 1-in-1 million to 1-in-10,000 exposed persons developing cancer (EPA 1990). ILCRs below 10^{-6} are considered acceptable; ILCRs above 10^{-4} are considered unacceptable. The range between 10^{-6} and 10^{-4} is of concern, and any decisions to address ILCRs further in this range, either through additional study or engineered control measures, should account for the uncertainty in the risk estimates. The ILCR is calculated using the equation below (EPA 1989):

$$ILCR = I \times CSF \tag{2-20}$$

where

I = chronic daily intake or DAD calculated in the exposure assessment (mg/kg-day),

CSF = cancer slope factor $(mg/kg\text{-}day)^{-1}$.

For a given exposure pathway, the total risk to a receptor exposed to several carcinogenic COPCs is the sum of the ILCRs for each carcinogen, as shown in Equation 2-21 below:

$$ILCR_{total} = \Sigma ILCR_i \qquad \textbf{(2-21)}$$

where

$ILCR_{total}$ = total probability of cancer incidence associated with all carcinogenic COPCs,

$ILCR_i$ = ILCR for the i^{th} COPC.

In addition to summing risks across all carcinogenic COPCs, risks are summed across all exposure pathways for a given environmental medium (e.g., ingestion, inhalation, and dermal contact with surface soil). Per EPA (1989) guidance, "there are two steps required to determine whether risks or hazard indices for two or more pathways should be combined for a single exposed individual or group of individuals. The first is to identify reasonable exposure pathway combinations. The second is to examine whether it is likely that the same individuals would consistently face the "reasonable maximum exposure" (RME) by more than one pathway." It is reasonable to assume the same individual may be exposed at the RME by multiple pathways to a given exposure medium. For example, a National Guard Trainee present at the 40 mm Range can reasonably be assumed to both ingest surface soil and inhale contaminated dust from the same area.

Risk Characterization for Non-carcinogens

In addition to developing cancer from exposure to contaminants, an individual may experience other toxic effects. The term "toxic effects" is used here to describe a wide variety of systemic effects ranging from minor irritations, such as eye irritation and headaches, to more substantial effects, such as kidney or liver disease and neurological damage. The risks associated with toxic (i.e., non-carcinogenic) chemicals are evaluated by comparing an estimated exposure (i.e., intake or dose) from site media to an acceptable exposure expressed as an RfD. The RfD is the threshold level below which no toxic effects are expected to occur in a population, including sensitive subpopulations. The ratio of intake over the RfD is the HQ (EPA 1989) and is calculated as:

$$HQ = I/RfD \qquad \textbf{(2-22)}$$

where

I = daily intake or DAD of a COPC (mg/kg-day),

RfD = reference dose (mg/kg-day).

The HQs for each COPC are summed to obtain a hazard index (HI), as shown below:

$$HI = \Sigma HQ_i \qquad \textbf{(2-23)}$$

where

HI = hazard index for all toxic effects,

HQ_i = hazard quotient for the i^{th} COPC.

An HI greater than 1 has been defined as the level of concern for potential adverse non-carcinogenic health effects (EPA 1989). This approach differs from the probabilistic approach used to evaluate carcinogens. An HQ of 0.01 does not imply a 1-in-100 chance of an adverse effect but indicates only that the estimated intake is 100 times less than the threshold level at which adverse health effects may occur.

In addition to summing hazards across all COPCs, hazards are summed across all exposure pathways for a given environmental medium.

Identification of COCs

Risks are characterized for each exposure medium/receptor combination. COCs are identified if the total ILCR for a chemical exceeds 10^{-6} or if total HIs exceed 1 for a medium/receptor combination.

3.3 HUMAN HEALTH RISK CHARACTERIZATION RESULTS

3.3.1 DIRECT CONTACT

Table 3. Summary of Risk Characterization Results for Direct Contact with Soil

Receptor	ILCR	COCs	HI	COCs
National Guard Trainee	6E-06	Arsenic 5E-06	0.4	None
Resident Farmer – adult	**3E-05** **(4E-05)**	Arsenic **2E-05** Benzo(a)pyrene 4E-06 Dibenz(a,h)anthracene 4E-06 n-Nitroso-di-n-propylamine 3E-06	0.2 (0.2)	None
Resident Farmer – child	**3E-05** **(4E-05)**	Arsenic **2E-05** Benzo(a)pyrene 2E-06 Dibenz(a,h)anthracene 2E-06 n-Nitroso-di-n-propylamine 2E-06	1 (1)	None
Security Guard/ Maintenance Worker	**1E-05**	Arsenic 5E-06 Benzo(a)pyrene 2E-06 Dibenz(a,h)anthracene 2E-06 n-Nitroso-di-n-propylamine 1E-06	0.05	None
Hunter	8E-08	None	0.0004	None

ILCR > 1E-05 shown in **bold**.

Risk/hazard results for surface (0-1 ft bgs) and subsurface (1-3 ft bgs) soil.

Note: The estimated risks from exposure of these receptors to the background concentration of arsenic (15.4 mg/kg) in surface soil are:

National Guard Trainee 9E-06
Security Guard/Maintenance Worker 6E-06
On-Site Resident Farmer: Adult 2E-05
On-Site Resident Farmer: Child 3E-05

Risks to these receptors from arsenic at 40 MM AOC are below the risks associated with the background concentration of this metal.

The calculated ILCRs were compared to the range specified in the National Oil and Hazardous Substances Pollution Contingency Plan of 1E-06 to 1E-04, or 1 in 1 million to 1 in 10,000 exposed person's chance of developing cancer if exposed as assumed in the HHRA (EPA 1990). The ILCRs below 1E-04 are considered acceptable. ILCRs above 1E-04 are considered unacceptable. The range between 1E-06 and 1E-04 is of concern, and any decisions to address ILCRs further in this range, either through additional study or engineered control measures, should account for the uncertainty in the risk estimates. Ohio EPA Division of Emergency and Remedial Response (DERR), uses 1 E-05 as the official target risk goal for development of cleanup goals (Ohio EPA 2004).

The total HI for all receptors assessed in this HHRA was ≤ 1. This indicates that the COPC at 40 mm Range do not pose a non-carcinogenic risk to receptors.

The total excess cancer risk for all COPCs for the anticipated future land-use (National Guard Trainee) exceeds 1E-06, due primarily to arsenic, but is less than Ohio EPA's target risk goal of 1E-05. Similarly, the total risk to the Security Guard/Maintenance Worker exceeds 1E-06, due primarily to arsenic, but is equal to 1E-05.

The total risk for Resident Farmer exceeds 1E-05 due to arsenic and 3 SVOCs [benzo(a)pyrene, dibenz(a,h)anthracene, and n-nitroso-di-n-propylamine). Individual ILCRs for these SVOCs are each less than 1E-05 and all three of these SVOCs were non-detect in all soil samples, removing them from further consideration.

The EPCs for arsenic (12 mg/kg in shallow surface soil (0-1 ft bgs), 19 mg/kg in subsurface soil (1-3 ft bgs)) are similar to the background criteria of 15 mg/kg in shallow surface soil (0-1 ft bgs) and 20 mg/kg in subsurface soil (1-3 ft bgs). This indicates, the calculated cancer risk related to arsenic at the 40 mm Range does not exceed the cancer risk for arsenic estimated for facility-wide background and will not be considered a Constituent of Concern.

3.3.2 INDIRECT CONTACT

Detailed hazard and risk results for the Resident Farmer's indirect contact with COPCs in surface soil are presented in Tables B-13 and B-14 and summarized in Table 4. Indirect contact includes ingestion of venison, beef, milk, and vegetables. The Resident Farmer is the only receptor potentially exposed by these indirect pathways.

Table 4. Summary of Risk Characterization Results for Indirect Contact with Shallow Surface Soil (0-1 ft bgs)

Receptor	ILCR	COCs	HI	COCs
Resident Farmer adult	**5E-03**	Arsenic **2E-03** Benzo(a)pyrene **4E-04** Dibenz(a,h)anthracene **9E-04** Hexachlorobenzene **5E-05** n-Nitroso-di-n-propylamine**1E-03**	**23**	Aluminum 4 Arsenic 13 Thallium 4 2-Methyl-4,6-dinitrophenol 2
Resident Farmer child	**5E-03**	Arsenic 2E-03 Benzo(a)pyrene 4E-04 Dibenz(a,h)anthracene 1E-03 Hexachlorobenzene 5E-05 n-Nitroso-di-n-propylamine 1E-03	**115**	Aluminum 18 Arsenic 61 Thallium 19 Vanadium 5 2-Methyl-4,6-dinitrophenol 12

ILCR > 1E-05 and HI > 1 shown in **bold**.

The total HI is > 1 due to four metals and 2-methyl-4,6-dinitrophenol. The EPCs for arsenic and vanadium are less than background criteria. The EPC for chromium exceeds the background criterion. Thallium background criterion for shallow surface (0-1 ft bgs) soil was set to zero (0) because it was not detected in background. 2-Methyl-4,6-dinitrophenol was non-detect in all soil samples.

The total risk across all COPCs exceeds 1E-05 due to arsenic and 4 SVOCs [benzo(a)pyrene, dibenz(a,h)anthracene, hexachlorobenzene, and n-nitroso-di-n-propylamine]. All four of these SVOCs were non-detect in all soil samples.

The EPCs for arsenic (12 mg/kg in shallow surface soil (0-1 ft bgs) 19 mg/kg in subsurface soil (1-3 ft bgs)) are similar to the background criteria of 15 mg/kg in shallow surface soil (0-1 ft bgs) and 20 mg/kg in subsurface soil (1-3 ft bgs).. Thus, the cancer risk related to arsenic at the 40 mm Range does not exceed the cancer risk for arsenic estimated for facility-wide background.

3.4 UNCERTAINTIES

This section identifies the uncertainties associated with each step of the human health risk assessment process, where possible. Uncertainties are not mutually exclusive.

3.4.1 HUMAN HEALTH UNCERTAINTIES ASSOCIATED WITH DATA EVALUATION

In addition to the normal analytical uncertainty associated with all laboratory analysis, the Data Evaluation process completed in the HHRA inserts more uncertainties. Detection limits required for certain chemicals is often limited due to analytical methods. Often detection limits are greater than risk-based screening levels (i.e., PRG concentrations). Six chemicals were assessed in the HHRA using one-half their detection limit. These chemicals were not detected in soil samples but their detection limits were greater than PRGs. Risks from these chemicals should be considered as overestimated based on the following observations:

- Very few organic chemicals were detected at the 40 mm Range. Only 2 SVOCs were detected and one of these [bis(2-ethylhexyl)phthalate] is a common laboratory contaminant.
- ~~There is no known source for these six chemicals at the 40 mm Range (although PAHs do tend to be ubiquitous in the environment).~~ There are no documented sources for these six chemicals at the 40 mm range. However, in addition to being ubiquitous in the environment, there is also the possibility that they are site-related due to previous Army activities.

The data evaluation includes comparison of MDC to background criteria. Five inorganic COPCs are identified based on this comparison; however, the EPCs for three of these metals (aluminum, arsenic, and vanadium) are less than the background criteria for all three soil depth horizons. Thallium background criterion for shallow surface (0-1 ft bgs) soil was set to zero (0) because it was not detected in background. This metal was detected in only 15% to 18% of shallow (0-1 ft bgs) and deep surface (0-3 ft bgs) soil samples. The EPC for thallium in subsurface (1-3 ft bgs) soil 1.08 mg/kg is only slightly greater than the background criterion of 0.91 mg/kg. Only the EPCs for chromium in shallow (0-1 ft bgs) (43.9 mg/kg) and deep (0-3 ft bgs) (33.6 mg/kg) surface soil exceed the background criterion (17.4 mg/kg). The EPC for chromium in subsurface (1-3 ft bgs) soil (19.2 mg/kg) is less than the background criterion (27.2 mg/kg) for this depth. Therefore, risks calculated for all five of these metals are likely related to naturally occurring background.

3.4.2 UNCERTAINTIES ASSOCIATED WITH EXPOSURE ASSESSMENT

Several uncertainties associated with the various components of the exposure assessment include uncertainties about the exposure pathway equations, exposure parameters, and land-use scenarios.

For each primary exposure pathway chosen for analysis in this HHRA, assumptions are made concerning the exposure parameters (e.g., amount of contaminated media a receptor can be exposed to and intake rates for different routes of exposure) and the routes of exposure. In the absence of site-specific data, the assumptions used are consistent with Ohio EPA-approved default values, which are assumed to be representative of potentially exposed populations (USACE 2004). All contaminant exposures are assumed to be from site-related exposure media (i.e., no other sources contribute to the receptor's health risk). The exposure scenarios are intended to over- rather than under-estimate risk. For example, the intended future land-use includes National Guard Training; therefore, a National Guard Trainee is a representative receptor. The National Guard Trainee scenario assumes the same individual will train exclusively at the 40 mm Range for their entire period of enlistment. Thus, while the receptor is representative of land-use at the 40 mm Range, the details of the exposure scenario are conservative.

There is a significant amount of uncertainty attached to the risk assessment evaluation of the ingestion of foodstuffs by the Resident Subsistence Farmer. The EPCs for aluminum (12,400 mg/kg), arsenic (12.5 mg/kg), and vanadium (22.7 mg/kg) in shallow surface (0-1 ft bgs) soil are less than the background criteria for the metals (17,700, 15.4, and 31.1 mg/kg respectively). Yet, the calculated HIs for these metals range from 4 to 61, and the calculated ILCR for arsenic is 2E-03 for the Resident Subsistence Farmer ingesting homegrown vegetables, beef, and milk products (the contribution from venison is negligible). These very high hazard and risk results for metals at concentrations below background are a symptom of the very conservative nature of the risk calculations for the food ingestion pathways. The risks to these receptors are hypothetical at best. In the United States, there are very few subsistence farmers and less subsistence farmers that grow up on a farm and then continue to live there as adults. The amount of land required to be a subsistence ranges from 0.25 acres to 2 acres per person for vegetarian diets (US Agronomics). Overestimation of risk from this pathway results from a variety of factors including:

- Conservative biotransfer factors often extrapolated from other chemicals;
- Conservative mass loading factors that assume 25 percent of the chemical in soil is deposited on the vegetation and consumed by either an animal (beef and milk) or

human receptor. In addition to this very high mass loading factor, it is assumed that human receptors do not wash homegrown vegetables prior to consumption;

- All of the chemicals are assumed to be 100 percent bioavailable at the detected or 1/2 detection limit concentrations, which would not occur for most chemicals;
- Despite these very conservative uptake assumptions, no loss of contaminants from the soil over the 30-year exposure duration is assumed; and
- Conservative ingestion rates that assume a receptor consumes a large quantity of beef, milk, and vegetables, and much or all of this food is raised within the 2 acre 40 mm Range AOC.

While a land-use plan has been drafted for the RTLS, and OHARNG will control the property, there is uncertainty in the details of the future land-use (e.g., ~~if the~~ perimeter fence ~~is~~ not maintained, land uses could change, a trespasser could enter the property, and the like). There is little to no uncertainty associated with the assumption that the RVAAP/RTLS will not be released for residential use; however, a Resident Subsistence Farmer receptor was evaluated to provide a baseline scenario.

3.4.3 UNCERTAINTIES ASSOCIATED WITH THE TOXICITY ASSESSMENT

The toxicological data (CSFs and RfDs) for dose-response relationships of chemicals are frequently updated and revised, which can lead to overestimation or underestimation of risks. These values are often extrapolations from animals to humans, and this can also cause uncertainties in toxicity values. It is likely differences can exist in chemical absorption, metabolism, excretion, and toxic response between animals and humans. The carcinogenic potential of a chemical can be estimated through a two-part evaluation involving:

(1) a Weight-of-Evidence (WOE) assessment to determine the likelihood that a chemical is a human carcinogen, and

(2) a slope factor assessment to determine the quantitative dose-response relationship.

Uncertainties occur with both assessments. Chemicals fall into one of five groups on the basis of WOE studies of humans and laboratory animals (EPA 2005):

- Group A – known human carcinogen;
- Group B – probable human carcinogen based on limited human data or sufficient evidence in animals, but inadequate or no evidence in humans;
- Group C – possible human carcinogens;
- Group D – not classified as to human carcinogenicity; and
- Group E – evidence of no carcinogenic effects in humans. One COPC identified at the 40 mm Range is a Group A carcinogen (arsenic); five are Group B carcinogens [benzo(a)pyrene, bis(2-ethylhexyl)phthalate, dibenz(a,h)anthracene, hexachlororbenzene, and n-nitroso-di-n-propylene].

No toxicity information is available for nitrocellulose. Therefore, until and unless additional toxicity information allows the derivation of toxicity factors, potential risk from this chemical cannot be quantified.

3.4.4 UNCERTAINTIES ASSOCIATED WITH HUMAN HEALTH RISK CHARACTERIZATION

Risk assessment, as a scientific activity, is subject to uncertainty. This is true even though the methodology used in this HHRA follows EPA guidelines. As noted previously, the risk evaluation in this report is subject to uncertainty pertaining to sampling and analysis, selection of COPCs, exposure estimates, and availability and quality of toxicity data. The risk characterization integrates the findings of the data analysis, exposure assessment, and toxicity assessment; therefore, all of the uncertainties associated with each of these steps impact the risk characterization. And the compounding conservatism of the upper-bound assumptions used to compensate for uncertainties in each of these steps result in over- rather than under-estimation of risk.

3.5 SUMMARY AND CONCLUSIONS

3.5.1 HUMAN HEALTH RISK ASSESSMENT

Calculated non-cancer HIs for direct contact are less than 1 for all receptors. Calculated ILCRs are less than or equal to 1E-05 for National Guard Receptors (National Guard Trainee and Security Guard/Maintenance Worker). Calculated ILCRs exceed 1E-05 for the Resident Farmer scenario; however, risks are driven by background concentrations of arsenic and the detection limits for 3 SVOCs not detected in any soil sample at the 40 mm Range.

4.0 ECOLOGICAL SCREENING

4.1 SCREENING FOR CONTAMINANTS OF POTENTIAL ECOLOGICAL CONCERN

The screening to identify contaminants of potential ecological concern (COPECs) consists of three sequential questions as follows:

1. Is maximum detected or maximum non-detected concentrations above the soil ecological screening value (ESV), or if detected and below the ESV or there was no ESV, is the analyte a persistent, bioaccumulative, and toxic (PBT) chemical?

No – eliminate

Yes – go to step 2.

2. Is maximum detected or maximum non-detected concentration above upper threshold limit (UTL) background criterion (most inorganics) or no background criterion (organics)?

No – eliminate

Yes – go to step 3.

3. Is analyte a Site Related Chemical (SRC) From Army Usage?

No – eliminate

Yes – COPEC.

Each step is now explained in greater detail below.

For Concentrations Compared to Background And PBT Evaluation (Step 1)

In step 1, we ask: Is MDC concentration (if there was at least one detection in the applicable soil depth) or maximum non detect (if there were no detections in the applicable soil depth) above the soil ESV, or if detected and below the ESV or there was no ESV, is the analyte a PBT chemical?

- No – eliminate from further consideration
- Yes – go to step 2.

Step 1 entailed comparing maximum soil concentrations from the applicable depths against soil ESVs. Several sources of ESVs were used from which a preferred ESV was selected, except for substances that had a Plant Protection Level (PPL) as identified in Report on the Draft Biological Field-Truthing Effort at Winklepeck Burning Grounds (SAIC 2002). The hierarchy for selection of the ESV, in order of preference (Ohio EPA 2003) was as follows:

- Efroymson, R.A., G.W. Suter II, B.E. Sample, and D.S. Jones, 1997a. *Preliminary Remediation Goals for Ecological Endpoints.* ES/ER/TM-162/R2.

- Efroymson, R.A., M.E. Will, and G.W. Suter II, 1997b. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision.* ES/ER/TM-126/R2.

- Efroymson, R.A., M.E. Will, G.W. Suter II, and A.C. Wooten, 1997c. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision.* ES/ER/TM-85/R3.

- U.S. EPA, 1999a. Ecological Data Quality Levels (EDQL), U.S. EPA, Region 5, Final Technical Approach for Developing EDQLs for RCRA Appendix IX Constituents and Other Significant Contaminants of Concern. However, that reference has been superseded by U.S.EPA, 2003. Ecological Screening Levels for Region 5 Corrective Action. Thus, updated EPA (2003a) values were used as the fourth source of ESVs.

The soil ESVs and PPLs are presented in Appendix Table C-2. Results of the screening of chemicals in soil samples to ESVs for shallow surface (0 to 1 ft bgs), subsurface (1 to 3 ft bgs), and deep surface (0 to 3 ft bgs) are presented in Appendix Tables C-3 through C-5, respectively.

PBT compounds as defined by Ohio EPA (2003) were identified at the AOC for inorganics and included cadmium, lead, mercury, and zinc; whereas, organic PBTs are analytes whose log octanol-water partition coefficient (Log Kow) is greater than or equal to 3.0 (Appendix Table C-1). PBT chemicals are especially prone to bioaccumulate in biota; thereby, they are capable of being passed up the food chain and causing exposure (and therefore potential adverse impacts) to animals that ingest prey that contain the bioaccumulated analytes.

Comparison Against Background

In step 2 we ask: Is maximum detected or maximum non-detected concentration above the background 95% UTL or are there no background data?

- No – eliminate from further consideration
- Yes – go to step 3.

Results of the screening against background UTL for shallow surface (0 to 1 ft bgs), subsurface (1 to 3 ft bgs), and deep surface (0 to 3 ft bgs) are presented in Appendix Tables C-3 through C-5, respectively.

Role of Site-related Compounds

In step 3 we ask: Is the analyte a SRC (from Army usage)?

- No – eliminate from further consideration
- Yes – COPEC.

The non-SRCs per Army usage include the following: metals – iron; organics-semivolatiles – 2,4-dimethylphenol, 2-chloronaphthalene, benzo(a)pyrene, dibenzo(a,h)anthracene, and hexachloro-butadiene. The concentrations of organic compounds were less than instrument detection limits. Likewise 2,4-dimethylphenol, 2-chloronaphthalene and hexachloro-butadiene are commonly found in transformer and hydraulic fluids so if these chemicals were released at the site, their concentrations in soil sample would be expected to exceed low instrument detection limits. Concentrations of two chemicals, benzo(a)pyrene, and dibenzo(a,h)anthracene were less than those commonly reported as anthropogenic levels.

Summary of Screening for COPECs

COPECs were identified as analytes meeting all of the following criteria: (1) maximum detect or maximum non-detect concentrations exceeded the ESV (or if detected but maximum detect was below ESV or no ESV but was a PBT chemical), (2) maximum detect or maximum non-detect concentrations exceeded the background 95% UTL, and (3) the analyte was a SRC. Results of the screening for SRCs and identification of the COPECs for shallow surface (0 to 1 ft bgs), subsurface (1 to 3 ft bgs), and deep surface (0 to 3 ft bgs) are presented in Appendix Tables C-3 through C-5, respectively. The COPECs were carried forward for further evaluation of ecological receptor-specific risks to identify contaminants of ecological concern (Section 4.2).

4.1.1 ECOLOGICAL SCREENING VALUE COMPARISON RESULTS

Chemicals identified as COPECs (App C, Tables C-3, C-4 and C-5) are summarized in Table 5 and below.

Explosives

- 2,6-dinitrotoluene — Shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs) maximum non detected concentrations (MNDC) for 2,6-dinitrotoluene exceeded eco-criteria, there were no background concentrations, and the analyte is a SRC.

Metals

- Aluminum — Shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs) MDCs for aluminum exceeded eco-criteria and background concentrations and the analyte is a SRC.
- Arsenic — Shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs) MDCs for arsenic exceeded eco-criteria and background concentrations and the analyte may be SRC.
- Cadmium — Shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs) MDCs for cadmium did not exceed eco-criteria but did exceed background concentrations and the analyte is a PBT and may be SRC.
- Chromium — Shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs) MDCs for chromium exceeded eco-criteria and background concentrations and the analyte is a SRC.
- Chromium, hexavalent — Shallow surface (0-1 ft bgs) MDCs for chromium, hexavalent exceeded eco-criteria, there were background concentrations, and the analyte is a SRC. Subsurface (1-3 ft bgs) and deep surface (0-3 ft bgs) MNDC also exceeded eco-criteria, there were background concentrations, and the analyte is a SRC.
- Cobalt — Subsurface (1-3 ft bgs) and deep surface (0-3 ft bgs) MDCs for cobalt exceeded eco-criteria and background concentrations and the analyte may be SRC.
- Copper — Shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs) MDCs for copper exceeded eco-criteria and background concentrations and the analyte is a SRC.
- Lead — Shallow surface (0-1 ft bgs) and deep surface (0-3 ft bgs) MDCs for lead exceeded eco-criteria and background concentrations and the analyte is a PBT and SRC. The subsurface (1-3 ft bgs) MDC for lead did not exceed the eco-criteria, but did exceed background and the analyte is a PBT and SRC.
- Mercury — Shallow surface (0-1 ft bgs) MNDC for mercury exceeded eco-criteria and background concentrations and the analyte is a PBT and SRC.
- Nickel — Deep surface (0-3 ft bgs) MDC for nickel exceeded eco-criteria and background concentrations and the analyte is a PBT and SRC.
- Thallium — Shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs) MDCs for thallium exceeded eco-criteria and background concentrations and the analyte may be SRC.

- Vanadium — Shallow surface (0-1 ft bgs) and deep surface (0-3 ft bgs) MDCs for vanadium exceeded eco-criteria and background concentrations and the analyte may be SRC.

- Zinc — Shallow surface (0-1 ft bgs) and deep surface (0-3 ft bgs) MDCs for zinc exceeded eco-criteria and background concentrations and the analyte is a PBT and SRC.

Pesticides/PCBs

- 4,4'–DDE — Shallow surface (0-1 ft bgs) and deep surface (0-3 ft bgs) MDCs for 4,4'–DDE did not exceed eco-criteria but there were no background concentrations and the analyte is a PBT and may be SRC.

- Aldrin — Shallow surface (0-1 ft bgs) and deep surface (0-3 ft bgs) MDCs for aldrin did not exceed eco-criteria but there were no background concentrations and the analyte is a PBT and may be SRC.

- Dieldrin — Shallow surface (0-1 ft bgs) and deep surface (0-3 ft bgs) MNDCs for dieldrin exceeded eco-criteria, there were no background concentrations, and the analyte is a PBT and SRC.

- Endrin aldehyde — Shallow surface (0-1 ft bgs) and deep surface (0-3 ft bgs) MDCs for endrin aldehyde did not exceed eco-criteria but there were no background concentrations and the analyte is a PBT and may be SRC.

- Heptachlor — Shallow surface (0-1 ft bgs) and deep surface (0-3 ft bgs) MDCs for heptachlor did not exceed eco-criteria but there were no background concentrations and the analyte is a PBT and may be SRC.

- Lindane — Shallow surface (0-1 ft bgs) and deep surface (0-3 ft bgs) MDCs for lindane did not exceed eco-criteria but there were no background concentrations and the analyte is a PBT and may be SRC.

Semivolatiles

- 3,3'–dichlorobenzidine — Subsurface and deep surface MNDCs for 3,3' –dichlorobenzidine exceeded eco-criteria, there were no background concentrations, and the analyte is a PBT and SRC.
- Bis(2–ethylhexyl)phthalate — Shallow surface (0-1 ft bgs) and deep surface (0-3 ft bgs) MDCs for Bis(2-ethylhexyl)phthalate did not exceed eco-criteria, but there were no background concentrations, and the analyte is a PBT and SRC.

Volatiles

- 1,2-dimethylbenzene — Subsurface (1-3 ft bgs) and deep surface (0-3 ft bgs) MDCs for 1,2-dimethylbenzene had no eco-criteria but there were no background concentrations, and the analyte is a PBT and may be SRC.

~~Many analytes were eliminated from further consideration because they did not meet the criteria for COPECs. The eliminated analytes are summarized by analytical classes as follows:~~

~~Explosives~~

- ~~Shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs) each had 16 explosives eliminated from further consideration.~~

~~Metals~~

- ~~The shallow surface (0-1 ft bgs) had 13 metals eliminated from further consideration, whereas the subsurface had 14 metals eliminated and deep surface had 12 metals eliminated.~~

~~Pesticides/PCBs~~

- ~~The shallow surface (0-1 ft bgs) and deep surface (0-3 ft bgs) each had 23 pesticides/PCBs eliminated from further consideration, whereas the subsurface had 29 pesticides/PCBs eliminated.~~

~~Semivolatiles~~

- ~~The shallow surface (0-1 ft bgs) had 54 SVOCs eliminated from further consideration, whereas the subsurface had 61 SVOCs eliminated and deep surface had 60 SVOCs eliminated.~~

~~Volatiles~~

- ~~The subsurface and deep surface both had 45 VOCs eliminated from further consideration, whereas the shallow surface soil (0-1 ft bgs) had 46 VOCs eliminated.~~

4.2 IDENTIFICATION OF CONTAMINANTS OF ECOLOGICAL CONCERN (COECs)

COPECs from the three soil depths were further evaluated to determine whether they posed receptor-specific risks. A ratio was calculated by dividing the expected exposure concentrations (estimated doses) to receptor-specific toxicity reference values (TRVs). The resulting ratio was deemed a hazard quotient (HQ). Because TRVs represent concentrations below which adverse impacts are not expected to occur, exposure concentrations or doses that exceed the TRV, that result in HQs greater than 1, indicate the concentration of the chemical may have potential to impact ecological receptors.

Ecological Receptors

Six terrestrial receptors, including plants, terrestrial invertebrates (i.e. earthworms), Eastern cottontail rabbits (*Sylvilagus floridanus*) (rabbits), short-tailed shrews (*Blarina* *brevicauda*) (shrews), red foxes (*Vulpes vulpes*) (foxes), and red-tailed hawks (*Buteo jamaicensis*) (hawks) were selected for evaluation of ecological risks to identify COECs. The selection of the specific receptors is consistent with recommended guidance from Ohio EPA (2003) and USACE (2003). Plants and earthworms represent receptors exposed by direct contact to soil. Rabbits represent herbivores whereas shrews represent insectivores. Foxes and hawks represent carnivores (top predators). Per Ohio EPA (2003), only the PBT COPECs were evaluated for foxes and hawks.

Exposure

Detailed descriptions of the methods for calculating exposures for the terrestrial receptors in this study are presented in Ohio EPA (2003), so the methods are only briefly discussed herein. Exposures for all the receptors were calculated using the RME soil concentration for the applicable depth. The RME is defined as the lower value among the maximum detect concentration and the 95% UCL.

For plants and earthworms, the exposure concentration is the soil RME because these receptors are assumed to receive exposure via direct contact with the surrounding soil. Thus, these receptors have direct exposure to soil COPECs.

For wildlife receptors (rabbits, shrews, foxes, and hawks), exposure doses to COPECs are indirect because they are based on calculated average daily doses (ADDs) for ingested plant food (ADD_P), animal food (ADD_A), and soil (ADD_S) (Ohio EPA 2003). The ADDs represent doses of a COPEC ingested by a receptor and are expressed as mass of COPEC ingested concentration per kilogram body weight per day. The ADDs are based on the receptor's dietary, body weight, and home range parameters, as well as various bioaccumulation factors and area use factors (AUFs). More specifically, the ADDs are based on the receptor's daily food intake rates, which include fractions of diet that are plants, animals, and soil. Bioaccumulation factors used for calculating ADDs included soil-to-plant (vegetative parts) (SPv), soil-to-plant (reproductive parts) (SPr), soil-to-invertebrates (BAFi), and animal-to-mammal and animal-to-bird transfer factor (BAF TP). AUFs are ratios of the receptor's home range relative to the area of the exposure unit. AUFs greater than 1 are rounded to 1. The receptor parameters for rabbits, shrews, foxes, and hawks are presented in Appendix Tables C-6 through C-9, respectively. Bioaccumulation factors are presented in Appendix Table C-10. AUFs and receptor ingestion rates are presented in Appendix Tables C-11 and C-12, respectively. More details are available in the Ohio EPA (2003) and the Army COE (USACE 2003) on the exposure equations for each of the receptor.

Ecological Effects

Ecological effects to the receptors are represented by receptor- and chemical-specific TRVs. The TRVs for plants and earthworms are mostly based on lowest observed adverse effect levels (LOAELs). The plant TRVs were obtained from Efroymsom et al. (1997c) (Appendix Table C-13), whereas the earthworm TRVs were obtained from Efroymson et al. (1997b) (Appendix Table C-14).

The TRVs for mammals and birds were based on no observed adverse effect levels (NOAELs) and obtained from various sources (Appendix Tables C-15 through C-18). Test studies based on chronic duration were the preferred duration, so TRVs for chemicals whose original studies were based on acute or subchronic durations were multiplied by 0.1 to correct for the shorter durations. The preferred endpoint from the test studies was a NOAEL, so if the endpoint was a LOAEL or other endpoint, the original toxicity benchmark was multiplied by 0.1 to obtain the estimated NOAEL.

COEC Identification

COEC identification was performed by calculating receptor-specific HQs for the COPECs from each of the soil depths. The HQs were obtained by dividing either the RME soil concentrations (for plants and earthworms) or total ADDs (for wildlife receptors) by the receptor-specific TRVs for the corresponding COPECs. COECs were identified as any COPECs meeting one of the following conditions for at least one receptor at the applicable soil depth: 1) having an HQ greater than 1, or 2) not having a TRV. Appendix Tables C-19 through C-33 shows the HQ calculations and COEC identifications for all of the receptors for all three soil depths.

Table 5. Summary of Soil COPECs Following the ESV Screening Step and COECs Following HQ Calculations for the 40 mm Range, RVAAP

SRC	Soil Depth (0-1ft; 1-3 ft; 0-3ft bgs)					
	Shallow Surface		Subsurface		Deep Surface	
	COPEC	COEC	COPEC	COEC	COPEC	COEC
Organics-Explosives						
2,6-Dinitrotoluene	X	X	X	X	X	X
Metals						
Aluminum	X	X	X	X	X	X
Arsenic	X	X	X	X	X	X
Cadmium	X	...	X	...	X	...
Chromium	X	X	X	X	X	X
Chromium, hexavalent	X	X	X	X	X	X
Cobalt	--	...	X	X	X	X
Copper	X	...	X	...	X	...
Lead	X	...	X	...	X	...
Mercury	X	...	--	...	--	...
Nickel	--	...	--	...	X	...
Thallium	X	X	X	X	X	X
Vanadium	X	X	--	...	X	X
Zinc	X	X	--	...	X	X
Organics-Pesticides/PCBs						
4,4'-DDE	X	X	--	...	X	X
Aldrin	X	X	--	...	X	X
Dieldrin	X	X	--	...	X	X
Endrin aldehyde	X	X	--	...	X	X
Heptachlor	X	X	--	...	X	X
Lindane	X	X	--	...	X	X
Organics – Semivolatiles						
3,3'-Dichlorobenzidine	--	...	X	X	X	X
Bis(2-ethylhexyl)phthalate	X	X	--	...	X	X
Organics - Volatiles						
1,2-Dimethylbenzene	--	...	X	X	X	X

ESV = ecological screening value

RVAAP = Ravenna Army Ammunition Plant

COPEC = chemical of potential ecological concern

"X" = the analyte is a COPEC at this soil depth
"--" = the analyte was not a COPEC at this soil depth

"..." = the COPEC was not a COEC at this soil depth

4.2.1 COPECS ELIMINATED FROM BEING COECS

Several metals were eliminated from further consideration because their HQs were less than 1. The eliminated metals are summarized as follows:

- Cadmium, copper, and lead were eliminated from further consideration for shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs).
- Mercury was eliminated from further consideration for shallow surface (0-1 ft bgs) depth.
- Nickel was eliminated from further consideration for the combined depth.

4.2.1.1 EVALUATION OF COECS BASED ON RECEPTOR-SPECIFIC HAZARD QUOTIENTS

Using RME soil concentrations and receptor-specific NOAEL TRVs [except for LOAELs for plants and earthworms], the following COECs were identified based on having an HQ greater than 1 for at least one receptor (Table 6) and are discussed below. In addition, there are COECs identified that are based on having no TRVs for at least one receptor, and those COECs are also summarized below.

4.2.1.2 COECS BASED ON AN HQ GREATER THAN ONE

Explosives

Shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs) each had no COECs based on HQs greater than 1 for any receptor.

Table 6. Summary Table of Hazard Quotients Exceeding 1 in 40 mm Range Soils

COEC With an HQ	Hazard Quotient Magnitude		
	1< HQ <10	**10 < HQ <100**	**HQ > 100**
		Shallow Surface Soil (0 to 1 ft)	
Organics-Explosives	--	--	--
Metals			
Aluminum	--	**54 (rabbit)**	**785 (shrew)** **248 (plant)**
Arsenic	**4 (shrew)** **1 (plant)**	--	--
Chromium	--	**44 (plant)**	**110 (earthworm)**
Thallium	**7 (shrew)**	--	--
Vanadium	--	**11 (plant)** **10 (shrew)**	--
Zinc	**1 (plant)**	--	--
Organics-Pesticides/PCBs	--	--	--
Organics-Semivolatiles	--	--	--
Organics-Volatiles	--	--	--
		Subsurface Soil (1 to 3 ft)	
Organics-Explosives	--	--	--
Metals			
Aluminum	--	**59 (rabbit)**	**861 (shrew)** **272 (plant)**
Arsenic	**7 (shrew)** **1 (plant)** **1 (rabbit)**	--	--
Chromium	--	**48 (earthworm)** **19 (plant)**	--
Thallium	**1 (plant)**	**10 (shrew)**	--
Vanadium	--	**12 (plant)** **11 (shrew)**	--
Organics-Pesticides/PCBs	--	--	--
Organics-Semivolatiles	--	--	--
Organics-Volatiles	--	--	--
		Deep Surface Soil (0 to 3 ft)	
Organics-Explosives	--	--	--

Table 6. Summary Table of Hazard Quotients Exceeding 1 in 40 mm Range Soils (Continued)

	Hazard Quotient Magnitude		
COEC With an HQ	**1< HQ <10**	**10 < HQ <100**	**HQ > 100**
Metals			
Aluminum	--	**55 (rabbit)**	**798 (shrew)** **252 (plant)**
Arsenic	**5 (shrew)** **2 (plant)** **1 (rabbit)**	--	--
Chromium	--	**84 (earthworm)** **34 (plant)**	--
Thallium	**7 (shrew)**	--	--
Vanadium	--	**11 (plant)** **10 (shrew)**	--
Zinc	**1 (plant)**	--	--
Organics-Pesticides/PCBs	--	--	--
Organics-Semivolatiles	--	--	--
Organics-Volatiles	--	--	--

COEC = chemical of ecological concern
HQ = hazard quotient

"--" = analyte either was not a COPEC or had
COPEC = chemical of potential ecological

Metals

- Aluminum — Shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs) RMEs for aluminum produced HQs > 100 for shrews and plants, with the highest HQs in the subsurface soil (861 for shrews, 272 for plants).
- Arsenic — Subsurface and deep surface RMEs for arsenic produced HQs between 1 and 9 for shrews, plants, and rabbits, with the highest HQ in the subsurface soil (7) for shrews. The HQs for shrews and plants also were between 1 and 9 in shallow surface (0-1 ft bgs) soil.
- Chromium — Shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs) RMEs for chromium produced HQs between 10 and 110 for shrews and plants, with the highest HQ (110) for earthworms in the shallow surface (0-1 ft bgs) soil. The highest HQ for plants (44) was also in shallow surface (0-1 ft bgs) soil. Subsurface soil had the lowest HQs for chromium among the 3 depths.
- Thallium — Shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs) RMEs for thallium produced HQs between 1 and 10 for shrews, plus and HQ of 1 for plants in the subsurface soil. The highest HQ was for shrews (10) at the subsurface soil.

- Vanadium — Shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs) RMEs for vanadium produced HQs between 10 and 100 for shrews and plants, with the highest HQs in the subsurface soil (12 for plants, 11 for shrews).
- Zinc — Shallow surface (0-1 ft bgs) and deep surface (0-3 ft bgs) RMEs for zinc produced an HQ of 1 for plants. No HQs exceeded 1 for any receptor for the subsurface soil.

Pesticides/PCBs

- There were no HQs for pesticides/PCBs that exceeded 1 for any receptor exposed to shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), or deep surface (0-3 ft bgs).

SVOCs

- There were no HQs for SVOCs that exceeded 1 for any receptor exposed to shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), or deep surface (0-3 ft bgs).

VOCs

- There were no HQs for VOCs that exceeded 1 for any receptor exposed to shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), or deep surface (0-3 ft bgs).

4.2.1.3 COECS BASED ON ABSENCE OF TRVS

There were COECs identified based on an absence of TRVs for at least one receptor, and they are summarized below.

Explosives

- 2,6-Dinitrotoluene — This was the only COEC for explosives based on "No TRV" but was a COEC for shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs).

Metals

- Chromium, hexavalent – This was a metal COEC based on "No TRV" for shallow surface (0-1 ft bgs), subsurface (1-3 ft bgs), and deep surface (0-3 ft bgs).

- Cobalt – This was a metal COEC based on "No TRV" for subsurface and deep surface.

Pesticides/PCBs

- Six pesticides were COECs based on "No TRV" for shallow surface (0-1 ft bgs) and deep surface (0-3 ft bgs), but there were no pesticide/PCBs COECs based on "No TRV" for subsurface.

SVOCs

- 3,3' –dichlorobenzidine — This was a SVOC COEC based on "No TRV" for subsurface and deep surface.
- Bis(2-ethylhexyl)phthalate — This was a SVOC COEC based on "No TRV" for shallow surface (0-1 ft bgs) and deep surface (0-3 ft bgs).

VOCs

- 1,2-Dimethylbenzene — This was a VOC COEC based on "No TRV" for subsurface and deep surface.

4.3 SUMMARY AND CONCLUSIONS

4.3.1 ECOLOGICAL RISK ASSESSMENT

Twenty-three SRCs were identified as COPECs because their concentrations exceeded an ESV, exceed background criterion, had no ESV, or were PBT compounds detected above background (Table 5). HQs were calculated for exposure of ecological receptors to COPECs using RME concentrations. Any COPEC that had at least one HQ greater than 1 or lacked a TRV for at least one receptor remained as a COEC. COECs are also shown on Table 5.

Five metal COPECs (cadmium, copper, lead, mercury, and nickel) were eliminated from being COECs based on low HQ values. There were no COECs based on HQs greater than 1 for explosives, pesticides/PCBs, SVOCs, or VOCs, nor any HQs greater than 1 for top predators (e.g., hawks and shrews).

Six metals were COECs because their HQ values exceeded 1. These are aluminum, arsenic, chromium, thallium, vanadium, and zinc. Aluminum had the highest HQs (861 for shrews and 272 for plants), followed by the HQ for chromium (110) for earthworms. Several COECs were based on an absence of having a TRV for at least one receptor, including one explosive (2,6-dinitrotoluene), one metal (chromium, hexavalent), 6 pesticides, two SVOCs [3,3' –dichlorobenzidine and bis(2-ethylhexyl)phthalate], and one VOC (1,2-dimethylbenzene) (the uncertainties due to lacking a TRV for at least one receptor are discussed further in Section 4.3.2.3).

Based upon results of this ecological assessment, concentrations of six metals may exceed concentrations that are protective of certain ecological receptors if assumptions used in estimating exposure point concentrations are met. There is potential for impact for certain terrestrial receptors at 40 mm Range if exposure assumptions are met.

4.3.2 UNCERTAINTIES FOR ECOLOGICAL RISK ASSESSMENT

Uncertainties are discussed briefly in this section by the four interrelated steps of the EPA approach to a ERA: problem formulation, exposure assessment, effects assessment, and risk characterization. There is also a section about the lack of influence of any runoff from 40 mm Range to the nearby Fuze and Booster ponds.

4.3.2.1 UNCERTAINTIES ASSOCIATED WITH PROBLEM FORMULATION

The concentrations of COECs in soil at the 40 mm Range were based on a limited number of samples, especially for organic chemicals. It was assumed that chemical concentrations were uniform over the 40 mm Range although concentrations actually differed from sample to sample. Variations among chemical constituents are expected in the environment because of compositional and distributional heterogeneity. Some constituents that may not be above background concentrations have been included in the conservative analysis (see Section 4.3.2.4). For other COECs, use of the 95th percentile upper confidence limit (UCL_{95}) of the mean or the maximum concentration likely overestimates rather than underestimates the actual exposure concentrations of COECs.

Representative ecological receptors (plants, earthworms, cottontail rabbits, shrews, red foxes, and red-tailed hawks) were used to estimate risks. These receptors or those represented by these animals are known to be at the site. Other receptors at the site could be more or less sensitive to COEC exposure than the representative receptors. It is also uncertain that the receptors are uniformly distributed, as is implied in the problem formulation.

4.3.2.2 UNCERTAINTIES ASSOCIATED WITH EXPOSURE ASSESSMENT

Assumptions made in the exposure assessment include the assumption that all COECs in soil are completely bioavailable. This assumption likely overestimates exposure (refer to Sections 4.3.2.3 and 4.3.2.4). In addition, exposure models include bioaccumulation factors (BAFs) that are used to calculate the movement of COECs through the food chain. Measured BAFs are not available for some COECs at the 40 mm Range. Instead, BAFs may be calculated from empirical formulas or may be default values. For example, BAF-S values for metals that do not have measured values are 0.22, the mean of measured values reported by U.S. EPA (1999b). This mean value for published BAFs surely overestimates bioaccumulation for many of the metals for which values have not been published. Assumptions used to estimate how often a particular receptor utilizes a site are not fully addressed by application of AUFs. These type of assumptions are particularly true for upper level consumers such as foxes and hawks that have a large home range.

4.3.2.3 UNCERTAINTIES ASSOCIATED WITH EFFECTS ASSESSMENT

TRVs are intended to be the highest exposure concentrations that will not cause harm to individuals and ecological populations. However, none of the TRVs were derived from studies of populations. The best TRVs are NOAELs from chronic studies of reproductive success, but many of the TRVs are extrapolated from LOAELs, from subchronic or acute studies, and even from acute LD_{50} values. The conversion factors used to calculate TRVs are rather arbitrary, and there is uncertainty that they are reliable.

In addition, it is uncertain that laboratory toxicological studies accurately predict the toxicity of COPECs in environmental settings. For example, COPECs in nature may not be biologically available or they may not have the potential to impact usually more resistant wildlife. Comparisons of long term (chronic values) are generally not truly representative of long term studies for wildlife. Wild life are likely to be less accessible of certain reproductive effects when compared to laboratory a-reared animals. For example, wildlife has certain visual cues used to select their appropriate breeding area or nesting habitat. These visual cues are not activated in the laboratory – reared animals. The measured effect manifested in the test populations may not be seen in wildlife populations. This is particularly true of aluminum, which had HQs of 44 for plants, 110 for earthworms, 54 for cottontail rabbits, and 785 for shrews.

EPA (2003b) states "comparisons of total aluminum concentrations in soil samples to soluble aluminum-based screening values are deemed by EPA to be inappropriate." Rather than establishing a numerical value of a soil screening benchmark for aluminum, EPA and the Army recommend that aluminum is not a COPEC unless the soil pH is below 5.5 (EPA 2003b). In fact, soil pH at RVAAP is greater than 6. Therefore, the TRVs for aluminum likely do not represent actual toxicity to ecological receptors. In addition, populations may respond to chronic exposure by developing resistance to the toxic effects or by increasing reproductive rates to compensate for lower survival of offspring. For these and other reasons, TRVs used in the risk assessment may underestimate but usually overestimate the risk to ecological receptors.

4.3.2.4 UNCERTAINTIES ASSOCIATED WITH ECOLOGICAL RISK CHARACTERIZATION

In this section all the various uncertainty elements combine to result in uncertainty about the findings in the risk characterization.

At the 40 mm Range, each of the receptors is at risk of toxicity from a few COECs, as indicated by HQs greater than 1 (Table 6, above) or by having no TRV. It is not certain that these criteria actually represent ecological risk, or if so, that the risks justify further actions such as any more study. The following discussion addresses uncertainties of the risk characterization phase of this ecological assessment. The application of these uncertainties is shown on Table 7.

1. COECs that were not detected

Concentrations of chemicals that were measured as non-detectable (non-detects) were carried through the risk assessment because of concern that they may be present at concentrations above ESLs but below detection limits. However, non-detected COECs cannot be remediated because neither their location nor their toxicity at that location is known. Therefore, non-detects provide some useful information for decision-making but are likely an overestimation of potential risk..

If the maximum reported detection limit of a COEC is below the ESV, it can safely be concluded that no sample whose concentration is below the detection limit exceeded the ESV. The non-detect COECs were 2,6-dinitrotoluene, hexavalent chromium, and dieldrin in shallow surface (0-1 ft bgs) soil; 2,6-dinitrotoluene, hexavalent chromium, and 3,3'-dichlorobenzidine in subsurface soil (1-3 FT BGS); and 2,6-dinitrotoluene, hexavalent chromium, dieldrin, and 3,3'-dichlorobenzidine in deep surface soil (0-3 FT BGS) (Table 7). Of these, only dieldrin in subsurface soil had a maximum detection limit (0.0021 mg/kg) that was below the ESV (0.0024 mg/kg). Therefore, dieldrin was eliminated as a COEC in subsurface soil (1 to 3 ft) but retained in shallow surface soil (0 - 1 ft bgs) and deep surface soil (0 - 3 ft bgs). 2,6-Dinitrotoluene, hexavalent chromium, and 3,3'-dichlorobenzidine were not detected, but they were retained at all depths for further evaluation because it is not certain that non-detected concentrations are below ESVs.

2. COECs with HQs less than 1

The remaining COECs included several that were retained because a TRV for at least one receptor was not available. COPECs that lacked a TRV for any receptor were conservatively classified COECs in the HQ screen. However, if there is evidence to support that exposures are not harmful to receptors for which TRVs are available, it is likely that the COEC can safely be eliminated. COECs that had been retained because of a lack of published TRVs were 2,6-dinitrotoluene, hexavalent chromium, pesticides (4,4'-DDE, aldrin, dieldrin, endrin aldehyde, heptachlor, and lindane) and bis(2-ethylhexyl)phthalate in shallow surface (0-1 ft bgs) soil; 2,6-dinitrotoluene, hexavalent chromium, cobalt, 3,3'-dichlorobenzidine, and 1,2-dimethylbenzene in subsurface soil (1-3 ft bgs); and 2,6-dinitrotoluene, hexavalent chromium, pesticides, bis(2-ethylhexyl)-phthalate, cobalt, and 1,2-dimethylbenzene in deep surface soil (0-3 ft bgs) (Table 7). These COECs lack TRVs for plants and earthworms but have TRVs for mammals (except endrin aldehyde and 3,3'-dichlorobenzidine) and birds (except aldrin, endrin aldehyde, and 3,3'-dichlorobenzidine). The greatest reported HQ for any of these COECs was 0.002. There is no TRV for endrin aldehyde. However, if the TRV for endrin (Appendix Table C-16) is used as a surrogate for the endrin aldehyde TRV for mammals and birds, the maximum HQ is approximately 0.0003. Based on this analogy, 2,6-dinitrotoluene, hexavalent chromium, cobalt, the six pesticides, bis(2-ethylhexyl)-phthalate, and 1,2-dimethylbenzene can safely be eliminated as COECs. Aldrin and 3,3'-dichlorobenzidine remain as COECs because they lack a TRV. However, potential risks from exposure to these COECs cannot be evaluated.

Table 7. Further Evaluation of COECs in Soil at 40 mm Range at RVAAP

COEC	Not detected[a]	No HQ >1[b]	Background comparison			Additional information available on exposure and/or effects	Retained for further discussion
			95% UCL mean background concentration[c]	Mean COEC concentration[c]	Mean COEC concentration < UCL mean background concentration		
			Shallow Surface soil (0 - 1 ft)				
Organics-Explosives							
2,6-Dinitrotoluene	X	X[d]					
Metals							
Aluminum			19200	11100	X		
Arsenic			12.2	11.4	X		
Chromium			14.4	26.5		X	X
Chromium, hexavalent	X	X[d]					
Thallium			0.339	0.611		X	X
Vanadium			23.2	20.7	X		
Zinc			55.8	60.6		X	X
Organics-Pesticide/PCB							
4,4'-DDE		X					
Aldrin		X					
Dieldrin	X	X[d]					
Endrin aldehyde		X					
Heptachlor		X					
Lindane		X					
Organics-Semivolatile							
Bis(2-ethylhexyl)phthalate		X					

Table 7. Further Evaluation of COECs in Soil at 40 mm Range at RVAAP (Continued)

COEC	Not detected[a]	No HQ >1[b]	Background comparison: 95% UCL mean background concentration[c]	Background comparison: Mean COEC concentration[c]	Background comparison: Mean COEC concentration < UCL mean background concentration	Additional information available on exposure and/or effects	Retained for further discussion
Organics-Explosives							
2,6-Dinitrotoluene	X	X[d]					
Metals							
Aluminum			13300	12600	X		
Arsenic			13.4	17.5		X	X
Chromium			19	17.9	X		
Chromium, hexavalent	X	X[d]					
Cobalt		X					
Thallium			0.409	0.759		X	X
Vanadium			22.3	22	X		
Organics-Semivolatile							
3,3'-Dichlorobenzidine	X	X[d]					
Organics-Volatile							
1,2-Dimethylbenzene		X					
Deep Surface soil (0 to 3 ft)							
Organics-Explosives							
2,6-Dinitrotoluene	X	X[d]					
Metals							
Aluminum			19200	11700	X		
Arsenic			12.2	13.8		X	X
Chromium			14.4	23.1		X	X

Table 7. Further Evaluation of COECs in Soil at 40 mm Range at RVAAP (Continued)

COEC	Not detected[a]	No HQ >1[b]	Background comparison			Additional information available on exposure and/or effects	Retained for further discussion
			95% UCL mean background concentration[c]	Mean COEC concentration[c]	Mean COEC concentration < UCL mean background concentration		
Chromium, hexavalent	X	X[d]					
Cobalt		X					
Thallium			0.339	0.669		X	X
Vanadium			23.2	21.2	X		
Zinc			55.8	60.5		X	X
Organics-Pesticide/PCB							
4,4'-DDE		X					
Aldrin		X					
Dieldrin	X	X[d]					
Endrin aldehyde		X					
Heptachlor		X					
Lindane		X					
Organics-Semivolatile							
Bis(2-ethylhexyl)phthalate		X					
3,3'-Dichlorobenzidine	X	X[d]					
Organics-Volatile							
1,2-Dimethylbenzene		X					

COECs are those remaining after the HQ calculation (Table 5).

[a] COEC was not detected in any sample.

[b] Either all HQs < 1 or no TRV

[c] From Appendix Table C-4

[d] Calculated using the lower of half of the maximum detection limit and the UCL_{95} of the mean of 1/2 the detection limit for each sample.

3. COECs Whose Mean Concentrations are Below Background

The background screen for COPECs compared the maximum detected or non-detected concentration of each metal to its background criterion, which is the 95th percentile UTL of the background sampling results (see Section 4.1 and Appendix A). The use of the UTL is the traditional statistic for this early comparison, but in the uncertainty section, another comparison used—the UCL_{95} of the mean background concentration. The UTL screen is a conservative screen intended to include any COEC with a maximum concentration that was higher than the background concentration distribution. However, the chronic exposure of ecological receptors is unlikely to be to the maximum concentration, but rather to the mean concentration. Therefore, the UCL_{95} of the mean background concentration was calculated for each COEC. This is a conservative measure of the background mean rather than a conservative measure of the measured background results (UTL). The mean concentration of each detected COEC that had an HQ above 1 was compared to the UCL_{95} of the mean background concentration (Appendix Table C-4) to determine whether chronic exposures are likely to be above background exposures. In shallow surface soil (0-1 ft bgs), mean aluminum, arsenic, and vanadium concentrations were below the UCL_{95} mean background concentrations. In subsurface soil (1-3 ft bgs), the mean aluminum, chromium, and vanadium concentrations were below the UCL_{95} mean background concentration. In deep surface soil (0-3 ft bgs), the mean aluminum and vanadium concentrations were below the UCL_{95} mean background concentration for shallow surface soil (0-1 ft bgs) (Table 7). COECs whose mean concentrations were less than the UCL_{95} mean background concentrations were eliminated from further consideration.

4. Further Discussion of Exposure and/or Effects of Remaining COECs

There is environmental information about the remaining COECs: arsenic, chromium, thallium, and zinc. By soil depth, the remaining COECs are chromium, thallium, and zinc in shallow surface soil (0-1 ft bgs); arsenic and thallium in subsurface soil (1-3 ft bgs); and arsenic, chromium, thallium, and zinc in deep surface soil (0-3 ft bgs).

The initial background screen compared the maximum detected concentration to an upper limit of the background concentration (UTL_{95}). Another way to compare site-specific values to background is to compare the central tendency of each population (mean and UCL_{95} concentrations). In shallow surface soil (0-1 ft bgs), the mean chromium, thallium, and zinc concentrations were less than twice the UCL_{95} mean background concentration; the mean zinc concentration was approximately 10% above the background concentration. In subsurface soil (1-3 ft bgs), the mean arsenic and thallium concentrations were less than twice the UCL_{95} mean background concentrations. In deep surface soil (0-3 ft bgs), the mean arsenic, chromium, thallium, and zinc concentrations were less than twice the UCL_{95} mean background concentration. The mean arsenic concentration was 13% above the UCL_{95} mean background concentration, and the mean zinc concentration was approximately 9% above the UCL_{95} mean background concentration.

Laboratory measured concentrations of a chemical do not adequately represent its bioavailability. For example, laboratory analysis uses harsh digestion procedures to strip all of the metal ions from the soil. However, bioavailability of the chemical in the soil matrix differs under different field conditions. Toxicity to ecological receptors requires the chemical to be bioavailable, but many chemical forms in nature are not bioavailable. Bioavailability of a chemical in a particular type of soil is affected by many factors such as the water content of the soil, carbon content of the soil, cation exchange capacity, soil pH, and solubility. Chemicals may also be bound to substances that make them unavailable for bio-transfer. For example, ions may be bound to ionically charged components of soil particles, and multivalent ions such as Cr^{+3} may bind to organic components of soil such as humic and fulvic acids. All of these factors can markedly reduce the bioavailability of chemicals in soil.

Each of the retained COECs (arsenic, chromium, thallium, and zinc) is discussed separately in the following paragraphs, within the context of bioavailability of metals in soil.

Arsenic: Arsenic in soil has low bioavailability. Bioavailability in non-40 mm Range soil was studied by measuring the pharmacokinetics of arsenic administered to Capuchin monkeys either by injection or by ingestion of soil (Roberts et al. 2002). Exposure to equivalent concentrations resulted in blood and urine concentrations of 10% to 25% as much arsenic from soil as by direct injection.

The highest HQ for arsenic at the 40 mm Range was 7 for shrews (Table 6), approximately 2/3 of which came directly from ingestion of soil. Because the TRV was derived from ingestion of arsenic in water (Appendix Table C-15) rather than soil, the calculated TRV overestimates toxicity. If bioavailability of arsenic in soil is negligible compared to food, the actual exposure may be only the calculated 1/3 that came from food. Therefore, arsenic exposures may have been overestimated by up to 3-fold. The maximum HQs for other ecological receptors are 1.5 to 1.9 for plants. Confidence in the TRV for plants is characterized as moderate (Efroymson et al. 1997a), and several studies showed no toxicity at higher concentrations. Given the uncertainty in arsenic uptake and plant TRVs, both of which likely overestimate toxicity, it is unlikely that concentrations of arsenic in soil pose an unacceptable risk to biota at the 40 mm Range.

Chromium: Chromium is an example of a metal that occurs in different chemical forms with different bioavailabilities and toxicities. Chromium exists in different oxidation states, predominantly as trivalent chromium [Cr (III)] and hexavalent chromium [Cr (VI)]; Cr (III) is less bioavailable and less toxic than Cr (VI). Natural Cr (VI) is rare in nature (James 2002), and Cr (VI) was not detected in the soil samples. Nearly all naturally occurring chromium is in the form of the Cr^{+3} (chromic) cation, which is in the Cr (III) oxidation state. Compounds of Cr (III) such as chromic acetate [$Cr\ (CH_3O_2)_3$] or chromic sulfate [$Cr_2\ (SO_4)_3$] are soluble in water because they disassociate into Cr^{+3} ions and the corresponding anions (e.g., acetate and sulfate), which are soluble. However, Cr^{+3} ions react with negatively charged ions in soil and sediment and can form insoluble precipitates, which are not bioavailable. For example, Cr^{+3} reacts readily with hydroxide ions (OH^-) to form $Cr(OH)_3$, which has a solubility of about 5×10^{-8} μg Cr/L at pH 8 (James 2002) and is, therefore, not bioavailable. Some chromates, especially $BaCrO_4$,

$HgCrO_4$, and $PbCrO_4$ are also very poorly soluble in water (Clifford 1961) and, therefore, are not readily bioavailable. Thus, Cr(III) forms insoluble compounds in soil that are not bioavailable.

The greatest HQs for chromium are 44 for plants and 110 for earthworms (Table 6); HQs for mammals and birds are less than 0.001. The TRV for plants was derived for hexavalent chromium (Efroymson et al. 1997c), which was not detected in the soil samples. No TRV for total chromium in soil was given (Efroymson et al. 1997c), but in studies in solution, hexavalent chromium was approximately 200 times as toxic to plants as trivalent chromium (the predominant form that is measured as total chromium). Therefore, it is unlikely that the reported HQ represents the true toxicity of chromium in soil at the 40 mm Range. The TRV for earthworms is 0.4 mg/kg for hexavalent chromium, including an uncertainty factor of 5-fold to account for the sparseness of toxicity data (Efroymson et al. 1997b). However, a study was reported in which the added chromium was allowed to equilibrate with soil for 8 weeks, a concentration of 1250 mg/kg had no effect on survival and reproduction (Efroymson et al. 1997b). The RME concentration of chromium in shallow surface soil (0-1 ft bgs) at the 40 mm Range was 44 mg/kg, about 1/28 of the 1250 mg/kg that was ineffective in the reported study. In summary, given the likely overestimates of toxicity to plants and earthworms and the low HQs for mammals and birds, it is unlikely that concentrations of chromium in soil pose an unacceptable risk to biota at the 40 mm Range.

Thallium: Thallium ions form complexes with soil particles that reduce the solubility of thallium in soil, as indicated by its rather high soil-water distribution coefficient (K_D) of 1500 (Baes et al. 1984) to 19,000 (ATSDR 1992). Therefore, its bioavailability is likely to be low. The highest HQ for thallium is less than 10 for the shrew (Table 6). The majority of the exposure is by ingestion of earthworms that have take up thallium from soil. However, the thallium uptake factor (BAF-S) for earthworms is not a measured value (EPA 1999b). Instead, it is a default value (0.22 kg soil/kg tissue) calculated as the mean of all measured BAF-S values for metals reported by EPA (1999b), including readily available inorganics such as cadmium (0.96) and cyanide (1.12). Much lower BAF-S values were measured for metals whose properties are more similar to those of thallium; for example, chromium (0.01), copper (0.04), lead (0.03), and nickel (0.02) had much lower values (EPA 1999b). Thus, exposure of shrews is overestimated by use of the default BAF-S, and, therefore, the toxicity to shrews and other ecological receptors is overestimated. Consequently, it is unlikely that concentrations of thallium in soil pose an unacceptable risk to biota at the 40 mm Range.

Zinc: The greatest HQ for zinc is 1.3 for plants (Table 6). HQs for earthworms were less than 0.4, and HQs for mammals and birds were less than 0.01. Confidence in the TRV for plants is characterized as moderate (Efroymson et al. 1997c). Given the low HQs and only moderate confidence in the TRV for plants, it is unlikely that concentrations of zinc in soil pose an unacceptable risk to biota at the 40 mm Range.

4.3.2.5 SUMMARY OF ECOLOGICAL RISK UNCERTAINTIES

The context of the discussion is the standard four interrelated steps of an ERA: problem formulation, exposure assessment, effects assessment, and risk characterization.

Problem formulation does not describe the precise distribution of all SRCs nor of ecological receptors at the 40 mm Range. However, the use of conservative SRC concentrations likely overestimated rather than underestimated the risks. The chosen ecological receptors were judged to be good representatives of the ecological populations at the site.

Uncertainties were introduced into the exposure assessment by assumptions about the bioavailability and bioaccumulation of COPECs at the 40 mm Range. The assumptions were conservative, so exposures were judged to be overestimated rather than underestimated.

The effects assessment includes uncertainties about how well laboratory toxicity tests measure toxicity to the ecological receptors in the field and how well the test results apply to conditions at the 40 mm Range. The TRVs used in the risk assessment may underestimate toxicity in some cases but usually are expected to overestimate toxicity to the ecological receptors in the field.

Within risk characterization, where all of the technical topics come to a head, there were four questions developed to deal with uncertainty. The questions touched on detection of the chemical, size of the HQ and especially relative to an HQ of 1, comparison of observed to background concentrations, and availability of pesticides (one semivolatile, and one volatile), and it ended with most COECs being eliminated. The remaining four (arsenic, chromium, thallium, and zinc) were further examined and none survived the next set of questions about being bioavailable (none was) and being based on a proper chronic reproductive toxicity metric (usually an inferior toxicity metric). See the full arguments in the full uncertainty section. Thus, each of the four metals was ruled out of being a concern to ecological receptors at the 40 mm Range.

4.3.2.6 FATE AND TRANSPORT TO NEARBY PONDS

Within 500 feet to the west of the 40 mm Range are two ponds (Fuze and Booster Quarry Ponds). If any COEC metals were to impact the aquatic environment, the likely impact would have occurred to the south pond of the Fuze and Booster Quarry Landfill/Ponds AOC. Aquatic impact at the 40 mm Range, if any, was studied at Fuze and Booster South Pond as part of the Facility Wide ~~Surface Water Assessment~~Biological and Water Quality Study 2003 (USACE 2005, Final). Surface water at the south pond was non-detect for explosive compounds, PCBs, pesticides and total cyanide. Detected concentrations of lead, copper, and pH Water Quality Standard (WQS) exceeded respective eco-criteria at the south pond. However, surface water quality was consistent with reference conditions and/or below water quality criteria.

Fuze and Booster Pond sediment sampling results indicated moderate contamination. Two metal parameters (cadmium and copper) were reported at levels above the Threshold

Effect Concentration (TEC) and above the Sediment Reference Values (SRVs). In addition, lead (177 mg/kg) and zinc (632 mg/kg) were measured above the Probable Effect Concentration (PEC). ~~Further, iron exceeded sediment criteria at 20 ppm (Ontario MOE-Low).~~ DDT metabolites (4,4'-DDD; 4,4'-DDE; and 4,4'-DDT), di-n-butyl phthalate, fluoranthene, and Aroclor 1260 were the only organic parameters detected in Fuze and Booster Quarry Pond; however, levels were below screening levels. Explosive compounds were not detected in the sediment, and ammonia-N and total phosphorus levels were below screening guidelines.

~~Although~~ Water and sediment quality (lead and zinc); (iron, lead, zinc, or chromium), respectively at the Fuze and Booster Quarry Pond suggests the potential for a negative impact. However, results from macroinvertebrate and attached algae (periphyton) community analysis indicate their community conditions were comparable to those determined for reference ponds. Therefore, based on the attainment status and the biological communities in the Fuze and Booster Quarry Ponds it was concluded that the ponds were not affected by chemical exposures from past activities at RVAAP.

~~Rather, Lead and zinc exceeded state surface water and sediment criteria. Additionally, antimony and copper failed sediment reference values (Ohio EPA 2003). However,~~

5.0 LOCATIONS OF SAMPLES AND CONCENTRATIONS

Figures 1 and 2 have sample locations and respective concentrations of inorganic and organic COPCs and COPECs, respectively, in surface soil. Likewise Figures 3 and 4 shave sample locations and respective concentrations of inorganic and organic COPCs and COPECs, respectively, in subsurface soil. Figures 1 through 4 show that detected COPCs and COPECs (and, ~~be~~ by inclusion, COCs and COECs) are distributed rather uniformly in surface and subsurface soil. The concentrations shown in these figures do not indicate any "hot spots" where risks would be much higher at other locations. Therefore, conclusions reached for RME concentrations are valid for any particular location as well as for the entire 40 mm Range. Note that 2,6-Dinitrotoluene was analyzed for at 40 locations (surface soil) and 26 locations (subsurface soil), and there were no detects of this COPC and COPEC.

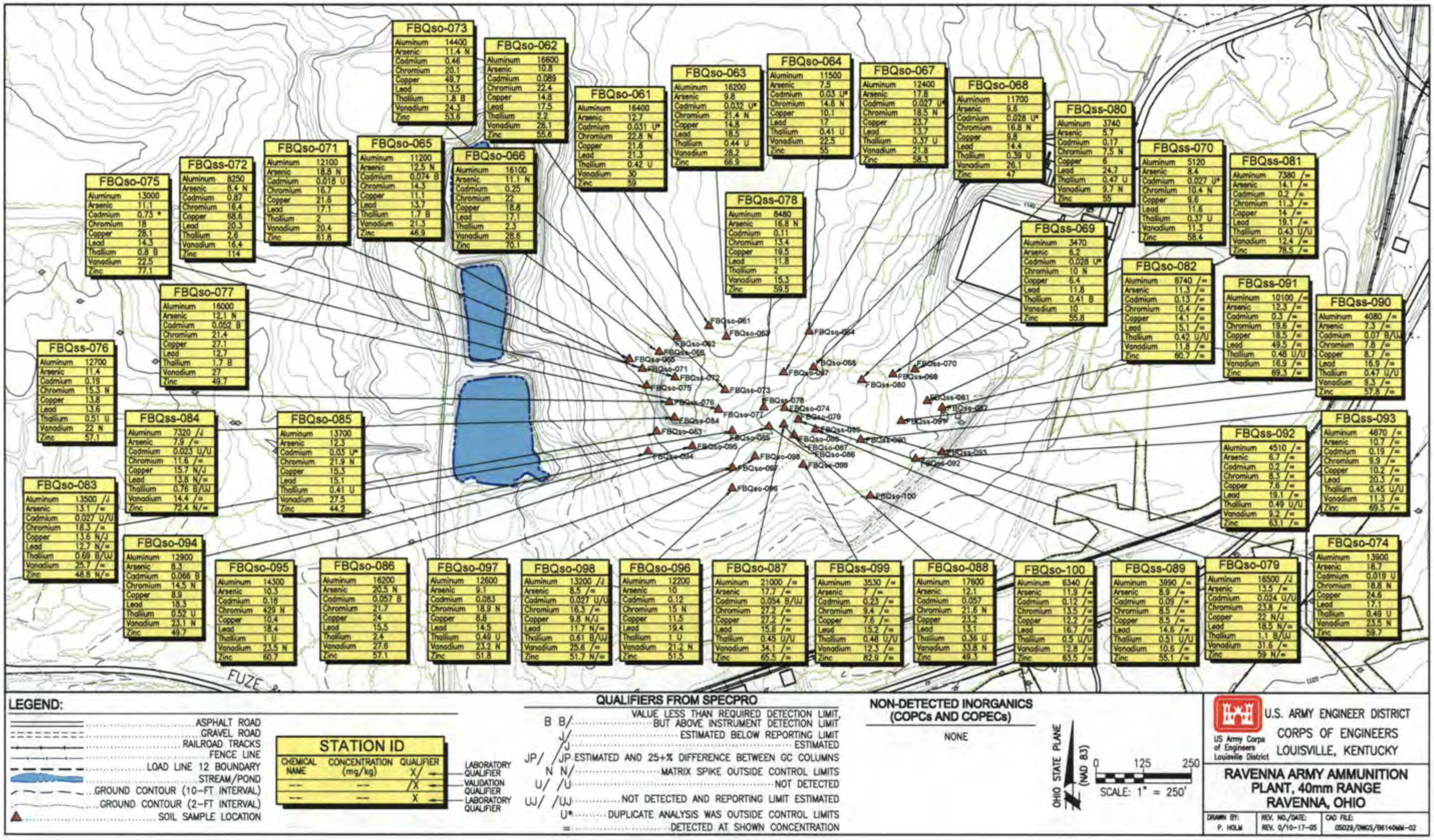

Figure 1. Inorganic COPCs and COPECs in shallow surface soil (0 to 1 ft) at the 40 mm Range.

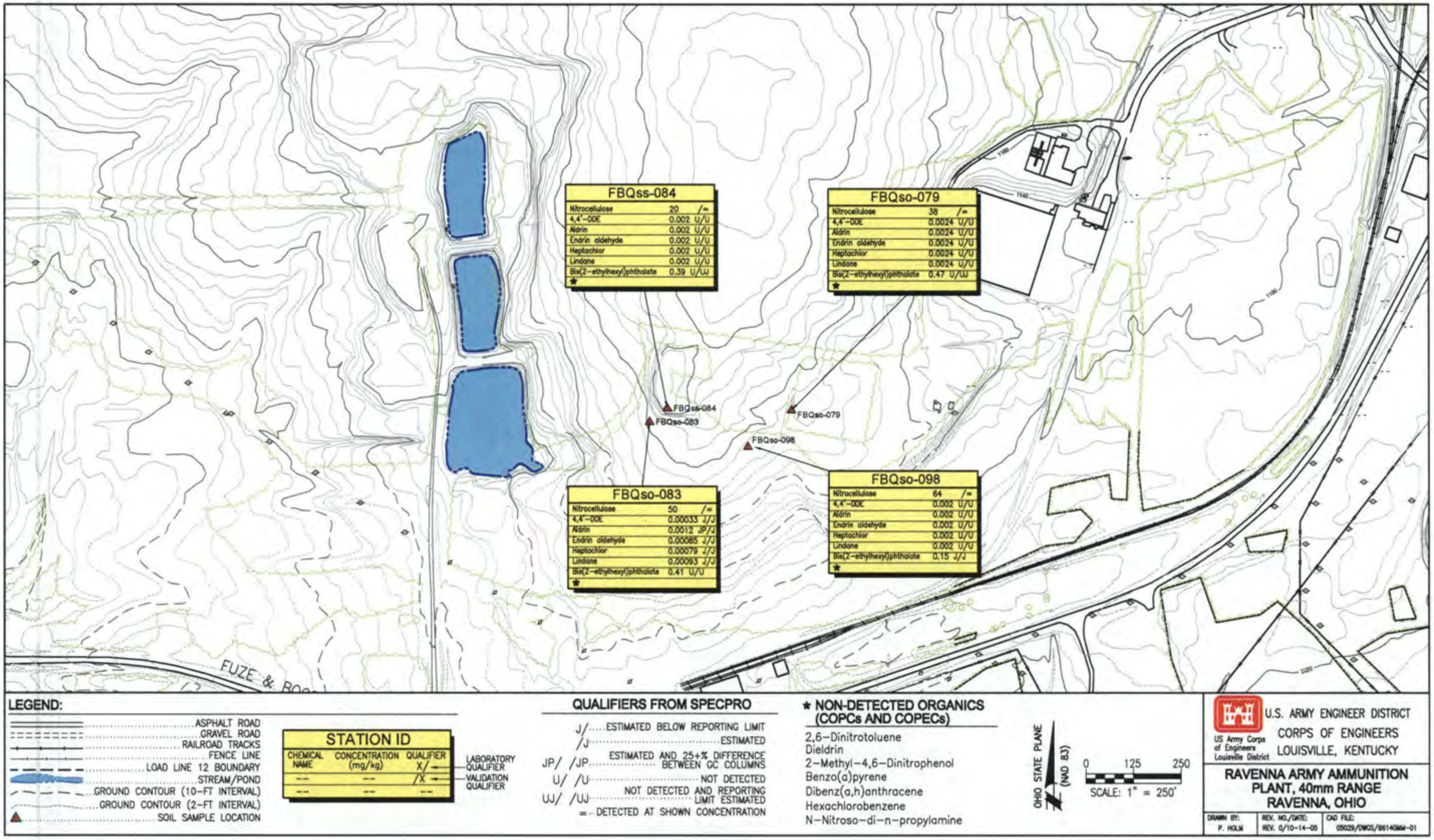

Figure 2. Organic COPCs AND COPECs in shallow surface soil (0 to 1 ft) at the 40 mm Range.

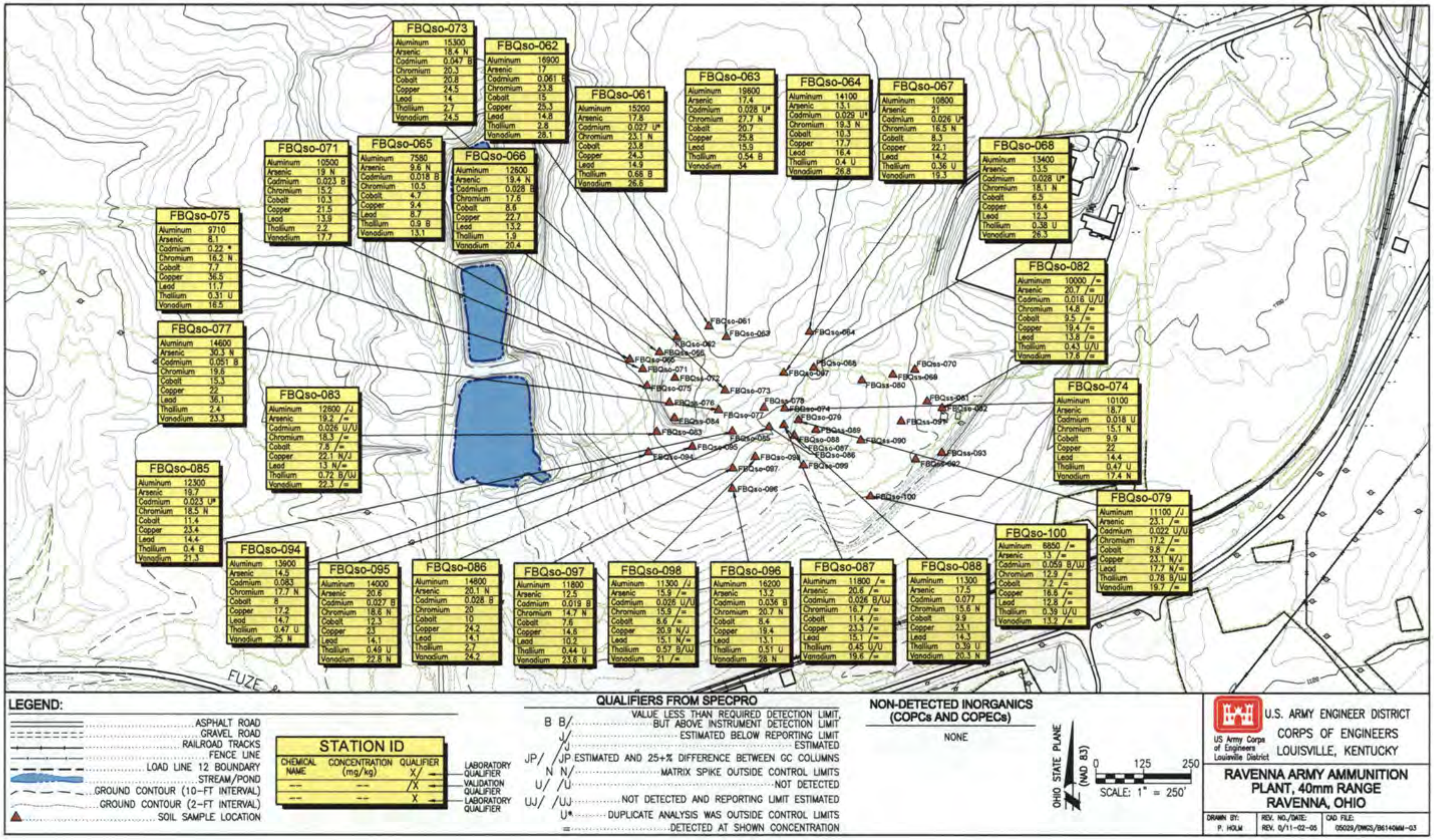

Figure 3. Inorganic COPCs and COPECs in subsurface soil (1 to 3 ft) at the 40 mm Range.

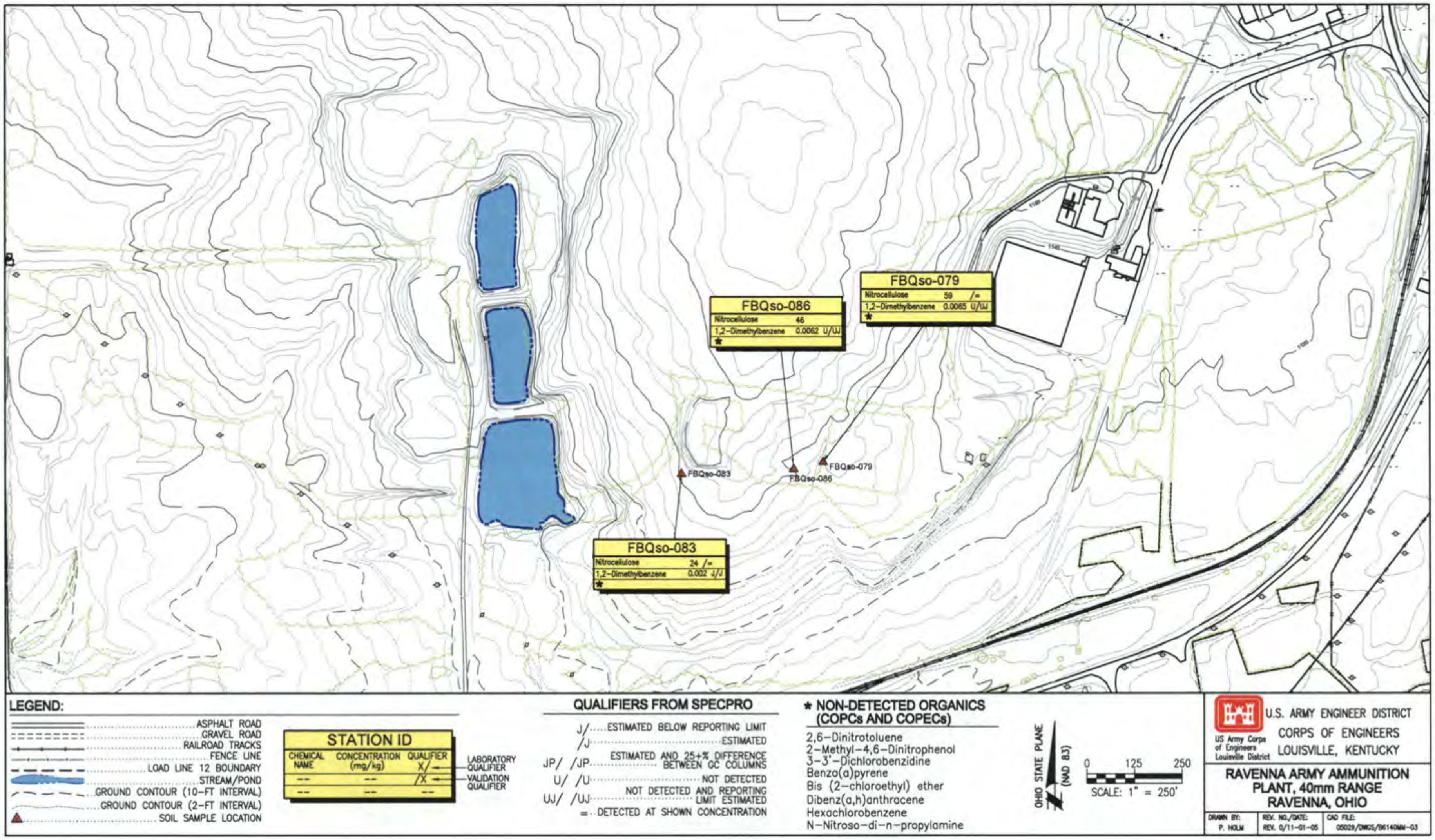

Figure 4. Organic COPCs AND COPECs in subsurface soil (1-3 ft) at the 40 mm Range.

6.0 RECOMMENDATIONS

The estimated human health non-cancer HIs for direct contact exposure pathways are less than 1 for all human health receptors. Calculated ILCRs are less than or equal to 1E-05 for the representative National Guard Receptors (National Guard Trainee and Security Guard/Maintenance Worker) and the Recreational Hunter. Calculated ILCRs exceed 1E-05 for the Resident Farmer scenario; however, risks are the result of background concentrations of arsenic and the analytical detection limits for 3 SVOCs not detected in any soil sample at the 40 mm Range. As discussed in the uncertainty analysis, these estimated risks are more likely to be overestimates than underestimates of actual risk at the site. ~~Based on these results, there is no unacceptable human health risk for the probable land use at the 40 mm Range, and it is recommended for no further action.~~

~~This later assumption about low to no risk is supported by the facts that the terrestrial ecosystem has abundant vegetation and animal life that looks healthy and functioning. Further,~~ The majority of HQs estimated for ecological receptors were less than 1. The HQ values that exceeded 1 were for a few metals only and were for lower-trophic level organisms not upper-level consumers such as foxes and hawks. The greatest HQs were for aluminum (as high as 861 to shrews), but the soil pH at RVAAP remains much higher than the low pHs assumed in the biological uptake numbers and in the laboratory experiments with toxicity measures that were used in the HQ estimates. This indicates that the HQs for aluminum were greatly overestimated. The rest of the few HQs were below one hundred and the 4 metals remaining after the first four steps of the uncertainty analysis (arsenic, chromium, thallium, and zinc) also may not be bioavailable. The ecological uncertainty discussion led to the conclusion that sources of exposure were greatly limited at the 40 mm Range because of low bioavailability of chemicals in the soil, and, therefore, it logically follows that there is low to no ecological risk at the 40 mm Range. Further, there was no evidence in the nearby Fuze and Booster Ponds (down gradient and within 500 feet) that any chemical had caused any ecological issues because the ponds contained healthy and functioning aquatic life such as fish according to biological field work conducted by the Ohio EPA and the Army ACE.

In summary the 40 mm Range is recommended as a "no further action location". This recommendation is based on the following:

- Land Use Controls (e.g., no digging nor use of groundwater) will be institutionalized for the site and will reduce the potential for contact with low levels of chemicals identified at the site.
- Results of the human health and ecological risk characterization performed on the relatively low concentrations of chemicals present, and the depth at which these analytes were found (0-3 ft bgs), indicate that there is no unacceptable risk likely to occur.
  - Initial sampling evidenced no subsurface action from prior use (such as soil discoloration, trenches, buried debris that made its way to the surface, foul odors once surface was broken, and the like). Shallow rock is close to the surface with refusal (0-1 ft bgs) occurring at sample locations 69, 70, 72, 76, 78, 80, 81, 84, 89, 90, 91, 92, 93, and 99. Further surface detects did not evidence residuum, nor source release to subsurface (below 3').

- Further, groundwater is addressed facility-wide and developed to allow an exit strategy permitting a cyclic review of the 'no-use' groundwater control.

7.0 REFERENCES

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APPENDIX A

DATA EVALUATION

CHAIN OF CUSTODY

GP LABORATORIES, LLLP

20[illegible] Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference	1 of 1 Pgs.

Project:	RVAAP FBQ Ph 1/2 RI
Client:	Spec Pro Inc
Send Results To:	Chantelle Carroll
Address:	8451 St. Rt. 5
	Ravenna OH
Phone:	330-358-1753

	Explosives	TAL metals	Explos/TAL metals	Water temp							Lab Cooler No.
Turnaround Time											
# of Containers	9	9	1	1							
Container Type	8oz	8oz	8oz								
Preservative Used	none	none	none								

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Explosives	TAL metals	Explos/TAL metals	Water temp								CLIENT COMMENTS
FBQ50-039-0077-50	10/3	103	SOIL	OC	X	X										
FBQ55-047-0093-50	10/2	1500	SOIL	MD	X	X										
FBQ55-042-0083-50	10/3	925	SOIL	MD	X	X										
FBQ55-041-0081-50	10/3	1057	SOIL	MD	X	X										
FBQ50-046-0091-50	10/3	1035	SOIL	MD	X	X										
FBQ55-038-0075-50	10/3	925	SOIL	CC	X	X										
FBQ50-038-0076-50	10/3	1002	SOIL	CC	X	X										
~~FBQ55-048-0099-50~~	~~10/6~~	~~1515~~	~~SOIL~~	~~GD~~	~~X~~	~~X~~										
FBQ55-028-0055-50	10/7	1405	SOIL	WD	X	X										
FBQ50-028-0056-50	10/7	1455	SOIL	WD			X									
FBQ55-035-0069-50	10/7	1400	SOIL	WD	X	X										

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	10/8 1600			Chow	10/9/07 10:00

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
				2.0

G.P. W.O. 310062

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference:

1 of 1 Pgs.

Project: RVAAP FBQ

Client: Spec Pro Inc

Send Results To: Chantelle Carroll

Address: 8451 State Rt 5, Ravenna OH

Phone: 330-358-1753

Turnaround Time														
# of Containers					5	3	3	1	1	2	2	3	2	1
Container Type					8oz	8oz	8oz	4oz	4oz	8oz	8oz	4oz	8oz	
Preservative Used					none	none	none	none	none	none	none	none	none	
Type of Analysis					Explos	TAL metals	Explos/TOC	Explos	TAL Metals	TAL/Cr+6	PCB/Pest	VOC	SVOC/Metals Water	Lab Cooler No.
Sample ID#	**Date Sampled**	**Time Sampled**	**Sample Matrix**	**Sampler's Initials**										**CLIENT COMMENTS**
FBQss-082-0062-SO	10/8	938	SOIL	CC	X					X	X	X	X	(x) Should be FBQss-052-0065 for VOCs
FBQso-082-0064-SO	10/8	1010	SOIL	CC			X							
FBQss-089-0057-SO	10/8	1030	SOIL	CC	X					X	X	X	X	
FBQso-089-0058-SO	10/8	1054	SOIL	CC			X							
FBQso-089-0167-SO	10/8	1059	SOIL	CC			X							
FBQss-030-0059-SO	10/8	1138	SOIL	CC	X	X								ID should be FBQss-0030-0059
FBQss-030-0168-SO	10/8	1138	SOIL	CC	X	X								
FBQso-030-0060-SO	10/8	1211	SOIL	CC				X	X					Sample ID should be FBQss030-0060
TB-0369	10/8	1400	Water	CC								X		
Temp			Water										X	
~~FBQss-011-0067-SO~~	~~10/7~~	~~1520~~	~~SOIL~~	~~CC~~	~~X~~	~~X~~								Sample Cancelled

Relinquished By:	Date/Time	Received By:	Relinquished By:		Received for Laboratory By:	Date/Time
Chantelle Carroll	10/8 1600				[signature]	10/9/03 10:00
Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments: Above changes made per discussion w/ Chantelle Carroll 10/9/03			Temp: 2.0

G.P. W.O. 310062

LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

1 of 1 Pgs.

Fed Ex 840760020480 . . .

Project: RVAAP

Client: Spec Pro Inc

Send Results To: Chantelle Carroll

Address: 8451 St. Rt 5
Ravenna OH

Phone: 330-358-1753

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	VOC	Explosives	TAL metals/CN	PCB/Pestic	SVOC/PAH	Exp/TAL metal	VOC	Temp Blank	Lab Cooler No.	CLIENT COMMENTS
Turnaround Time														
# of Containers														
Container Type					Voa	8oz	8oz	8oz	8oz	8oz	U°Glas	vial		
Preservative Used					none	none	none	none	none	none	none	none		
FBQ20-019-0087-50	10/13	0900	Soil	AL	X									
FBQ20-019-0088-50	10/13	945	SOIL	AL	X	X	X	X	X					
FBQ35-010-0119-30	10/13	9:45	SOIL	SK	X	X	X	X	X					
FBQ20-010-0120-30	10/13	1045	Soil	Sk	X	X	X	X	X					
FBQ35-017-0033-30	10/13	1030	SOIL	Sk	X	X	X	X	X					
FBQ20-017-0034-50	10/13	1045	Soil	Sk						X				
FBQ35-045-0051-30	10/13	9:10	SOIL	Sk	X	X	X	X	X					
FBQTB-0074	10/13	1400	Water	CC							X			
Temp Blank											X			

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	10/13 1400			Chris	10/14/03 9:55
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Relinquished By:	Date/Time	Received By:	Lab Comments:		Temp: 2.0

G.P. W.O. 310082

GPL Laboratories

GPL LABORATORIES
202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802

CHAIN OF CUSTODY

DATE: 10/13/2003

COC #:

PAGE: OF

GPL Project Manager: Debbie Griffith	Project Contact: Chanteile Carroll	Site: RVAAP	Disposal Instructions: Lab
Project Name: RVAAP FBQ	Phone Number: 330-358-1753	Address 8451 State Route 5	Shipment Method: Fed-Ex
Project Number:	Purchase Order No.: PO 0000174	Ravenna OH 44266	Waybill Number

Comments: H=Hold Analysis Request X=Analyze

Preservatives and Containers

Sample Information

Methods for Analysis

No.	LAB Sample ID	Date Sampled	Time Sampled	Matrix	Sampler's Initials	Explosives (8 oz)	TAL Metals (8 oz)	Explosives/TAL Metals (8 oz)	TAL Metals/CrVI (8 oz)	PCBs/Pesticides (8 oz)	SVOC/Propellant (8 oz)	VOC (4 oz)	RUSH	QC (MS/MSD)	TOTAL BOTTLES
1	FBQss-031-0061-SO	10/9/2003	945	Soil	AL	x	x								
2	FBQss-031-0370-SO	10/9/2003	0900	Soil	AL	x	x								
3	FBQss-026-0051-SO	10/9/2003	1040	Soil	AL	x	x								
4	FBQss-026-0052-SO	10/9/2003	1115	Soil	AL			x							
5	FBQss-020-0039-SO	10/9/2003	1600	Soil	AL	x	x								
6	FBQss-020-00371-SO	10/9/2003	1600	Soil	AL	x	x								
7	FBQss-020-0040-SO	10/9/2003	1635	Soil	AL			x							
8	FBQss-020-0372-SO	10/9/2003	1635	Soil	AL			x							
9	FBQss-040-0079-SO	10/6/2003	1515	Soil	AL	x	x								
10	FBQss-040-0080-SO	10/6/2003	1610	Soil	AL			x							
11	FBQss-040-0368-SO	10/6/2003	1610	Soil	AL			x							
12	FBQss-035-0049-SO	10/9/2003	1200	Soil	AL	x	x								

Relinquished By: Chantelle Carroll	Date: 10/13/03	Time: 1400
Received By: Chen	Date: 10/14/03	Time: 9:58
Relinquished By:	Date:	Time:
Received By:	Date:	Time:
Relinquished By:	Date:	Time:

For Lab Use

GPL WORK ORDER #: 310084

Fed Ex 840760201480

GPL Laboratories

GPL LABORATORIES
202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802

CHAIN OF CUSTODY

DATE: 10/13/2003
COC #:
PAGE: ____ OF ____

GPL Project Manager:	Debbie Griffith	Project Contact:	Chantelle Carroll	Site:	RVAAP	Disposal Instructions:	Lab
Project Name:	RVAAP FBQ	Phone Number:	330-358-1753	Address	8451 State Route 5	Shipment Method:	Fed-Ex
Project Number:		Purchase Order No.:	PO 0000174		Ravenna OH 44266	Waybill Number	

Comments: H=Hold Analysis Request X=Analyze

Preservatives and Containers

Sample Information

Methods for Analysis

No.	LAB Sample ID	Date Sampled	Time Sampled	Matrix	Sampler's Initials	Explosives (8 oz)	TAL Metals (8 oz)	Explosives/TAL Metals (8 oz)	TAL Metals/CrVI (8 oz)	PCBs/Pesticides (8 oz)	SVOC/Propellant (8 oz)	VOC (4 oz)	RUSH	QC (MS/MSD)	TOTAL BOTTLES
1	FBQss-044-0087-SO	10/7/2003	1520	Soil	AL	X	X								
2	FBQss-036-0071-SO	10/7/2003	0900	Soil	AL	X	X								
3	FBQss-036-0072-SO	10/7/2003	0925	Soil	AL			X							
4	FBQss-033-0065-SO	10/7/2003	1300	Soil	AL	X	X								
5	FBQss-033-0066-SO	10/7/2003	1330	Soil	AL			X							
6	FBQss-034-0087-SO	10/7/2003	1050	Soil	AL	X	X								
7	FBQss-021-0041-SO	10/9/2003	1415	Soil	AL	X	X								
8	FBQss-021-0373-SO	10/9/2003	1415	Soil	AL	X	X								
9	FBQss-021-0042-SO	10/9/2003	1446	Soil	AL			X							
10	FBQss-021-0374-SO	10/9/2003	1445	Soil	AL			X							
11	FBQss-022-0043-SO	10/9/2003	1505	Soil	AL	X	X								
12	FBQss-022-0044-SO	10/9/2003	1535	Soil	AL			X							

Relinquished By: Chantelle Carroll	Date: 10/13/03	Time: 1400
Received By: Chris	Date: 10/14/03	Time: 9:50
Relinquished By:	Date:	Time:
Received By:	Date:	Time:
Relinquished By:	Date:	Time:

For Lab Use

GPL WORK ORDER #: 310082

FedEx 840760201480

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

1 of 1 Pgs.

Fed-Ex 840760020/480

Project: RVAAP FBQ

Client: Spec Pro Inc

Send Results To: Chandelle Carroll

Address: 8451 State Rt 5
Ravenna OH

Phone: 330-358-1753

	Turnaround Time										Lab Cooler No.
	# of Containers							O			
	Container Type	8oz	8oz	8oz	8oz	8oz	4oz	8oz			
	Preservative Used	none	none	none	none						
	Type of Analysis	Explos	Tot metal	Explos/Tot metal	TAL metal/...	PCB/Pestic	~~VOC~~	SVOC/propell	Water fume		

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Explos	Tot metal	Explos/Tot metal	TAL metal	PCB/Pestic	~~VOC~~	SVOC/propell	Water fume			CLIENT COMMENTS
FBQss-027-0053	10/10	1030	SOIL	AL	X	X									
FBQss-024-0047-50	10/10	900	SOIL	AL	X	X									
FBQss-024-0375-50	10/10	9:00	SOIL	AL	X	X									
FBQss-029-0045-50	10/10	1315	SOIL	AL	X	X									
FBQss-023-0376-50	10/10	1315	SOIL	AL	X	X									
FBQso-023-0046-50	10/10	1200	SOIL	AL			X								
FBQso-023-0377-50	10/10	1200	SOIL	AL			X								
FBQss-045-0047-50	10/10	0940	SOIL	AL	X	X									
FBQss-045-0378-50	10/10	0940	SOIL	AL	X	X									
FBQss-019-0048-50	10/10	0910	SOIL	AL	X			X	X		X				
Water												X			
FBQss-016-0001-50	10/13	1105	SOIL	AL	X	X									

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chandelle Carroll	10/13 1400			Chavo	10/14/?? 9:55

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
				2.0

G.P. W.O. 310083

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

1 of 1 Pgs.

Project: RAAP
Client: SpecPro
Send Results To: Chantelle Carroll
Address: 8451 St. Rt
Ravenna OH
Phone: 330-357-1753

	VOC	SVOC	Pollent	Pestic	PCB	Explos	TAL Metal			Lab Cooler No.
Turnaround Time										
# of Containers	6	2	4	2	2	2	2			
Container Type	Vial	L amber	L amber	L amber	L amber	L amber	Poly			
Preservative Used	HCL	none	none	none	none	none	HNO_3			

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	VOC	SVOC	Pollent	Pestic	PCB	Explos	TAL Metal			CLIENT COMMENTS
ER 380	10/10	1600	water		X	X	X	X	X	X	X			
ER 381	10/13	1600	water		X	X	X	X	X	X	X			

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	10/13 1600			[signature]	10/13 9:55

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
				2.0

G.P. W.O. 310083

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference	1 of 1 Pgs.

Project:	Fuze/Booster RVAAP
Client:	Spec Pro
Send Results To:	Chantelle Carroll
Address:	8451 St Rt 5 Ravenna OH
Phone:	330-357-1758

	Explos	TAL Metals	Exp/TAL metals	Water temp							Lab Cooler No.
Turnaround Time											
# of Containers	6	6	6								
Container Type	8oz	8oz	8oz								
Preservative Used	none	none	none								

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Explos	TAL Metals	Exp/TAL metals	Water temp							Client Comments
FBDss-014-0001-SO	10/14	820	SOIL	AL	X	X									
FBDss-014-0002-SO	10/14	1015	SOIL	AL			X								
FBDss-010-0001-SO	10/14	905	SOIL	AL	X	X									
FBDss-010-0002-SO	10/14	940	SOIL	AL			X								
FBDss-008-0015-SO	10/14	1445	SOIL	AL	X	X									
FBDss-008-[illegible]-SO	10/14	1500	SOIL	AL			X								
FBDss-002-0003-SO	10/14	1210	SOIL	AL	X	X									
FBDss-002-0004-SO	10/14	1240	SOIL	AL			X								
FBDss-001-0001-SO	10/14	1110	SOIL	AL	X	X									
FBDss-001-0002-SO	10/14	1140	SOIL	AL			X								
FBDss-013-0005-SO	10/15	910	SOIL	AL	X	X									
FBDss-013-0006-SO	10/15	930	SOIL	AL			X								

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	10/[illegible] 2:00			Chano	10/[illegible] 9:40

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
				2.0

G.P. W.O. 310138

G[illegible] LABORATORIES, LLLP

20[illegible] Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference:

1 of 1 Pgs.

Project: Fuze/Booster
Client: Spec Pro Inc
Send Results To: Chantelle Carroll
Address: 8451 St Rt 5
Ravenna OH
Phone: 330-357-1753

	Explos	TAL metals	MS/MSD	Exp/TAL metals	Exp/TAL metals MS/MSD	TAL metal					Lab Cooler No.
Turnaround Time											
# of Containers	5	5	6	3	1	1					
Container Type	8oz	8oz	8oz	8oz	8oz	1 poly					
Preservative Used	none	none	none	none	none	HNO_3					

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Explos	TAL metals	MS/MSD	Exp/TAL metals	Exp/TAL metals MS/MSD	TAL metal					Lab Cooler No.	CLIENT COMMENTS
FBQ00-003-0005-SO	10/20	1456	SOIL	AL	X	X	X									
FBQ50-004-0007-SO	10/20	1555	SOIL	AL	X	X	X									
FBQ00-004-0008-SO	10/20	1615	SOIL	AL			X	X								
FBQ33-005-0009-SO	10/20	1410	SOIL	AL	X	X	X	X								
FBQ50-005-0010-SO	10/20	1435	SOIL	AL			X	X								
FBQ33-006-0011-SO	10/20	1630	SOIL	AL	X	X	X									
FBQ50-006-0012	10/20	1645	SOIL	AL				X								
FBQ55-012-0023-SO	10/20	1715	SOIL	AL	X	X										
FBQ50-012-0024-SO	10/20	1722	SOIL	AL					✓							
Water temp																
FBQSW-147-0292	10/21	1008	Water	RB						✓						

Relinquished By:	Date/Time	Received By:	Relinquished By:		Received for Laboratory By:	Date/Time
Chantelle Carroll	10/21 1200				[signature]	10/22/03 9:53
Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:			Temp: 2.0

G.P. W.O. 310127

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

1 of 1 Pgs.

Project: Fuze/Booster - RVAAP
Client: Spec Pro
Send Results To: Chantelle Carroll
Address: 8451 St Rt 5
Ravenna OH
Phone: 330358-1753

Turnaround Time								
# of Containers	3	1	4	4	4	4	2	1
Container Type	8oz	8oz	8oz	8oz	4oz	8oz	8oz	vial
Preservative Used	None	None	None	None	None	None	None	HCl
Type of Analysis	Explos	Explos/MS/MSD	PCB/Pestic	SVOC/Propell	VOC	TAL Metal/Cyan	MS/MSD	VOC

Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Explos	Explos/MS/MSD	PCB/Pestic	SVOC/Propell	VOC	TAL Metal/Cyan	MS/MSD	VOC	CLIENT COMMENTS
FBQ20-009-0017-SO	10/20	1055	SOIL	AL	X		X	X	X	X	X		
FBQ20-009-0015-SO	10/20	1140	SOIL	AL		X	X	X	X	X			
FBQ20-019-0033-SO	10/20	930	SOIL	AL	X		X	X	X	X	X		
FBQ20-003-0016-SO	10/20	1523	SOIL	AL	X		X	X	X	X			
Water trip TB-0382	10/20		water	CC								X	

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	10/21 12:00			[signature]	10/22/01 9:55
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:		Temp: 2.0

W.O. 310127

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202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

of Pgs.

Project: Fize Boost
Client: Chantelle Carroll
Send Results To: Spec Pro
Address: 8451 St Rt 5
Ravenna OH
Phone: 330-358-1753

					Turnaround Time											
					# of Containers											
					Container Type	1L Amb	1L Amb	1L Amb	4oz	VOA	8oz	8oz	8oz	8oz		
					Preservative Used	none	none	none	none	HCL	none					
Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Type of Analysis	SVOC Pest/PCB	Exp/Propell	Perchlorate/Cr+6	VOC	VOC	SVOC Propell	PCB/Pest	Explos	TAL/[illegible]	[illegible]	Lab Cooler No. / CLIENT COMMENTS
FBQsw [illegible]-0292	10/21	1008	Water	RB		2	2	2								
FBQsd-145-0070sd	10/21	1333	Sed	RB					1		1	1	1	1		
FBQsd-147-0072sd	10/21	1403	Sed	RB					1		1	1	1	1		
FBQsd-148-0073sd	10/21	1346	Sed	RB					1							
TB-0384	10/21	1700	water	CC						1						

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	10/21 1735			[signature]	10/22/07 9:55
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:		Temp: 2.0

G.P. W.O. 310127

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

Project: Fuze / Booster
Client: Spec Pro
Send Results To: Chantelle Carroll
Address: 8451 St Rt 5
Ravenna OH
Phone: 330-358-1753

	SVOC	Exp/propell	Pest/PCB	Perchlor/Cr+6	TAL metal	VOC	Water				Lab Cooler No.
Turnaround Time											
# of Containers	4	2	8	2	1	6					
Container Type	L Amb	L Amb	Amber	L Amb	1L poly	vial					
Preservative Used	none	none	none	none	HNO_3	HCl					

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	SVOC	Exp/propell	Pest/PCB	Perchlor/Cr+6	TAL metal	VOC	Water				CLIENT COMMENTS
FBQsw145-6791-SW	10/21	950	Water	RB	2	2	2	2	1	3					
FBQsw147-0292sw	10/21	1008	Water	RB	~~2~~	~~2~~	~~2~~	~~2~~	~~1~~	3					
water [illegible]											1				
TB-B383	10/21	1530	water							1					

Relinquished By:	Date/Time	Received By:	Relinquished By:		Received for Laboratory By:	Date/Time
Chantelle Carroll	10/21 1600				[signature]	10/22/07 9:55
Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:			Temp: 2.0

P. W.O. 710127

G[illegible] LABORATORIES, LLLP

20[illegible] Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

1 of 2 Pgs.

Project: Fuze Beaston Quarry
Client: SpecPro, Inc
Send Results To: Chantelle Carroll
Address: 8451 SC Rt 5
Ravenna OH
Phone: 330 358 1753

	VOC	TAL MET/CN		VOC
Turnaround Time				
# of Containers	3	11	7	1
Container Type	8oz	8oz	4oz	Vial
Preservative Used	NA	NA	WE	HCl

Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	VOC	TAL MET/CN		VOC	CLIENT COMMENTS
FBQsd 158-0265SD	10/21/03	1652	Sed(*)	RB	X	X			
FBQsd 154-0279SD	10/21/03	1620			X	X			
FBQsd 155-0280SD	10/21/03	1637			X	X			
FBQsd 152-0277SD	10/21/03	1526			X	X	X		
FBQsd-144-0269SD	10/21/03	1058			X	X	X		
FBQsd-157-0282SD	10/21	1703			X	X	X		
FBQsd-153-0278SD	10/21	1541			X	X	X		
FBQsd 151-0276SD	10/21	1552			X	X	X		
FBQsd 149-0274SD	10/21	1511			X	X	X		
FBQsd 150-0275SD	10/21	1515			X	X	X		
FBQ 148 0273SD	10/21	1346				X			
TB 0386	10/22	1200						X	

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
[signature]	10/22/03 1200			Chris	10/23/03 9:40

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
			(*) Per Client All sediment samples Require TOC. 8 10/24/03	2.0

G.P. W.O. 310139

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference:

Project: Fuze Booster Quarry
Client: SpecPro Inc
Send Results To: Chantelle Carroll
Address: 8451 St Rt 5
Ravenna OH
Phone: 330 358 1753

Turnaround Time:
# of Containers: 1
Container Type: Vial
Preservative Used: NA
Type of Analysis: H2O Temp

Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	H2O Temp	CLIENT COMMENTS
Temp Blank	10/22	1200	H_2O	RJS	X	

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
[signature]	10/22/03 1200			[signature]	10/23/03 9:40
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:		Temp: 2.0

G.P. W.O. 310139

LABORATORIES, LLLP

y Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

Project: RVAAP FBQ
Client: SpecPro
Send Results To: Chantelle Carroll
Address: 8451 St Rt 5
Ravenna OH
Phone: 330-358-1753

					Turnaround Time									Lab Cooler No.	
					# of Containers	3	1	1	1	1	1	1			
					Container Type	Vial	L amber	L amber	L amber	L amber	L amber	Poly			
					Preservative Used	HCl	n/a	n/a	n/a	n/a	n/a	HNO_3			
Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Type of Analysis	VOC	SVOC	Propellant	Pesticide	PCB	Explosive	TAL Metal			CLIENT COMMENTS
ER Ø385	10/22/03	09ØØ	H_2O	RB	X	X	X	X	X	X	X				

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
[signature]	10/22/03 1250			[signature]	10/23/03 9:40
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:		Temp: 2.0

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GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

Project: RVAAP FBQ
Client: SpecPro
Send Results To: Chantelle Carroll
Address: 8451 St Rt 5
Ravenna OH
Phone: 330 358 1753

Turnaround Time					
# of Containers	2	3	3	1	
Container Type	8oz	8oz	8oz	Vial	
Preservative Used					
Type of Analysis	EXP/TAL Met	TAL Met	EXP	Water Temp	Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	EXP/TAL Met	TAL Met	EXP	Water Temp							CLIENT COMMENTS
FBQss-[illegible]	10/15	1115	Soil	AL		X	X								
FBQso-[illegible]	10/15	1125			X										
FBQso-015[illegible]	10/15	1018			X										
FBQss-015[illegible]	10/15	0957				X	X								
FBQss-0110-02150	10/15	1040				X	X								
FBQso-0110-0225[illegible]	10/15	1050													
Temp Blank	10/22	1200	H_2O	SRB				X							

Relinquished By:	Date/Time	Received By:	Relinquished By:		Received for Laboratory By:	Date/Time
[signature]	10/22/03 1200				[signature]	10/23/03 9:40
Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:			Temp: 2.0

G.P. W.O. 310139

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

of Pgs.

Project: Fuze Booster Quality
Client: SpecPro Inc
Send Results To: Chantelle Carroll
Address: 8451 St Rt 5
Ravenna OH
Phone: 330 358 1753

	Turnaround Time				
# of Containers	8	8	8	1	
Container Type	Amb	Amb	Amb	Vial	
Preservative Used	n/a	n/a	n/a	n/a	
Type of Analysis	Exp/TOC	SVOC/Prop	PCB/Pest	Water temp	Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Exp/TOC	SVOC/Prop	PCB/Pest	Water temp							CLIENT COMMENTS
FBAsd148 027350	1021	1346	Sed	RB	X	X	X								
FBAs 153 0275SD	1021	1540			X	X	X								
FBAsd149 0275SD	1021	1500			X	X	X								
FBQsd151 0275SD	1021	1552			X	X	X								
FBQsd144 0275SD	1021	1058			X	X	X								
FBQsd152 0275SD	1021	1526			X	X	X								
FBQsd150 0275SD	1021	1515			X	X	X								
Temp Blank	1023	1400	H_2O					X							
FBQsd 157 0275SD	1021	1703	SED		X	X	X								

Relinquished By:	Date/Time	Received By:	Relinquished By:		Received for Laboratory By:	Date/Time
[signature]	1023 / 1400				Chuno	10/24/0 9:50
Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:			Temp: 2.0

G.P. W.O. 310152

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

1 of 1 Pgs.

175

Project:	FBQ RAAP
Client:	Specpro Inc
Send Results to:	Chantelle Carroll
Address:	8451 SR Rt 5
	Ravenna, OH 44266
Phone:	330 358 1753

Type of Analysis	TAL Met / Cr	Expl / TOC	SVOC/Prop	PCB/Pest	VOC	VOC	Temp (H2O)			Lab Cooler No.
Turnaround Time										
# of Containers	8oz 3	8oz 2	6	6	3	1	1			
Container Type	8oz	8oz	8oz	8oz	8oz	Vial	Vial			
Preservative Used	N/A	N/A	N/A	N/A	N/A	HCL	N/A			

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	TAL Met / Cr	Expl / TOC	SVOC/Prop	PCB/Pest	VOC	VOC	Temp (H2O)			CLIENT COMMENTS
FBQsd126Ø25-135D	1Ø23	Ø936	Sed	AL	X	X	X	X	X					
FBQsd127Ø25-135D	1Ø23	1Ø19	Sed	AL	X	X	X	X	X					
FBQsd128Ø25-135D	1Ø25	1Ø48	Sed	AL	X	X	X	X	X					
FBQsd154Ø27-135D	1Ø21	1620				X	X	X						
FBQsd155Ø28-135D	1021	1637				X	X	X						
FBQsd158Ø25-135D	1Ø21	1652	Sed	RB		X	X	X						
TB-383	1023	1400	H_2O	RB						X				
Temp Blank	1023	1400	H_2O	RB							X			

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
[signature]	1023 1400			[signature]	10/24/08 0850
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:		Temp: 2.0

G.P. W.O. 310152

G LABORATORIES, LLLP

20 y Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

1 of 1 Pgs.

Project: RVAAP-Fuze/Booster
Client: Chantelle Carroll
Send Results To: SpecPro
Address: 8451 St Rt 5
Ravenna OH
Phone: 330 358-1753

Turnaround Time													
# of Containers													
Container Type					1L Amber	1L Amber	1L Amber	1L Amber	1L Poly	vial	4oz		
Preservative Used					NA	None	None	None	HNO_3	HCl	4°C		
Type of Analysis					SVOC	Exp/Propell	Pest/PCB	Perchlorate	TAL metal	VOC	VOC	Lab Cooler No.	
Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials									CLIENT COMMENTS
FBQgw-153-0294-GW	11/3	1135	Water	AL	2	2	2	2	1	3			
FBQgw-154-0298-GW	11/3	1025	Water	AL						3			
TB-0387	11/3	1245	Water	CC						1			
FBQsd-156-0281-SD	11/3	1030	Soil	AL							1		
FBQsd-146-0276-SD	11/3	915	Soil	AL							1		

Relinquished By: Chantelle Carroll	Date/Time 11/3 1600	Received By:	Relinquished By:	Received for Laboratory By: Chris	Date/Time 11/4/03 10:00
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:		Temp: 3.0

G.P. W.O. 311010

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

of Pgs.

Project: LUAAP Fuze
Client: Spec Pro
Send Results To: Chantelle Carroll
Address:
Phone: 330-358-1753

	SVOC	Exp/Propell	Pest/PCB	[illegible]	TAL metal	VOC					Lab Cooler No.
Turnaround Time											
# of Containers	2	2	2	4	1	10					
Container Type	Amber	Amber	Amber	Amber	Poly	Vial					
Preservative Used	none	none	none	none	HNO_3	HCl					

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	SVOC	Exp/Propell	Pest/PCB	[illegible]	TAL metal	VOC					CLIENT COMMENTS
* FBQSW-132-0297-SW	11/3	1550	Water	KB	2	2	2	2	1	3					
* FBQSW-130-0295-SW	11/3	1445	Water	KB				1		3					
* FBQSW-131-0296-SW	11/3	1440	Water	KB				1	1	3					
TB-0588 Temp	11/3	1700	water	CC						1					

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	11/3 1700			C[illegible]	11/4/03 10:00

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
			* Per Client Perchlorate required for FBQSW-132-0297-SW + FBQSW-130-0295-SW + FBQSW-131-0296 & 11/5/03	3.0

GPL W.O. 311010

G[illegible]. LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1709

Contract #/Billing Reference

of Pgs.

Project: RVAAP
Client: SpecPro
Send Results To: Chantelle Carroll
Address:
Phone: 330-358-1753

	Pest/PCB	Exp/Propel	Thallium	SVOC	[illegible]	Explos/TOC	Total metals	SVOC/[illegible]		Lab Cooler No.
Turnaround Time										
# of Containers										
Container Type	Amber	Amber	Poly	Amber	8oz	8oz	8oz	8oz		
Preservative Used	none	none	HNO3	none	none	none	none	none		

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Pest/PCB	Exp/Propel	Thallium	SVOC	[illegible]	Explos/TOC	Total metals	SVOC/[illegible]		CLIENT COMMENTS
FBQsw-130-0995-SW	11/4/05	1445	water	RB	2	2	1							
FBQsw-135-0697-SW	11/4	920	water	RB	2	2	1	2						
FBQsd-130-0689-SD	11/3	1505	Soil	AB				[illegible]	1	1	1	1		
temp blank														
FBQsw-141-0998-SW	11/4	850	Water	RB			1							

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle McCarroll	11/4 1830			[illegible]	11/5/05 9:50

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
				3.0

G.P. W.O. 31120

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

of Pgs.

Project: RVAAP ~~[illegible]~~ Fuze Booster

Client: Spec Pro

Send Results To: Chanelle Carroll

Address:

Phone: 330-358-1753

Turnaround Time					
# of Containers					
Container Type	[illegible]	Vials	Amber		
Preservative Used	none	HCL	none		
Type of Analysis	DOC	VOC	Cr+6/Perchlo	Exp/Propell	PCB/Pest	SVOC

Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	DOC	VOC	Cr+6/Perchlo	Exp/Propell	PCB/Pest	SVOC					CLIENT COMMENTS
FBQsd-131-0026-SO	11/3	1545	soil	RB	1										
FBQsd-130-0095-SO	11/3	1525	soil	RB	1										
FBQsd-132-0097-SO	11/3	1615	soil	RB	1										
FBQso-141-00[illegible]-SO	11/4	1150	water	RB		3	2	2	2	2					
FBQso-133-00[illegible]9-SO	11/4	920	water	RB		3	2								
FBQTB-0[illegible]0	11/4	9:00	water	CE		1	~~[illegible]~~								
FBQsd-130-00[illegible]-SO	11/3	1535	soil	RB	1										
tempblank															
[illegible]															

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chanelle Carroll	11/4 4:30			[illegible]	11/5/[illegible] 9:50

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
			(2) Per client, do not analyze samples for perchlorate. [illegible] 11/6/03	4.0

G.P. W.O. 31020

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

6377

Contract #/Billing Reference

of Pgs.

Project: RUMMP
Client: Chantelle Carroll
Send Results To: [illegible]
Address:

Phone: 350-557-1753

Turnaround Time	
# of Containers	
Container Type	8 oz, 8 oz, 8 oz, 8 oz, Amb, Amb, Amb, POLY
Preservative Used	none, none, none, none, none, none, none, HNO3
Type of Analysis	Exp/TOC, Tox metals, SVOC/[illegible], PCB/Pest, PCB/Pest, Cr+6, perchl, Exp/propell, Tox metal

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Exp/TOC	Tox metals	SVOC/[illegible]	PCB/Pest	PCB/Pest	Cr+6	perchl	Exp/propell	Tox metal		Lab Cooler No.	CLIENT COMMENTS
FBRsd-13I-0056-30	11/3	1515	Soil	RB	1	1	1	1								
FBRsd-13I-0555-30	11/3	1535	Soil	RB	1	1	1	1								
FBRsd-132-0057-00	11/3	1615	Soil	RB	1	1	1	1								
FBRmo 135-0392-10	11/4	1053	Water	RB					2	2	2					
FBRmo 134-0200-50	11/4	1230	Water	RB								1				

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	11/4 1500			Chuo	11/5/03 9:50
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments: (2) Per client do not analyze samples for perchlorate. 8 11/6/03		Temp: 4.0

G.P. W.O. 311020

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

1 of 1 Pgs.

Project: RVAAP – Fuze
Client: Spec Pro
Send Results To: Chantelle Carroll
Address:
Phone: 330-358-1753

					Turnaround Time								
					# of Containers								
					Container Type	Amb	Amb	Amb	Amb	vial	Poly		
					Preservative Used	None	None	none	None	none	HNO3		
					Type of Analysis	Gen/Propert	PCB/Pest	SVOC	Perchlorate	TAL metal		Lab Cooler No.	
Sample IDs	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials									CLIENT COMMENTS
FBD[illegible]-01-07[illegible]	1/5	1440	Water	RB	2	2	2	(1)					
FB[illegible]-120-0915[illegible]	1/5	1445	water	RB		2	2	(1)					
wooden tamp													

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	1/4 10:00			Chino	1/6 9:50

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
			1. Per client, do not analyze samples for perchlorate. 8/11/6/03	3.0

G.P. W.O. 311020

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

of Pgs.

16403

Project: RVAAP-Fuze

Client: Spec Pro

Send Results To: Chantelle Carroll

Address:

Phone: 330-358-1753

		Type of Analysis	5VOC	Explo/propell	Cr+6/Perchl	PCB/Pest						Lab Cooler No.
		Turnaround Time										
		# of Containers	2	4	4	4						
		Container Type	Amb	Amb	Amb	Amb						
		Preservative Used	None	None	None	None						

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	5VOC	Explo/propell	Cr+6/Perchl	PCB/Pest						CLIENT COMMENTS
FBsw-134-0591	1/4	1230	Water	RB		2	2	2						
FBsw-134-0590	1/4	1230	Water	RB	2	2	2	8						
Water temp														

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	1/4 1400			Chano	1/5 950

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
				3°C

G.P. W.O. 311020

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Fax (301) 840-1209

Contract #/Billing Reference

of Pgs.

8407 7L020/469-6366/6377/6378/6399/6403

Project: RVAAP-Fuze

Client: Spec Pro

Send Results To: Chantelle Carroll

Address:

Phone: 330-358-1753

	Explos/propell	PCB/Pest	SVOC	Crtie/perchl	Tal Met
Turnaround Time					
# of Containers	2	4	2	2	3
Container Type	Amb	Amb	Amb	Amb	Poly
Preservative Used	None	None	None	None	HNO_3

Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Explos/propell	PCB/Pest	SVOC	Crtie/perchl	Tal Met	CLIENT COMMENTS
FBDsw-137-0803-sw	11/4	1435	Water	RB	2	2	2	2	1	
FBDsw-136-0802-sw	11/4	1400	Water	RB		2			1	
FBDsw-136-ms/msD	11/4	1400	Water	RB					1	
temp blank										

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	11/4 1540			Chimo	11/5/05 14:50

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
			(2) Per client don't do not analyze samples for perchlorate. 8 11/5/05.	3.0

G.P. W.O. 311020

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference	of Pgs.

-6399

Project: RUAAP- Fuze

Client: Spec Pro

Send Results To: Chandelle Carny

Address:

Phone: 330-358-1753

Turnaround Time	
# of Containers	6 / 2 / 2 / 2 / 2
Container Type	Amb / Poly / Amb / Amb / Amb
Preservative Used	none / HNO3 / none / none / none
Type of Analysis	SVOC / TAL Metal / PCB/Pest / Cr+6 / ~~Perchlorate~~ / Explos/Propell

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	SVOC	TAL Metal	PCB/Pest	Cr+6	Perchlorate / Explos/Propell						Lab Cooler No.	CLIENT COMMENTS
FBQsw 134-031130	11/4	1230	Water	RB	2	1										
FBQsw-135-0361.00	11/4	1258	water	RB	2	1	2	2	2							
FBQsw-135-0712.00	11/4	1258	Water	RB	2											
Water temp																

Relinquished By:	Date/Time	Received By:	Relinquished By:		Received for Laboratory By:	Date/Time
Chandelle Carroll	11/4 1500				Chris	11/5/03 9:50
Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments: (2) Per Client Do not analyze sample for perchlorate. [initials] 11/6/03			Temp: 3.0

G.P. W.O. 31020

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

3831

Contract #/Billing Reference

of Pgs.

Project: RVAAP-Fuze
Client: Chantelle Carroll
Send Results To: Spec Pro
Address:

Phone: 330-358-1753

	Turnaround Time										
	# of Containers	4	4	4	2						
	Container Type	Amb	Amb	Amb	Amb						
	Preservative Used	None	None	None	None						
	Type of Analysis	Exp/Propell	O-tu/Perch	SVOC	PCB/Pest						Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Exp/Propell	O-tu/Perch	SVOC	PCB/Pest						Client Comments
FDgw-[illegible]-0580	11/4	1100	Water	RB	2	2	2							
FDgw-136-mw050	11/4	1100	Water	RB	2	2	2	2						
Water temp														

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	11/4 1100			Chavo	11/5/[illegible] 4:50
Relinquished By:	**Date/Time**	**Received By:**	**Date/Time** / **Shipper:**	**Airbill No.:**	
Relinquished By:	**Date/Time**	**Received By:**	**Lab Comments:**		**Temp:**
			2. Per client, do not analyze samples for perchlorate. [illegible] 11/5/05		3.0

G.P. W.O. 311020

L LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

-3842

Contract #/Billing Reference:

of Pgs.

Project: RVAAP - Fuze
Client: Spec Pro
Send Results To: Chantelle Carroll
Address:
Phone: 330-358-1753

Turnaround Time							
# of Containers							
Container Type	Amb	Poly	Vial				
Preservative Used	None	HNO_3	HCL				
Type of Analysis	SVOC	Tot. Metals	VOC				Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	SVOC	Tot. Metals	VOC							CLIENT COMMENTS
FBQsw-137-0305-sw	1/4	1530	Water	RB	8	1	3							
FBQsw-138-0307-sw	1/4	1446	Water	RB		1	3							
FBQsw-136 [illegible]	1/4	1400	Water	RB			3							
FBQsw-136-0302sw	1/4	1400	Water	RB			3							
FBQsw-134-0301sw	1/4	1230	Water	RB			3							
FBQsw-134-0300sw	1/4	1230	Water	RB			3							
FBQsw-135-0302sw	1/4	1251	Water	RB			3							
FBQsw-135-0301sw	1/4	1251	Water	RB			3							
FBQsw-137-0303sw	1/4	1435	Water	RB			3							
FBQTB-0390	1/4	1700	Water	CC			1							

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	1/4 1700			Chris	1/5/07 4:50
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:		Temp: 3.0

G.P. W.O. 311020

GPL LABORATORIES, LLLP

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Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

3831

Contract #/Billing Reference

of Pgs.

Project: RVAAP
Client: Spec Pro
Send Results To: Charlotte Carroll
Address:
Phone: 330-358-1753

Turnaround Time									
# of Containers						4	4	2	4
Container Type						Amb	Amb	Amb	Amb
Preservative Used						none	none	none	none
Type of Analysis						Cn+te/perch	Explos/propell	SVOC	PCB/Pest
Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Lab Cooler No.				
FCGsw-139-0004-sw	11/4	1446	Water	RB		2	2	2	2
FCGsw-139-0005-sw	11/4	1530	Water	RB		2	2	2	2
Water Temp									

CLIENT COMMENTS

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Charlotte Carroll	11/4 1640			Chris	11/5/03 9:30

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
			(2) Per client don't analyze samples for perchlorate. [initials] 11/6/03	3.0

G.P. W.O. 311020

L LABORATORIES, LLLP

rry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

1 of 2 Pgs.

-6150

Project: RVAAP- Fuze / Booster
Client: Spec Pro
Send Results To: Chantelle Carroll
Address:
Phone: 330-358-1753

Turnaround Time
# of Containers: 12
Container Type: none
Preservative Used: 4/oz
Type of Analysis: VOC
Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	VOC										CLIENT COMMENTS
FBQsd-137-0200-SD	11/5	1515	SOIL	RB	X										
FBQsd-135-0016-SD	11/5	1350	SOIL	RB	X										
FBQsd-134-0209-SD	11/5	1420	SOIL	RB	X										
FBQsd-138-0872-SD	11/5	940	SOIL	RB	X										
FBQsd-138-0263-SD	11/5	940	SOIL	RB	X										
FBQsd-139-0254-SD	11/5	900	SOIL	RB	X										
FBQsd-133-0376-SD	11/5	1025	SOIL	RB	X										
FBQsd-133-0258-SD	11/5	1025	SOIL	RB	X										
FBQsd-135-0264-SD	11/6	0900	SOIL	RB	X										
FBQsd-136-0261-SD	11/6	840	SOIL	RB	X										
FBQsd-140-0015-SD	11/6	1010	SOIL	RB	X										
FBQsd-140-0895-SD	11/6	1010	SOIL	RB	X										

Relinquished By:	Date/Time	Received By:	Relinquished By:		Received for Laboratory By:	Date/Time
Chantelle Carroll	11/6 1730				Chino	11/7/03 9:55
Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:			Temp: 3.?

G.P. W.O. 311048

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

1 of 1 Pgs.

831419000716 -3853

Project: RVAAP Fuze / Booster

Client: Spec Pro

Send Results To: Chantelle Carroll

Address:

Phone: 330-358-1753

	Explos/TOC	PCB/Pest	SVOC/propell	Tox metals/Cyan						Lab Cooler No.
Turnaround Time										
# of Containers	8	8	8	8						
Container Type	8oz	8oz	8oz	8oz						
Preservative Used	none	none	none	none						

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Explos/TOC	PCB/Pest	SVOC/propell	Tox metals/Cyan							CLIENT COMMENTS
FBQsd-137-0260-SD	11/5	1515	SOIL	RB	X	X	X	X							
FBQsd-135-0240-SD	11/5	1350	SOIL	RB	X	X	X	X							
FBQsd 134-0295-SD	11/5	1420	SOIL	RB	X	X	X	X							
FBQsd 138-0393-SD	11/5	940	SOIL	RB	X	X	X	X							
FBQsd-138-0293-SD	11/5	940	SOIL	RB	X	X	X	X							
FBQsd-125-0084-SD	11/5	900	SOIL	RB	X	X	X	X							
FBQsd-133-0084-SD	11/5	10:35	SOIL	RB	X	X	X	X							
FBQsd-133-0058-SD	11/5	1025	SOIL	RB	X	X	X	X							

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	11/6 1100			[signature]	11/11/05 9:55
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:		Temp: 3.0

G.P. W.O. 311048

G LABORATORIES, LLLP

20 Parkway
Gaithers, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

1 of 2 Pgs.

-6150

Project: RVAAP- Fuze / Booster	Turnaround Time
Client: Spec Pro	# of Containers: 12
Send Results To: Chantelle Carroll	Container Type: none
Address:	Preservative Used: 4 oz
	Type of Analysis: VOC
Phone: 330-358-1753	

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	VOC	Lab Cooler No. / CLIENT COMMENTS
FBQsd-137-0202-SD	11/5	1515	SOIL	RB	X	
FBQsd-135-0010-SD	11/5	1350	SOIL	RB	X	
FBQsd-134-0267-SD	11/5	1420	SOIL	RB	X	
FBQsd-138-0893-SD	11/5	940	SOIL	RB	X	
FBQsd-138-0263-SD	11/5	940	SOIL	RB	X	
FBQsd-126-0354-SD	11/5	900	SOIL	RB	X	
FBQsd-133-0394-SD	11/5	1025	SOIL	RB	X	
FBQsd-133-0258-SD	11/5	1025	SOIL	RB	X	
FBQsd-135-0[illegible]-SD	11/6	0900	SOIL	RB	X	
FBQsd-136-02[illegible]-SD	11/6	840	SOIL	RB	X	
FBQsd-140-0015-SD	11/6	1010	SOIL	RB	X	
FBQsd-140-0395-SD	11/6	1010	SOIL	RB	X	

Relinquished By:	Date/Time	Received By:	Relinquished By:		Received for Laboratory By:	Date/Time
Chantelle Carroll	11/6 1730				Chuno	11/7/03 9:55
Relinquished By:	**Date/Time**	**Received By:**	**Date/Time**	**Shipper:**	**Airbill No.:**	
Relinquished By:	**Date/Time**	**Received By:**	**Lab Comments:**			**Temp:** 3.0

G.P. W.O. 211048

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

2 of 2 Pgs.

-6150

Project: RVAAP - Fuze Booster

Client: Spec Pro

Send Results To: Chantelle Carroll

Address:

Phone: 330-358-1753

Turnaround Time	
# of Containers	
Container Type	4oz / 8oz / 8oz / 8oz / 8oz / vial
Preservative Used	none / none / none / none / none / HCL
Type of Analysis	VOC / Explos/TOC / PCB/Pest / SVOC/propell / TAL metal/CN / VOC

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	VOC	Explos/TOC	PCB/Pest	SVOC/propell	TAL metal/CN	VOC					Lab Cooler No.	CLIENT COMMENTS
FBQsd-143-0[illegible]sd	11/6	1110	Soil	RB	X											
FBQsd-159-m/md	11/6	1250	Soil	RB	X											
FBQsd-159-0[illegible]sd	11/6	1250	Soil	RB	X											
FBQsd-160-0[illegible]sd	11/6	1325	Soil	RB	X											
FBQsd-165-0[illegible]so	11/6	1405	Soil	RB	X	X	X	X	X							
FBQsd-164-0[illegible]so	11/6	1440	Soil	RB	X	X	X	X	X							
FBQsd-142-0[illegible]so	11/6	1510	Soil	RB	X	X	X	X	X							
FBQsd-161-0[illegible]so	11/6	1650	Soil	RB	X	X	X	X	X							
FBQsd-163-0[illegible]so	11/6	1615	Soil	RB	X	X	X	X	X							
FBQsd-162-0[illegible]so	11/6	1600	Soil	RB	X	X	X	X	X							
FBQsd-141-0[illegible]so	11/6	1540	Soil	RB	X	X	X	X	X							
FBQTB-0[illegible]	11/6	1700	Water							(*)						

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	11/6 1730			[illegible]	11/7/03 9:55
Relinquished By:	**Date/Time**	**Received By:**	**Date/Time** / **Shipper:**	**Airbill No.:**	
Relinquished By:	**Date/Time**	**Received By:**	**Lab Comments:** (*) Sample not received 11/10/03 [illegible] per sample receiving		**Temp:** 3.0

G.P. W.O. 311048

L LABORATORIES, LLLP

-3901

Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference:

1 of 1 Pgs.

Project: FBQ
Client: SpecPro Inc
Send Results To: Chantele Carroll
Address: 8451 St Rt 5
Ravenna OH 44266
Phone: 330 358 1753

Turnaround Time:
# of Containers: 4 | 4 | 4 | 2 | 1
Container Type: Amb → Vial
Preservative Used: 4/c →
Type of Analysis: Ex/Pro | SVOC | PCB/Pest | Cr+6 | Temp
Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Ex/Pro	SVOC	PCB/Pest	Cr+6	Temp						Client Comments
FBQsw-177	111103	1020	H_2O	RB	2	2	2	1							
	111103	1410	H_2O	RB	2	2	2	1							
Temp									1						

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
[signature]	11/11/03 1520			[signature]	11/11/03 9:50

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
				2.0

G.P. W.O. 311058

GPL LABORATORIES, LLLP

831419060727
-3901

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

1 of 1 Pgs.

Project: FBQ

Client: SpecPro Inc

Send Results to: Chantelle Carroll

Address: 8451 ST Rt 5
Ravenna OH 44266

Phone: 330 358 1753

	Tal metals	VOC	Exp Prep	SVOC	PCB/Pest	Cr +6	Temp			Lab Cooler No.
Turnaround Time										
# of Containers	3	9	2	2	2	1	1			
Container Type	Poly	Vial	Amb →				Vial			
Preservative Used	HNO_3	HCl	4°C →							

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Tal metals	VOC	Exp Prep	SVOC	PCB/Pest	Cr +6	Temp			CLIENT COMMENTS
FBQmw-177-0339-GF	11/10	1020	water	RB	1	3								
FBQmw-176-0337-GC	11/10	1410	water	RB	1	3								
FBQEF 0397	11/10	1520	H_2O	RB	1	3	2	2	2	1				
Temp	11/10	~~1520~~	↓	↓							1			
FBQ+B-0378	11/1.	1530	H_2O	RC		1								

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
[signature]	11/10/03 1520			Chuno	11/11/03 9:55

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:
/					

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
				2.0

G.P. W.O. 31058

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

1 of 2 Pgs.

— 6160

Project:	RVAAP – Fuze/Booster
Client:	SpecPro Inc
Send Results To:	Chantelle Carroll
Address:	8451 St. Rt 5
	Ravenna OH
Phone:	330-358-1753

Turnaround Time				
# of Containers	10	10	2	
Container Type	8oz	8oz	8oz	
Preservative Used	none	none	none	
Type of Analysis	Explos	TAL metals	Exp/TAL	Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Explos	TAL metals	Exp/TAL	CLIENT COMMENTS
FBQs-082-0140-50	11/11	9:05	SOIL	RB	X	X		
FBQs-082-0141-50	11/11	915	SOIL	RB			X	
FBQs-090-0145-50	11/11	1040	SOIL	RB	X	X		
FBQs-091-0148-50	11/11	1005	SOIL	RB	X	X		
FBQs-092-0155-50	11/11	1125	SOIL	RB	X	X		
FBQs-093-0158-50	11/11	1100	SOIL	RB	X	X		
FBQs-094-0160-50	11/11	940	SOIL	RB	X	X		
FBQs-087-0174-50	11/11	1514	SOIL	RB			X	
FBQSS-087-0175-50	11/11	1458	SOIL	RB	X	X		
FBQSS-089-0177-50	11/11	1345	SOIL	RB	X	X		
FBQSS-099-0197-50	11/11	1328	SOIL	RB	X	X		
FBQSS-100-0199-50	11/11	1300	SOIL	RB	X	X		

Relinquished By: [signature]	Date/Time 11/12/1700	Received By:	Relinquished By:	Received for Laboratory By: [signature]	Date/Time 11/13/07 9:20
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:		Temp: 3.0

G.P. W.O. 311076

GPL LABORATORIES, LLLP

203 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

2 of 2 Pgs.

-6160

Project: RVAAP - Fuze / Booster

Client: Spec Pro Inc

Send Results To: Chantelle Carroll

Address: 8451 St Rt 5
Ravenna OH

Phone: 330-358-1753

Turnaround Time
# of Containers: 1
Container Type: 80z
Preservative Used: none
Type of Analysis: Exp/TAL Met

Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Exp/TAL Met										CLIENT COMMENTS
FBQss-100-0000-SO	11/12	1310	SOIL	RB	X										
Temp blank			Water		—										

Relinquished By:	Date/Time	Received By:	Relinquished By:		Received for Laboratory By:	Date/Time
RandBly	11/12 1700				Chris	11/13 9:20
Relinquished By:	**Date/Time**	**Received By:**	**Date/Time**	**Shipper:**	**Airbill No.:**	
Relinquished By:	**Date/Time**	**Received By:**	**Lab Comments:**			**Temp:**
						3?

G.P. W.O. 311076

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

of Pgs.

540760198208 - 6160

Project: RVAAP — Fuze Booster
Client: Spec Pro
Send Results To: Charlotte Carroll
Address:
Phone: 330-358-1753

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Exp/Propellant	SVOC	PCB/Pest	TAL Metal	VOC	VOC				Lab Cooler No.	CLIENT COMMENTS
Turnaround Time															
# of Containers															
Container Type					Amb	Amb	Amb	Poly	Vial	4oz					
Preservative Used					none	none	none	HNO3	HCL	None					
FBDmw-171-0346-GW	[illegible]	1615	Water	CC	2	2	2		3						
FBDmw-170-0314-GW	[illegible]	1358	Water	CC	2	2	2		3						
FBDmw-170-0315-GF	[illegible]	1328	Water	CC				1							
FBDmw-171-0317-GF	[illegible]	1615	Water	CC				1							
Trip									1						
FBDss-079-0456-SO	[illegible]	0955	Soil	RB						1					
FBDss-079-0457-SO	[illegible]	0910	Soil	RB						1					
FBDss-079-0455-SO	[illegible]	1030	Soil	RB						1					

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Charlotte Carroll	1730 11/12			[signature]	[illegible]
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:		Temp: 3.0

G.P. W.O. 318076

GPL LABORATORIES, LLLP

-6182

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

Project: RVAAP
Client: Spec Pro
Send Results To: Chantelle Carroll
Address:
Ravenna OH
Phone: 330

Turnaround Time	
# of Containers	2 / 2 / 3 / 1
Container Type	8oz / 8oz / 8oz
Preservative Used	none / none / none
Type of Analysis	Exp / TAL Metal / Exp TAL metal / Water

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Exp	TAL Metal	Exp TAL metal	Water							Lab Cooler No.	CLIENT COMMENTS
RVQso-067-0134-so	11/14	955	SOIL	RB			X									
RVQso-063-0125-so	11/14	910	SOIL	RB	X	X										
RVQso-063-0126-so	11/14	925	SOIL	RB			X									
RVQso-061-0124-so	11/14	840	SOIL	RB	X	X										
RVQso-061-0122-so	11/14	855	SOIL	RB			X									
temp blank								X								

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	11/14 1500			Chris	11/15 9:25

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
				4.0

G.P. W.O. 311094

GPL LABORATORIES, LLLP

84076019625 2

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference	of Pgs.

Project:	RVAAP - Fuze/Booster Quarry
Client:	SpecPro Inc
Send Results To:	Chantelle Carroll
Address:	8451 St Rt 5
	Ravenna OH 44266
Phone:	330 358 1753

	VOC	SVOC/Prop	PCB/Pest	TAL Met/CN	Exp	TAL Met/Exp	Temp	VOC			Lab Cooler No.
Turnaround Time											
# of Containers	4	7	7	17	7	2	1	1			
Container Type	4oz	8oz	8oz	8oz	8oz	8oz	Vial	Vial			
Preservative Used	NA							HCl			

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	VOC	SVOC/Prop	PCB/Pest	TAL Met/CN	Exp	TAL Met/Exp	Temp	VOC			CLIENT COMMENTS
FBDxcA83 #1655SO	11/13	0940	Soil	CC	x	X	X	X	X						
FBDso A83 #1665SO	11/13	1005			X	X	X	X	X	X					
FBDxs A84 #1645SO	11/13	1400			X	X	X	X	X						
FBDss A84 #1675SO	11/13	1400			X	X	X	X	X						
FBDsd 079 #1585SO	11/12	0955		RB		X	X	X	X						
FBDss 079 #1575SO	11/12	0910				X	X	X	X						
Temp Blank	11/14	1400	H_2O								X				
FBDss 098 #1695SO	11/12	1030	Soil			X	X	X	X						
FBDso 098 #1965SO	11/12	1115								X					
FBATB0405	11/14	1400	H_2O	CC								X			

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
[signature]	11/14 1700			[signature]	11/14 0925

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
				4.0

G.P. W.O. 311095

GPL LABORATORIES, LLLP

-6171

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

1 of 2 Pgs.

Project: RVAAP- FBQ

Client: SpecPro, Inc

Send Results To: Chantelle Carroll

Address: 8457 St Rt 5
Ravenna OH 44266

Phone: 330 358 1753

Turnaround Time	
# of Containers	6, 6, 6
Container Type	8oz, 8oz, 8oz
Preservative Used	N/a →
Type of Analysis	TAL Met, E+P, Exp/TAL Met

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	TAL Met	E+P	Exp/TAL Met								Lab Cooler No.	CLIENT COMMENTS
FBQss074[illegible]0150	11/12	1325	Soil	RB	X	X										
FBQss094018750	11/12	↓			X	X										
FBQso094[illegible]50		1545					X									
FBQso094[illegible]850		↓					X									
FBQss096019150		1325			X	X										
FBQso[illegible]		1340					X									
FBQso097019450		1420					X									
FBQss097[illegible]19350		1405			X	X										
FBQss095018950		1440			X	X										
FBQso095019050	↓	1500					X									
FBQso074[illegible]50	11/11	1630					X									
FBQss074014750	11/11	1610	↓	↓	X	X										

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
[signature]	11/14 1700			[signature]	11/15 0930
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:		Temp: 4.0

G.P. W.O. 311096

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1709

Contract #/Billing Reference

[illegible] -6171

Project: RVAAP - Fuze Booster
Client: Spec Pro
Send Results To: Chantelle Carroll
Address: 8451 St Rt 5
Ravenna OH 44266
Phone: 330-358-1753

Turnaround Time
# of Containers: 4 | 4 | 2
Container Type: 8oz | 8oz | 8oz
Preservative Used: None | None
Type of Analysis: TAL Met | Exp | Exp/TAL Met
Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	TAL Met	Exp	Exp/TAL Met	CLIENT COMMENTS
FBQss-[illegible]	11/11	1405	Soil	RB	X	X		
FBQss-[illegible]	11/11	1405	Soil	RB	X	X		
FBQss-098-[illegible]	11/11	1405	Soil	RB			X	
FBQss-[illegible]-076-[illegible]	11/11	1405	Soil	RB			X	
FBQss-076-0[illegible]	11/11	1430	Soil	RB	X	X		
FBQss-080-0[illegible]	11/11	1615	Soil	RB	X	X		

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	11/14 1700			[illegible]	11/17/14 9:25

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
				4.0

G.P. W.O. 311096

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

84076019 8182

Project: RVAAP-Fuze Booster
Client: Spec Pro
Send Results To: Chantelle Carroll
Address: Ravenna OH
Phone: 330-358-1753

Turnaround Time															
# of Containers					6	6	5	4							
Container Type					8oz	8oz	8oz	8oz							
Preservative Used					none	none	none	none							
Type of Analysis					Exp	TAL Metal	Exp/TAL Metal	TCLP+RCI						Lab Cooler No.	
Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials											CLIENT COMMENTS
FBQss-062-0123-SO	11/7	845	SOIL	RB	X	X									
FBQss-062-0124-SO	11/7	901	SOIL	RB			X								
FBQss-062-[illegible]-SO	11/7	845	SOIL	RB	X	X									
FBQss-062-[illegible]-SO	11/7	901	SOIL	RB			X								
FBQss-066-0131-SO	11/7	920	SOIL	RB	X	X									
FBQss-066-0132-SO	11/7	940	SOIL	RB			X								
FBQss-065-0129-SO	11/7	1047	SOIL	RB	X	X									
FBQss-063-0130-SO	11/7	1055	SOIL	RB			X								
FBQss-072-0145-SO	11/7	955	SOIL	RB	X	X									
FBQss-071-0141-SO	11/7	1005	SOIL	RB	X	X									
FBQss-071-0142-SO	11/7	1040	SOIL	RB			X								
* FBQss-TCLP-	11/7	1630	SOIL	CC				4							

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	11/7 1730			[signature]	11/8 1035
Relinquished By:	**Date/Time**	**Received By:**	**Date/Time** / **Shipper:**	**Airbill No.:**	
Relinquished By:	**Date/Time**	**Received By:**	**Lab Comments:**		**Temp:** 3.0

G.P. W.O. 311104

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

2 of 2 Pgs.

8407160198182

Project: RVAAP - Fuze Booster

Client: Spec Pro

Send Results To: Chandele Carroll

Address:

Ravenna OH

Phone: 330-358-1753

	Explos	TAL Metal	Exp/TAL Metal	TAL Metal/Cr+6	PCB/Pest	SVOC/Paper	VOC				Lab Cooler No.
Turnaround Time											
# of Containers	6	4	2	2	2	2					
Container Type	8oz	8oz	8oz	8oz	8oz	8oz					
Preservative Used	none	none	none	none	none	none	none				

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Explos	TAL Metal	Exp/TAL Metal	TAL Metal/Cr+6	PCB/Pest	SVOC	VOC				CLIENT COMMENTS
FBQss-076-0171-SO	11/17	1300	SOIL	RB	X	X					X				
FBQso-076-0172-SO	11/17	1310	SOIL	RB	X			X	X	X	X				
FBQso-076-0406-SO	11/17	1310	SOIL	RB	X			X	X	X	X				
FBQss-073-0145-SO	11/17	1445	SOIL	RB	X	X									
FBQss-073-0146-SO	11/17	1500	SOIL	RB			X								
FBQss-078-0155-SO	11/17	1350	SOIL	RB	X	X									
FBQss-077-0154-SO	11/17	1405	SOIL	RB	X	X									
FBQss-078-0157-SO	11/17	1435	SOIL	RB			X								
			~~SOIL~~	~~RB~~											
			~~SOIL~~	~~RB~~											

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chandele Carroll	11/17 1730			Chris	11/18/03 10:55
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments: (X) Volatiles for these samples coming in separate cooler on 11/19/03 per client		Temp: 3.0

G.P. W.O. 311104

GPL LABORATORIES, LLLP

-6193

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

of Pgs.

Project: RVAAP Fuze Booster

Client: Spec Pro

Send Results To: Chantelle Carroll

Address:

Ravenna OH

Phone: 330-358-1753

	SVOC	PCB/Pest	TAL metal	Expl/Propell	Cr+6	Lab Cooler No.
Turnaround Time						
# of Containers	4	4	2	4	2	
Container Type	Amb	Amb	Poly	Amb	Amb	
Preservative Used	none	none	HNO3	none	none	

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	SVOC	PCB/Pest	TAL metal	Expl/Propell	Cr+6	CLIENT COMMENTS
FBQmw-169-0360-GW	11/18	1150	H2O	RB	2	2		2	1	
~~FBQmw-169-0361-GF~~	~~11/18~~	~~1150~~	~~H2O~~	~~RB~~			~~1~~			
FBQmw-171-0322-GW	11/18	1615	H2O	RB	2	2		2	1.	
FBQmw-171-0323-GF	11/18	1615	H2O	RB			1			
temp										

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	11/18 1700			C[illegible]	11/19/03 10:10

Relinquished By:	Date/Time	Received By:	Date/Time	Shipper:	Airbill No.:

Relinquished By:	Date/Time	Received By:	Lab Comments:	Temp:
			* Changed per client request 11/19/03 [illegible]	3.0

G.P. W.O. 311113

GPL LABORATORIES, LLLP

202 Perry Parkway
Gaithersburg, MD 20877
(301) 926-6802
Fax (301) 840-1209

Contract #/Billing Reference

of 1 Pgs.

8418469983740 - 6193

Project: SpecPro - Fuze Booster

Client: Spec Pro

Send Results To: Chantelle Carroll

Address: Ravenna OH

Phone: 330-358-1753

	Turnaround Time									
	# of Containers	4	4	4	3	13	0	0	2	
	Container Type	Amb	Amb	Amb	Poly	Vial	Amb	Amb	4oz	
	Preservative Used	none	none	none	HNO_3	HCL	none	none	none	
	Type of Analysis	Exp/Propell/Cr+6	SVOC	PCB/Pest	TAL metal	VOC	Exp/Propell	Cr+6	VOC	Lab Cooler No.

Sample ID#	Date Sampled	Time Sampled	Sample Matrix	Sampler's Initials	Exp/Propell/Cr+6	SVOC	PCB/Pest	TAL metal	VOC	Exp/Propell	Cr+6	VOC		Lab Cooler No.	CLIENT COMMENTS
FBQmw-167-0808-GW	11/1?	1155	H_2O	RB	2	2	2		3						
FBQmw-167-0809-GF	11/1?	1155	H_2O	RB				1							
FBQmw-167-0401-GW	11/1?	1155	H_2O	RB	2	2	2		3						
FBQmw-167-0401-GF	11/1?	1155	H_2O	RB				1							
FBQmw-169-0312-GW	11/1?	1140	H_2O	RB	2	2	2		3	2	X				
FBQmw-169-0313-GF	11/1?	1140	H_2O	RB				1							
FBQmw-174-0322-GW	11/1?		H_2O	RB		2	2		3	2	X				
~~FBQmw-174-0323-GF~~	~~11/1?~~		~~H_2O~~	~~RB~~				~~1~~							
FBQso-080-01??	11/1?	1300	Soil	RB											
FBQso-08?-0104-??	11/1?	1300	Soil	RB								1			
FBQ46-	11/1?	1600	H_2O	CC					1						

Relinquished By:	Date/Time	Received By:	Relinquished By:	Received for Laboratory By:	Date/Time
Chantelle Carroll	11/4 1800			[signature]	11/?/05 10:10
Relinquished By:	Date/Time	Received By:	Date/Time / Shipper:	Airbill No.:	
Relinquished By:	Date/Time	Received By:	Lab Comments:		Temp: 3.0

G.P. W.O. 311113

APPENDIX A 2

FUZE AND BOOSTER/40 MM SOIL SAMPLING LOGS

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APPENDIX D2 SOIL SAMPLING LOG LOCATOR SHEET

Page Number	Site Number
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8	81
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20	92
23	100
26	99
29	89
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35	87
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41	79
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50	97
53	95
56	94
59	83

Page Number	Site Number
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77	69
80	80
83	61
86	63
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95	64
98	67
101	66
104	72
107	71
110	65
113	86
116	78
119	77

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TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11-11-03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Cindu Loon | Steve King
Ronda Bailey |
Chandlle Caudll |

Narrative (include time and location):

9:00 Arrive at Sample location FB9-082 / Steve clears
9:05 Begin Sampling FBQSS-082-0163-SO
for explosives and TAL metals at the 0-1 interval
9:15 Start Sampling FBQSO-082-0164-SO
for explosives and TAL metals at the 1-3
ft interval - hit rock in center, change over to W. exp hole
9:58 Finish sampling, go to next location

RL 12.4.03

Daily Weather Conditions: A.M. Overcast, light drizzle 55 low, 65

P.M.

Recorded By Chandlle Caudll QA Checked By Mary Freeman

HTRW DRILLING LOG

DISTRICT: Louisville

HOLE NUMBER: FBQ-082 — 47

1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:
	SHEET 1 OF 1
3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Andre Leon	6. MANUFACTURERS DESIGNATION OF DRILL: n/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS Bowl/Spoon; SS 3½" auger/Bucket	8. HOLE LOCATION: FBQ
	9. SURFACE ELEVATION: n/A
	10. DATE STARTED: 11/11/03 — 11. DATE COMPLETED: 11/11/03
12. OVERBURDEN THICKNESS: n/A	15. DEPTH GROUNDWATER ENCOUNTERED: n/A
13. DEPTH DRILLED INTO ROCK: n/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/A
14. TOTAL DEPTH OF HOLE: 3"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): Water in hole after 1 ft

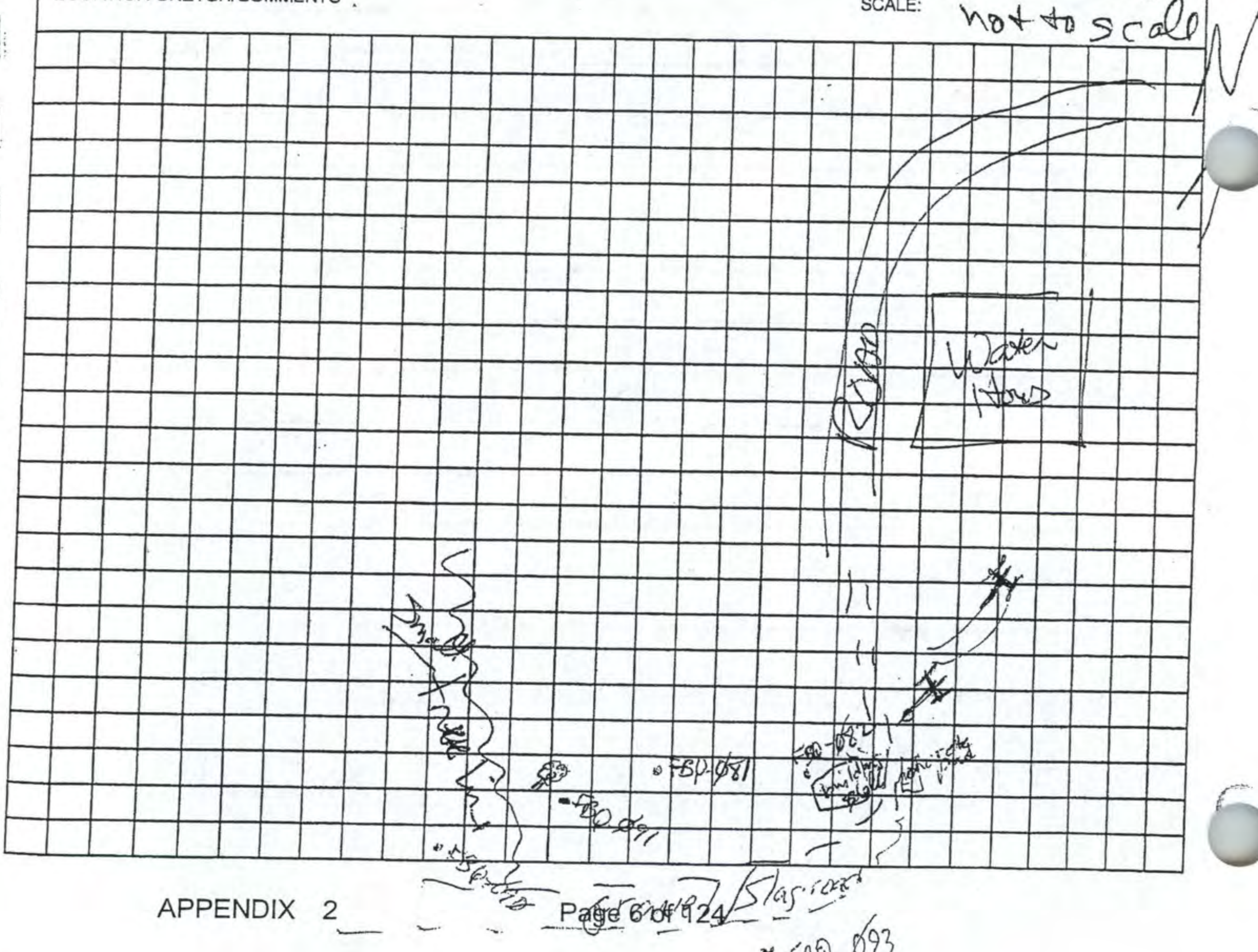
18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES

20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
see chain logs						

22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR
n/A	✓			C Card

LOCATION SKETCH/COMMENTS

SCALE: not to scale



HTRW DRILLING LOG

HOLE NUMBER: FBD-082

PROJECT: Fuze & Booster/RVAAP | INSPECTOR [illegible] | SHEET 1 OF 1

ELEV (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
		Sandy-silt, some clay, med brown, some sandstone, approx 40% slag	PID not functioning	n/a	FBDss-082-0163-SO	
	1	Sandy-silt, more sand than above, trace clay, some sandstone <40% slag	"	"	FBDss-082-0164-SO	hit refusal in center hole, so to 10. hole to get to the 1-3 interval
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

AB 12.4.03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11-11-03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Chandler Carroll Steve King

Andy Coon

Landa Bailey

Narrative (include time and location):

09:38 Arrive at sample location after Steve cleared

09:40 Began to sample FBQss-081-0161-SO

for explosives and TAL metals at the 0-1

interval

~~Steve~~ Refusal in all explosive holes at the 11-12"

Center hole refusal at the 11", unable to do 1-3 interval

10:00 Go to next location

12.4.03

Daily Weather Conditions: A.M. light drizzle, 40°F's

P.M.

Recorded By Chandler Carroll QA Checked By Amy [illegible]

HTRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBQ-087
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR: n/A	SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Andre Leon	6. MANUFACTURERS DESIGNATION OF DRILL: n/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS spoon / bowl; SS 3½" auger bucket	8. HOLE LOCATION: FBQ-087
	9. SURFACE ELEVATION: n/A
	10. DATE STARTED: 11/11/03 — 11. DATE COMPLETED: 11/11/03
12. OVERBURDEN THICKNESS: n/A	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
13. DEPTH DRILLED INTO ROCK: n/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/A
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): Water in hole after 7"

18. GEOTECHNICAL SAMPLES	DISTURBED		UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See act. 105						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR	C. Carroll	
	✓					

LOCATION SKETCH/COMMENTS

SCALE:

See page 47 for location
of FBQ-087 in soil logbook
#2

HTRW DRILLING LOG

PROJECT: Fuze & Booster/RVAAP	INSPECTOR C. Carroll	HOLE NUMBER: FBQ-081
		SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	1	Clayey Sand, trace silt, med. brown mottled tan/red, some gravel, med to pebble, 20% slag + 40% pebble, reddish sandstone appears two/ at 11-12"	PID non function	N/A	FBQss-081L 0141-50	water starts appearing in hole around 6-7"
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

Refusal in all explor holes around 11-12" - Center hole refusal @ 11"

RC 9-4-05

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11-11-03 Su M (Tu) W Th F Sa PAGE 1 OF ____

Task Team Members:

Andrew Logan   Steve King

Chantelle Carroll

Randa Bailey

Narrative (include time and location):

10:04 Arrive at sample FBQ-091, Steve pre-cleared

10:05 Begin to sample FBQss-091-0181-50

for explosives and TAL metals

Hit refusal at 6" in explosive holes and

at the 1ft in other two holes, Refusal at 6"

at the Center hole unable ~~to go to~~ the

1-3 ft interval

1025 Go to next sample

12-4-03

Daily Weather Conditions: A.M. overcast, cold, drizzle 50's/mn 40's

P.M. ____

Recorded By Chantelle Carroll QA Checked By Amy Greenawalt

55

HTRW DRILLING LOG

HTRW DRILLING LOG	DISTRICT: **Louisville**	HOLE NUMBER FBD-091
1. COMPANY NAME: **SpecPro, Inc.**	2. DRILL SUBCONTRACTOR: n/A	SHEET 1 OF 1

3. PROJECT: **Fuze & Booster/RVAAP**	4. LOCATION: **Fuze & Booster Quarry Landfill/Pond**
5. NAME OF DRILLER: Andre Leon	6. MANUFACTURERS DESIGNATION OF DRILL: n/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS bowl / Spoon; SS 3½" auger bucket	8. HOLE LOCATION: FBD 091
	9. SURFACE ELEVATION: n/A
	10. DATE STARTED: 11/11/03 — 11. DATE COMPLETED: 11/11/03
12. OVERBURDEN THICKNESS: n/A	15. DEPTH GROUNDWATER ENCOUNTERED: n/A
13. DEPTH DRILLED INTO ROCK: n/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/A
14. TOTAL DEPTH OF HOLE:	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES n/A			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See att log						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR C. Carroll		
	✓					

LOCATION SKETCH/COMMENTS

SCALE: Not to scale

See pg 47 in the soil logbook #2 for sample

HTRW DRILLING LOG

HOLE NUMBER: FBD-09

PROJECT: Fuze & Booster/RVAAP | INSPECTOR: C Carroll | SHEET 1 OF 1

56

ELEV. (ft)	DEPTH (ft)	DESCRIPTION OF MATERIALS	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO.	REMARKS
	0–1	Clayey-sand, trace silt, med brown - mottled lt gray, reddish sandstone gravel med to pebble size, 10% clay	non-functioning	N/A	FBss-091 0191-SO	Refused drill and attempted 1 ft in the other 3 explo holes. Center hole 8"
			Refusal			

AB 12.4.05

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11-11-03 Su M (Tu) W Th F Sa PAGE 1 OF 1

Task Team Members:

Ronda Bailey — Steve King

Andre Leon

Chandelle Canale

Narrative (include time and location):

10:35 Arrive at Sample location Steve clears
10:40 Begin to Sample BQss-090-0179-SD
for explosives and for metals
Refusal in all 3 explosive holes at
4-5" due to cobbles and rocks
Refusal @ 9" in center hole
10:59 Go to next Sample

AC 12-4-03

Daily Weather Conditions: A.M. overcast, mist rain 50 F

P.M.

Recorded By: Chandelle Canale QA Checked By: Amy Greenawalt

HTRW DRILLING LOG

HTRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBD-090 59
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR: n/A	SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Andre Leon	6. MANUFACTURERS DESIGNATION OF DRILL: n/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS bowl/spoon; SS 3½" auger bucket	8. HOLE LOCATION: FBD-090
	9. SURFACE ELEVATION: n/A
	10. DATE STARTED: 11-11-03 / 11. DATE COMPLETED: 11-11-03
12. OVERBURDEN THICKNESS: n/A	15. DEPTH GROUNDWATER ENCOUNTERED: n/A
13. DEPTH DRILLED INTO ROCK: n/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/A
14. TOTAL DEPTH OF HOLE	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/A

18. GEOTECHNICAL SAMPLES	DISTURBED		UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See act. log						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
n/A	✓			C. Carollo		

LOCATION SKETCH/COMMENTS SCALE:

See page 47 in the soil logbook #2 for location

APPENDIX 2

HTRW DRILLING LOG

PROJECT: Fuze & Booster/RVAAP	INSPECTOR C Cardl	HOLE NUMBER: FBS-[illegible]
		SHEET 1 OF 1

ELEV (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO (F)	REMARKS (G)
	0–1	Clayey sand, trace silt, med brown; mottled tan, reddish sandstone, some gravel med to pebble size, trace slag, plus	PID not functioning	N/A	FBS-05 0170 -0179-50	Refusal @ 9 at each of 4 FBS holes ~~roots throughout~~ some roots/stems throughout
	1–10	refusal at 9"				

AG 12.4.05

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 1/1/03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Pedro Lenny — Steve King

Randi Bomley

Chantelle Carroll

Narrative (include time and location):

1100 - Arrive @ FBQ 093. Cleared by S. King. Begin Sample 0-1 FBQss093Ø18SSø

1118 Refused @ 6" all holes

1120 - Depart site

AG 12-4-03

Daily Weather Conditions: A.M. Overcast drizzle low 40s

P.M.

Recorded By [signature] QA Checked By Amy Greenwald

HTRW DRILLING LOG

DISTRICT: Louisville		HOLE NUMBER FBQ Ø73
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Andre Legan	6. MANUFACTURERS DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS Bowl, SS auger, SS spoon	8. HOLE LOCATION: FBQ Ø93
	9. SURFACE ELEVATION:
	10. DATE STARTED: 11 11 Ø3 / 11. DATE COMPLETED: 11-11-Ø3
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 6"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

18. GEOTECHNICAL SAMPLES	DISTURBED		UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See act. Log						
22. DISPOSITION OF HOLE	BACKFILLED ✓	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

LOCATION SKETCH/COMMENTS See pg 47 SCALE:

HTRW DRILLING LOG

HOLE NUMBER: FB0093

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PROJECT: Fuze & Booster/RVAAP | INSPECTOR | SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	6"	MED Brn Sandy Clay. Some silt Some Slag; Trace gravel Bed SS			FBQ 093 -0185	organic material
		Refusal @ 6"			End	hole
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

AG 12.4.03

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TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11 11 03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Andre Leon — Steve King

Randc Vogelsang

Chantelle Conard

Narrative (include time and location):

1125 - Arrive @ FBQ 092. Cleared by Steve King. Ran Sampling

0-1 Exp for MK FBQ092 0183 50

1134 - Refusal @ 5", 6", 6" + 6"

1140 Leave Site for lunch

AL 12-4-03

Daily Weather Conditions: A.M Overcast, Rain, low 40s

P.M.

Recorded By [signature] QA Checked By Amy Hunewald

HTRW DRILLING LOG

HTRW DRILLING LOG	DISTRICT: Louisville -	HOLE NUMBER FBQ Ø92
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1
3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond	
5. NAME OF DRILLER: Steve Vance	6. MANUFACTURERS DESIGNATION OF DRILL:	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS Auger, SS Spoon, SS Bowl	8. HOLE LOCATION: FBQ Ø92	
	9. SURFACE ELEVATION:	
	10. DATE STARTED: 11 11 Ø3	11. DATE COMPLETED: 11-11-Ø3
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED: 3"	
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:	
14. TOTAL DEPTH OF HOLE 6"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See act. log						
22. DISPOSITION OF HOLE	BACKFILLED ✓	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

LOCATION SKETCH/COMMENTS See Pg 47 SCALE:

HTRW DRILLING LOG

HOLE NUMBER	FBQ-071
SHEET	OF

PROJECT: Fuze & Booster RVAAP

INSPECTOR [illegible signature]

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
		Med brn Sandy clay some slt. Stones, gravel, trace slag Red SS	0.0		FBQss-071 018350	2 - 6" Refusal 1 - 5" Refusal Center 6" Refusal Roots, glass, pieces etc.
		Refusal @ 5"				
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

AC
12.4.03

TASK TEAM ACTIVITY LOG SHEET

69

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11/11/03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Andre Leon

Ronda Bailey

Steve King

Narrative (include time and location):

1300 - Arrive @ FBQ 100. Cleared by S King

Begin 0-1' sample FBQss 100019950

1310. Begin 1-3' sample. Cleared by S King

Refused @ 13" FBQso 100020050

1318 - Leave site

AL

12.4.03

Daily Weather Conditions: A.M. ________

P.M. Overcast, sprinkle rain, mid 40's

Recorded By [signature] QA Checked By [signature]

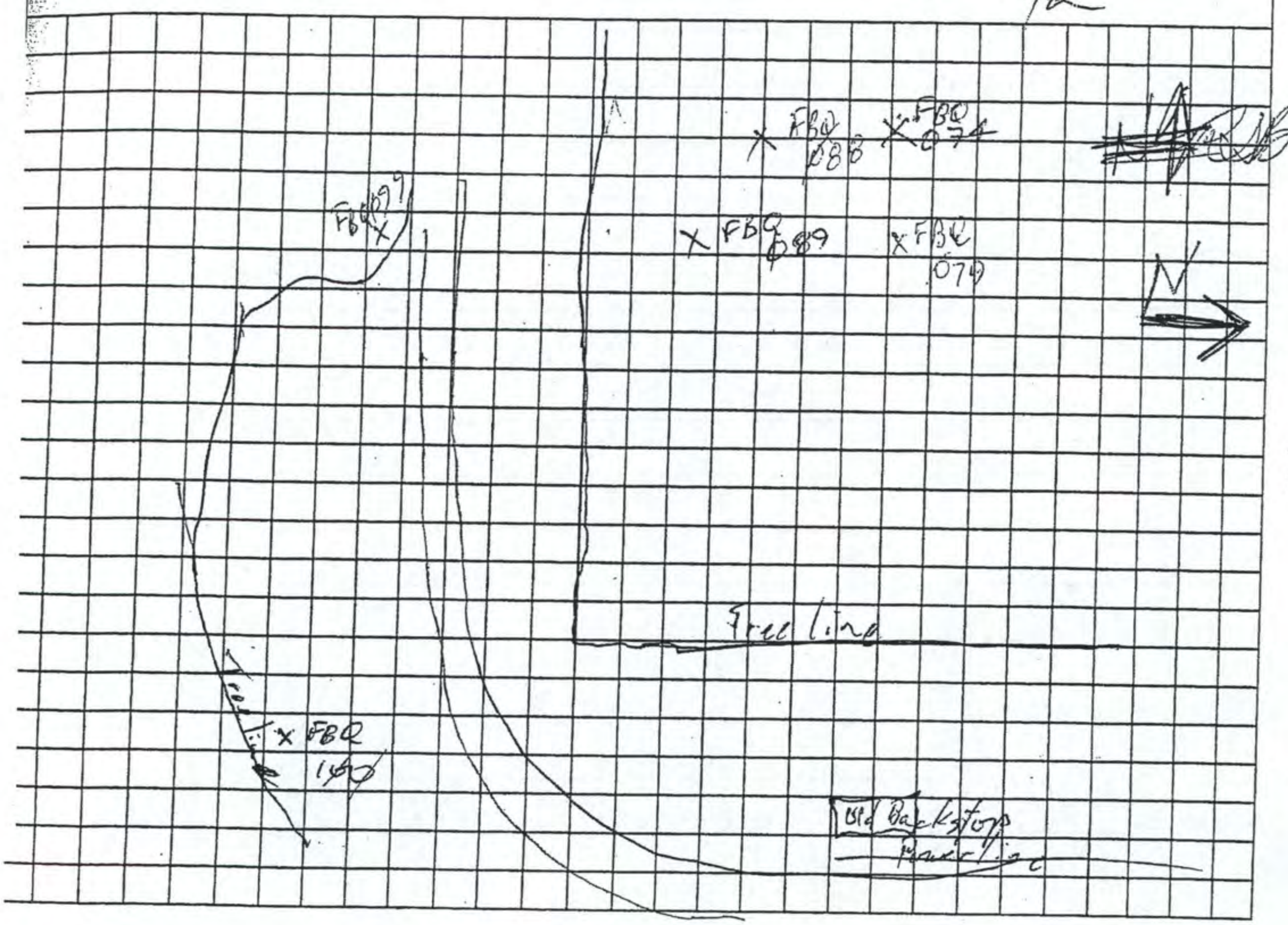
HTRW DRILLING LOG

DISTRICT: Louisville	HOLE NUMBER FBQ 140
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:
SHEET 1 OF 1	
3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS Spoon, SS Auger, SS bowl	8. HOLE LOCATION: FBQ 140
	9. SURFACE ELEVATION:
	10. DATE STARTED: 11 11 03
	11. DATE COMPLETED: 11-11-03
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 18"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See GAT log						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	✓					

LOCATION SKETCH/COMMENTS

SCALE: n/a



HTRW DRILLING LOG

HOLE NUMBER: FBQ 1[illegible]

PROJECT: Fuze & Booster/RVAAP | INSPECTOR [illegible signature] | SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	1	M brn sand and clay, some f. Hand gravel fine to pebble, Trace slag, wet soft				6" 5" 1" } EXP (6" + 5" refused) Rootz, grass leaves etc.
	18"	Same a/a				18" Refused
	2					
	3					
	4					
	5			[illegible] 12-4-03		
	6					
	7					
	8					
	9					
	10					

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11 11 03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Randc B[illegible]

Andre Leal

Steve King

Narrative (include time and location):

1328 - Arrived @ FBQ 099 Cleared by S. King
Begin 0-1 sample FBQSS-099-0197-30

1338 - Refused @ 8"

1342 - Leave Site

AG
12.4.03

Daily Weather Conditions: A.M.

P.M. Overcast high 40s

Recorded By [signature] QA Checked By Amy Groenewold

75

DRILLING LOG

DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBQ Ø99
NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1
Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond	
DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:	
SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS auger, SS bowl, SS spoon	8. HOLE LOCATION: FBQ Ø99	
	9. SURFACE ELEVATION:	
	10. DATE STARTED: 11 11 Ø3	11. DATE COMPLETED: 11-11-Ø3
OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED:	
DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:	
TOTAL DEPTH OF HOLE: 8"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):	

18. GEOTECHNICAL SAMPLES	DISTURBED		UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
Geo act. log	✓					
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	✓					

LOCATION SKETCH/COMMENTS See pg 71 SCALE:

HTRW DRILLING LOG

PROJECT: Fuze & Booster/RVAAP	INSPECTOR [signature]	HOLE NUMBER: FBC-097	SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0–1	lt and med brown sandy clay, some silt and gravel tan & red SS. fine to pebble. moist. soft.			FBC-SS-097-0197-20	6" 8" 8" 8" Roots, grass, leaves etc.
	1–10	Refusal @ 8"				

AC 12.4.03

1
2
3
4
5
6
7
8
9
10

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11 11 03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Ronald Bailey

Andrew Lee

Steve King

Narrative (include time and location):

1345 - Arrive @ FBQ 089. Observed by S King

Begin Soil Sample FBQSS-089-0177-00

1349 - Refusal @ 6", 6", 5", 5"

1357 - Leave Site

AG 12.4.03

Daily Weather Conditions: A.M.

P.M. Overcast, high 40s

Recorded By [signature] QA Checked By [signature]

HTRW DRILLING LOG

HTRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBQ Ø89
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS spoon, SS auger 3 1/2", SS bowl	8. HOLE LOCATION: FBQ Ø89
	9. SURFACE ELEVATION:
	10. DATE STARTED: 11-11-03 / 11. DATE COMPLETED: 11-11-03
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE 6"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY) / 21. TOTAL CORE RECOVERY %
See ACT. Log					
22. DISPOSITION OF HOLE	BACKFILLED ✓	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR [signature]	

LOCATION SKETCH/COMMENTS See Pg 71 SCALE:

HTRW DRILLING LOG

HOLE NUMBER: FBS/089 80

PROJECT: Fuze & Booster/RVAAP

INSPECTOR: RAB

SHEET 1 OF 1

ELEV (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
		H sl hard brn sandy clay some silt & gravel; tan and rd sg - fine to pebble; moist, soft			FBSss-089 0177-SO	6" 6" 5" 5" } Refusal; Organic Material Red & orange

Refusal @ 6"

AG 2.4.03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11/11/03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Ronda Bailey

Archie Leard

Steve King

Narrative (include time and location):

1405 - arrive @ FBO 088. Cleared by S King

Begin 0-1 sample and duplicate FBQss-088-0175-SO FBQss-088-0399-SO

1425 - 1-3' cleared by Steve K. Begin 1-3'

Sample & Duplicate FBQss-088-0176-SO FBQss-088-0400-SO

1445 - Leave site

RB 12-4-03

Daily Weather Conditions: A.M. ______

P.M. Overcast, high 40s

Recorded By RB QA Checked By Amy Hernandez

HTRW DRILLING LOG

DISTRICT: Louisville		HOLE NUMBER FBQ Ø88
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1
3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond	
5. NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS spoon, SS auger, SS bowl	8. HOLE LOCATION: FBQ Ø88	
	9. SURFACE ELEVATION:	
	10. DATE STARTED: 11 11 Ø3	11. DATE COMPLETED: 11-11-03
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED: 2"	
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:	
14. TOTAL DEPTH OF HOLE: 3'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See col (")						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	✓			[signature]		

LOCATION SKETCH/COMMENTS see pg 71 SCALE:

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HTRW DRILLING LOG

PROJECT: Fuze & Booster/RVAAP	INSPECTOR	HOLE NUMBER: FBG-166
		SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO (F)	REMARKS (G)
	0-1	lt brn sandy clay. Trace silt some gravel. soft wet fine to pebble				organic material roots & leaves & grass
	1-3	Same as above with increase of gravel. saturated				

12-4-03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11 11 03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Randi Bailey

Adre Leon

Steve King

Narrative (include time and location):

1458 - Arrive @ FBQ 087 Cleared by S. King. Begin 0-1 Sample FBQSS-087-0173-SS

1514 1-3' cleared by S. King. Begin 1'-3' sample interval FBQSS-087-0174-SO

1521 - Refusal @ 2'

1528 - Depart Site

AC 12.4.03

Daily Weather Conditions: A.M.

P.M. Overcast Mid 40s

Recorded By [signature] QA Checked By Amy Greenawalt

TRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBQ 088
COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

87

PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:
SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS spoon, SS auger, SS bowl	8. HOLE LOCATION: FBQ 088
	9. SURFACE ELEVATION: n/a
	10. DATE STARTED: 11/11/03 — 11. DATE COMPLETED: 11-11-03
12. OVERBURDEN THICKNESS: n/a	15. DEPTH GROUNDWATER ENCOUNTERED: n/a
13. DEPTH DRILLED INTO ROCK: n/a	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/a
14. TOTAL DEPTH OF HOLE: 2'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/a

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See acti loc						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	✓			[signature]		

LOCATION SKETCH/COMMENTS See Pg 71 SCALE:

HTRW DRILLING LOG

PROJECT: Fuze & Booster/RVAAP	INSPECTOR	HOLE NUMBER: FBQ-057	SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0–1	lt brn sandy clay, some silt, trace gravel fine to coarse, moist, soft			FBQsb-057 0179-SO	Some roots in gravel
	1–2	lt brn Sandy Silt, some clay, trace gravel fine to coarse, loose, Dry–damp.			FBQsb-057 0174-SO	Refusal @ 2'

Refusal @ 2'

11/17/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II RI Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER NO: 0012

Date (mm/dd/yy): 11/11/03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Archie Lao
Randi Bixby
Steve King

Narrative (include time and location):

1400 - Arrive @ FBQ 074. Cleared by Steve King. Begin 0-1 Sample FBQSS 074-0147-SO
1630 - 1-3' Cleared by S.King.
Begin Sample for 1-3' FBQSO-074-0148-SO
1645 - depart site

AL 12.4.03

Daily Weather Conditions: A.M.

P.M. Overcast High 40s

Recorded By [signature] QA Checked By Amy Freemantel

HTRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBQ c/74
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Andre Lea	6. MANUFACTURERS DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS Spoon, SS Liner, SS bowl	8. HOLE LOCATION: FBQ c/74
	9. SURFACE ELEVATION: n/a
	10. DATE STARTED: 11/11/03 — 11. DATE COMPLETED: 11-11-03
12. OVERBURDEN THICKNESS: n/a	15. DEPTH GROUNDWATER ENCOUNTERED: n/a
13. DEPTH DRILLED INTO ROCK: n/a	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/a
14. TOTAL DEPTH OF HOLE: 2'3"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/a

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See Act. Log						
22. DISPOSITION OF HOLE	BACKFILLED ~	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

LOCATION SKETCH/COMMENTS See Pg 71 SCALE:

HTRW DRILLING LOG

HOLE NUMBER: FBQ-074

PROJECT: Fuze & Booster/RVAAP | INSPECTOR: [illegible signature] | SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	lt brn clayey silt mottled orange & gray. Some sand trace gravel, fine to pebble damp firm			FBQ55-074 0147-SO	Some organics grass, leaves, roots
	1-2	A to med brn sandy silt. Some clay, trace gravel, loose, damp. ΔA @ 18" slight in color to lt brn mottled gray & orange			FBQ50-074 0148-SO	

Refusal @ 2'3"

[illegible initials] 11-17-03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II RI Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER NO: 0012

Date (mm/dd/yy): 1/1/2/03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Randa Bankey

Andre Lein

Steve King

Narrative (include time and location):

0910 Arrive @ FBQ 079. Cleared by S. King. Begin 0'-1' Sample

~~095~~ Full suite & split FBQ55-079-0157-50

0925 - Refusal @ 8", 10" & 1' for holes

0955 - S. King ~~Begin~~ Cleared 1-3'. Begin Full suite & split 1-3' FBQ50-079-0157-50 SPHB

1020 - Refusal @ 2".

1024 - Leave Site

AF 12-4-03

Daily Weather Conditions: A.M. Overcast, mid 50s

P.M.

Recorded By [signature] QA Checked By Amy Greenwald

HTRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBQ079
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS auger, SS bowl, SS spoon	8. HOLE LOCATION: FBQ079
	9. SURFACE ELEVATION: n/c
	10. DATE STARTED: 11 12 03 — 11. DATE COMPLETED: 11-12-03
12. OVERBURDEN THICKNESS: n/c	15. DEPTH GROUNDWATER ENCOUNTERED: 2" (Center hole in ditch)
13. DEPTH DRILLED INTO ROCK: n/c	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/c
14. TOTAL DEPTH OF HOLE: 2'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/c

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See coll. Log						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

LOCATION SKETCH/COMMENTS See Pg 71 SCALE:

HTRW DRILLING LOG

PROJECT: Fuze & Booster/RVAAP	INSPECTOR	HOLE NUMBER: FBQ 079
		SHEET 1 OF 1

ELEV (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	Lt brn Sandy Clay brown silt, some gravel fine - Pebble - wet			FBQss-079 0157-SO	Second organic material - roots, brown staining, 6" refusal, 1' refusal
	1-2	Same as above			FBQss-079 0158-SO	

Refusal @ 2'

11/17/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II RI Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER NO: 0012

Date (mm/dd/yy): 11/12/03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Andre Lea

Randi Bailey

Steve King

Narrative (include time and location): FBQS-092-0195-SO

1030 Arrive @ FBQ 092. Cleared by S King

Begin Sample 0-1 full suite & split.

1115. S. King cleared 1-3' Begin FBQSO-092-0196-SO

1-3' Sampled and split

1138 - Leave Site

Daily Weather Conditions: A.M. Partly cloudy, High 50s

P.M.

Recorded By [signature] QA Checked By Amy Hemmerwald

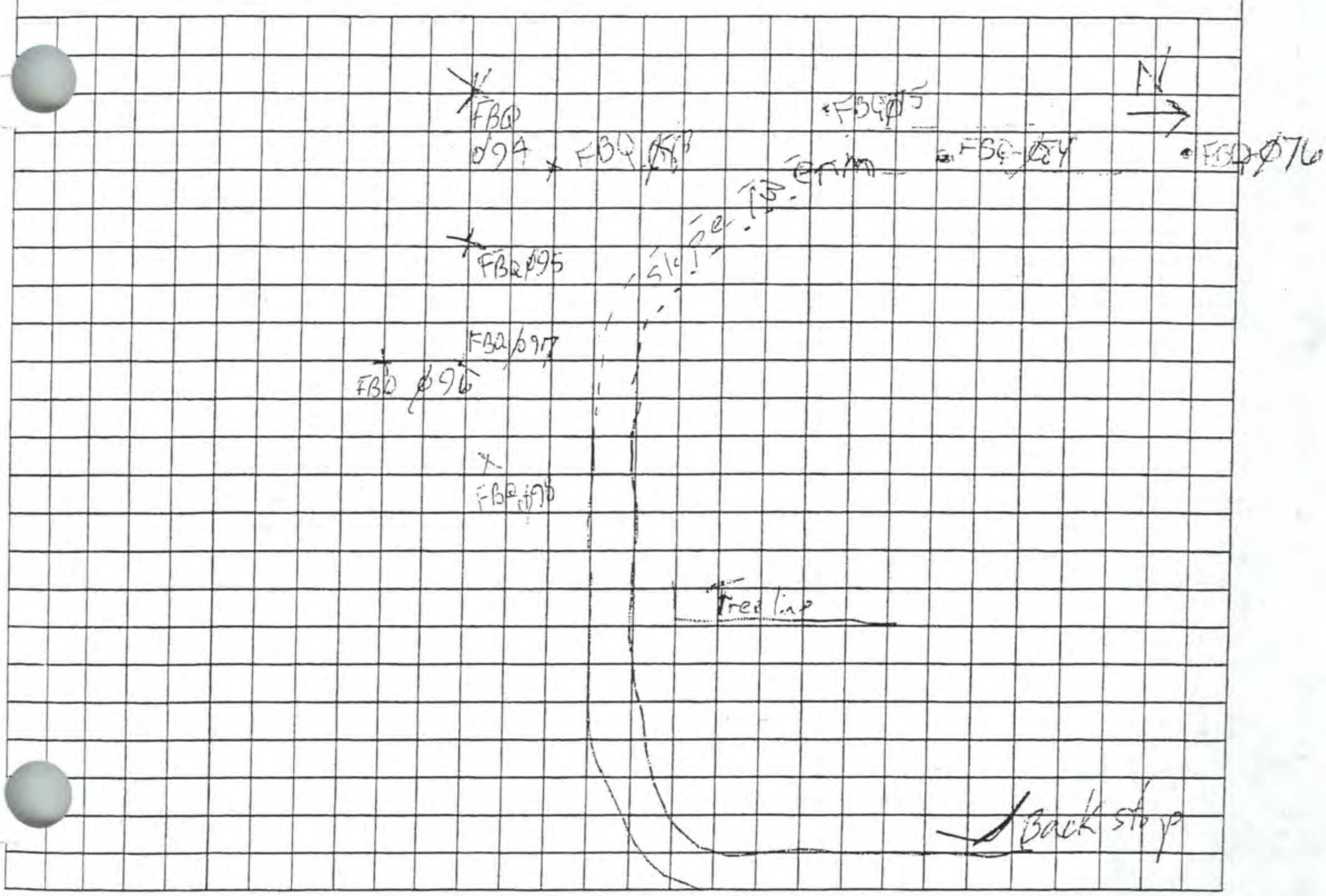
HTRW DRILLING LOG

HTRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBQ Ø98
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Andre Lee	6. MANUFACTURERS DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS spoon, SS auger, SS bowl	8. HOLE LOCATION: FBQ Ø98
	9. SURFACE ELEVATION:
	10. DATE STARTED: 11-12-Ø3
	11. DATE COMPLETED: 11-12-Ø3
12. OVERBURDEN THICKNESS	15. DEPTH GROUNDWATER ENCOUNTERED:
13. DEPTH DRILLED INTO ROCK	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED:
14. TOTAL DEPTH OF HOLE: 2' 6"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY):

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See act. log						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR	
				[signature]	

LOCATION SKETCH/COMMENTS SCALE: n/a



HTRW DRILLING LOG

HOLE NUMBER: FBG 096

PROJECT: Fuze & Booster/RVAAP | INSPECTOR [illegible signature] | SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO (F)	REMARKS (G)
	0-1	Hand med brown clayey silt, some sand, trace gravel fine textured. damp, loose			FBGss-097 0195-SO	Organic Material Roots, leaves, stems,
	1-3	Same as above with increase of sand and SS gravel. damp. loose			FBGso-098 0196-SO	

Refusal @ 2'6"

[illegible signature] 11/12/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11/12/Ø3 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Ronald Bailey

Andre Leon

Steve King

Narrative (include time and location):

133Ø - Arrive @ FBQ Ø90. Cleared by S. King. Begin Ø-1 FBQS-Ø90-Ø191-SO Sample & Split

134Ø - 1-3' Cleared by S. King. Begin 1-3' interval FBQSO-Ø90-Ø192-SO

135Ø - Refusal @ 2'6"

1355 - Depart site

AL 12-4-Ø3

Daily Weather Conditions: A.M.

P.M. Mostly cloudy, low 60s

Recorded By [signature] QA Checked By [signature]

HTRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBQ ø96
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS auger, SS spoon, SS bowl	8. HOLE LOCATION: FBQ ø96
	9. SURFACE ELEVATION:
	10. DATE STARTED: 11 12 03 — 11. DATE COMPLETED: 11-12-03
12. OVERBURDEN THICKNESS: n/c	15. DEPTH GROUNDWATER ENCOUNTERED: n/c
13. DEPTH DRILLED INTO ROCK: n/c	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/a
14. TOTAL DEPTH OF HOLE: 2' 6"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/c

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See act. Log						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	✓			[signature]		

LOCATION SKETCH/COMMENTS See pg 99 SCALE:

HTRW DRILLING LOG

HOLE NUMBER: FBG096 | SHEET 1 OF 1 104

PROJECT: Fuze & Booster/RVAAP | INSPECTOR [signature]

ELEV.	DEPTH (ft)	DESCRIPTION OF MATERIALS	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO.	REMARKS
	0-1	lt. / dark brn silt, some clay and sand. Trace of gravel fine, damp			FBGSS-096 0191-SO	Organic material roots, stems, leaves
	1-3	lt brn silt. Some clay, Trace sand. Trace gravel, fine to med. Stiff-Damp. This is below 18". 1'-16" is same as 0-1 description			FBGSO-096 0191-SO	
		Refusal @ 2'6"				

11/12/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 111203 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Andre Leon

Ronald Bzlkey

Steve King

Narrative (include time and location):

1405 - Arrive @ FBQ 097. Cleared by S.King. Begin 0-1 sample FBQSS-097-0193-SO

1420 - 1-3' Cleared by S.King. Begin 1-3 sample FBQSO-097-0194-SO

1435 - Leave Site

AL 12.4.03

Daily Weather Conditions: A.M. –

P.M. Overcast low 40s

Recorded By [signature] QA Checked By [signature]

107

HTRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBQ 097
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS Spoon; SS bowl; SS auger	8. HOLE LOCATION: FBQ 097
	9. SURFACE ELEVATION: n/c
	10. DATE STARTED: 111203 / 11. DATE COMPLETED: 11-12-03
12. OVERBURDEN THICKNESS: n/c	15. DEPTH GROUNDWATER ENCOUNTERED: n/c
13. DEPTH DRILLED INTO ROCK: n/c	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/c
14. TOTAL DEPTH OF HOLE: 2' 6"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/c

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See act. log						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	✓			[signature]		

LOCATION SKETCH/COMMENTS See Pg 94 SCALE:

HTRW DRILLING LOG

PROJECT: Fuze & Booster/RVAAP			INSPECTOR:			HOLE NUMBER:	SHEET 1 OF 1
ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)		REMARKS (G)
	8-1	lt and Med brn silt, some clay and sand trace gravel fine to med. loose to firm. Increasing density w/depth			FBGSS-097 0193-SO		Organic mat... roots stems, leaves
	1-3	Same a/a Δ @ 18" to 1' brn clayey sand, some silt & some gravel fine to pebble			FBGSO 097 0194-SO		
		Refusal @ 2'6"					

11/17/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11/12/03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Andre Lee

Randi Bailey

Steve King

Narrative (include time and location):

1440 - Arrive @ FBQ 095. Cleared by Steve King. Begin 0-1 Sample & Split FBQSS-095-0189-90

1500 - 1-3' cleared by S King Begin 1-3 Sample FBQSO-095-0190-SO

1515 Refusal @ 2'6"

1520 Leave site

AK 3.4.03

Daily Weather Conditions: A.M. ____

P.M. Overcast, low 60s

Recorded By [signature] QA Checked By Amy Greenawald

HTRW DRILLING LOG

HTRW DRILLING LOG	DISTRICT: **Louisville**	HOLE NUMBER FBQ 095
1. COMPANY NAME: **SpecPro, Inc.**	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

3. PROJECT: **Fuze & Booster/RVAAP**	4. LOCATION: **Fuze & Booster Quarry Landfill/Pond**
5. NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS auger; SS bowl; SS spoon	8. HOLE LOCATION: FBQ 095
	9. SURFACE ELEVATION:
	10. DATE STARTED: 11/12/03 — 11. DATE COMPLETED: 11-12-03
12. OVERBURDEN THICKNESS: n/c	15. DEPTH GROUNDWATER ENCOUNTERED: n/c
13. DEPTH DRILLED INTO ROCK: n/c	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/c
14. TOTAL DEPTH OF HOLE: 2' 6"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/c

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See act. log						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	✓			[signature]		

LOCATION SKETCH/COMMENTS See pg 99 SCALE:

HTRW DRILLING LOG

HOLE NUMBER: F-FO 095

PROJECT: Fuze & Booster/RVAAP | INSPECTOR | SHEET OF

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	Med Brown Clayey silt, soft. Some sand, trace gravel (fine gravel). Δ @ 1' to lt brn silt, firm, some sand, trace clay, damp			FB050-095-0179-SO	Organic material roots, stems, leaves
	1-3	Same a/a to 18" Δ to lt brn mottled gray & orange sandy silt, some clay, trace gravel fine to coarse. stiff			FB050-095-0198-SO	

Refusal @ 2'6"

1/17/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11 12 /03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Andre Loom

Randy Bailey

Steve King

Narrative (include time and location):

1525 - Arrive @ FBQ 094. Cleared by
S. King. Begin 0-1 sample
and duplicate for explos and TAL Metals FBQ55-094-0507, FBQ55-094-0401-
1545 - 1-3' cleared by S. King. Begin
1-3' sample and duplicated (explos/TAL metals) FBQ55-094-0, FBQ55-094-04
1600 - Refusal @ 2'6".
1605 Leave site

AG
12.4.03

Daily Weather Conditions: A.M.

P.M. Overcast, high 50s

Recorded By [signature] QA Checked By [signature]

HTRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBQ094 115
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS auger, SS bowl, SS spoon	8. HOLE LOCATION: FBQ/094
	9. SURFACE ELEVATION:
	10. DATE STARTED: 11/12/03 — 11. DATE COMPLETED: 11-12-03
12. OVERBURDEN THICKNESS: n/a	15. DEPTH GROUNDWATER ENCOUNTERED: n/a
13. DEPTH DRILLED INTO ROCK: n/a	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/a
14. TOTAL DEPTH OF HOLE: 2' 6"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/a

18. GEOTECHNICAL SAMPLES	DISTURBED		UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See act. log						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	✓					

LOCATION SKETCH/COMMENTS See Pg 94 SCALE:

HTRW DRILLING LOG

HOLE NUMBER: FBQ054

PROJECT: Fuze & Booster/RVAAP

INSPECTOR

SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	Md brn Sandy silt Some clay loose trace gravel Fine to coarse				Organic material roots, stems, leaves
	1-3	lt. brn silt + Sand Some gravel fine to cobble. Mottled gray and orange loose - firm				
		Refusal @ 2'6"				

11/12/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11-13-03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Chantelle Carroll

Andre Lean

Steve King

Narrative (include time and location):

0938 arrive at sample location FBQ-083

0940 Begin (after cleared by Steve) sampling full suite at the 0-1 interval for FBQss-083 016550 (Expl/TAL Metals/SVOC/Pest/PCB/Perch/Propell)

1005 Begin sampling the 1-3' interval (Full suite) for FBQss-083-011650 (after Steve cleared)

1020 Finish sample, go to next location

11-17-03

Daily Weather Conditions: A.M. Sunny, breezy

P.M.

Recorded By Chantelle Carroll QA Checked By [signature]

HTRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER: FBQ083
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR: N/A	SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Andre Leon	6. MANUFACTURERS DESIGNATION OF DRILL: N/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS Bowl/Spoon; SS 5 1/2" Auger Bucket	8. HOLE LOCATION: FBQ 083
	9. SURFACE ELEVATION: N/A
	10. DATE STARTED: 11/13/03 — 11. DATE COMPLETED: 11-13-03
12. OVERBURDEN THICKNESS: N/A	15. DEPTH GROUNDWATER ENCOUNTERED: N/A
13. DEPTH DRILLED INTO ROCK: N/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: N/A
14. TOTAL DEPTH OF HOLE: 3 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): N/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See Act log						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
N/A	✓			[signature]		

LOCATION SKETCH/COMMENTS

SCALE:

Soil Page 99
for Location &
Sample in the Soil
logbook #10

HTRW DRILLING LOG

HTRW DRILLING LOG		HOLE NUMBER: FBD Ø03
PROJECT: Fuze & Booster/RVAAP	INSPECTOR [illegible]	SHEET 1 OF 1

ELEV.	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	Ø-1 / 6"	[illegible], brown clay silt [illegible] sand; [illegible] clay silt - [illegible] brown [illegible]	not [illegible]	n/A	FBDss Ø03-Ø1L5 SO (Coll)	roots [illegible] throughout
	1-3	[illegible] more [illegible] [illegible] mottling			FBDso Ø03 Ø160-SO	
			CC	11-13-Ø3		
		[illegible] 11/17/03				

121

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11-13-03 Su M Tu W (Th) F Sa PAGE 1 OF 1

Task Team Members:

Chandler Carroll

Steve King

Andie Leon

Narrative (include time and location):

1040 Steve clears trail to site FBQ-075

1050 Began sampling FBQSS-075-0149-50 for explosives and TAL Metals and take a duplicate FBQSS-075-0903-50 at the 0-1 interval

1111 Began the 1-3 interval for explosives and TAL metals on FBQSO-075-0150-50 [illegible] Refusal due to rock at 3ft.

1120 Finish sample and go to next location

RMB 11/13/03

Daily Weather Conditions: A.M. Snowy, breezy

P.M.

Recorded By Chandler Carroll QA Checked By [signature]

HTRW DRILLING LOG

123

DISTRICT: Louisville		HOLE NUMBER FBD-075
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL: n/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS bowl/spoon, SS 3½" auger bucket	8. HOLE LOCATION: FBQ 075
	9. SURFACE ELEVATION: n/A
	10. DATE STARTED: 11-13-03 / 11. DATE COMPLETED: 11-13-03
12. OVERBURDEN THICKNESS: n/A	15. DEPTH GROUNDWATER ENCOUNTERED: n/A
13. DEPTH DRILLED INTO ROCK: n/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/A
14. TOTAL DEPTH OF HOLE: 2"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/A

18. GEOTECHNICAL SAMPLES	DISTURBED		UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See COC 105						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
n/A	✓			[signature]		

LOCATION SKETCH/COMMENTS

SCALE:

See page 99 in the soil logbook #3 for location

HTRW DRILLING LOG

HOLE NUMBER FBQ075

PROJECT: Fuze & Booster/RVAAP | INSPECTOR | SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	6" 0-1	top organics, medium clay - silt, trace sand some gravel grading into clay silt, lt. brown w/ reddish sand stone; mottling grading into larger cobbles; stones	PID not functioning	N/A	FBQ50-075 0149-50 + Dup	roots, stems
	1-3	grading into lighter brown tan w/ cobble, gravel and sandstones			FBQ50-075 0150-00	
	2	Refusal at 2'				

1/17/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11-13-03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Steve King

Chandler Carnal

Andre Leon

Narrative (include time and location):

1125 Go to FBQ-085 (Steve Clean prior)

11:26 Began to sample FBQSS-085-0169-30 for Explosives/TAL Metals

1148 Steve cleans 1-3 and began to sample the 1-3 interval for Explos/TAL Metals for Sample FBQSS-085-0170-30-

1200 Finish sample, go back to building

RCS 11/13/03

Daily Weather Conditions: A.M. Snowy, breezy

P.M.

Recorded By Chandler Carnal QA Checked By [illegible]

HTRW DRILLING LOG

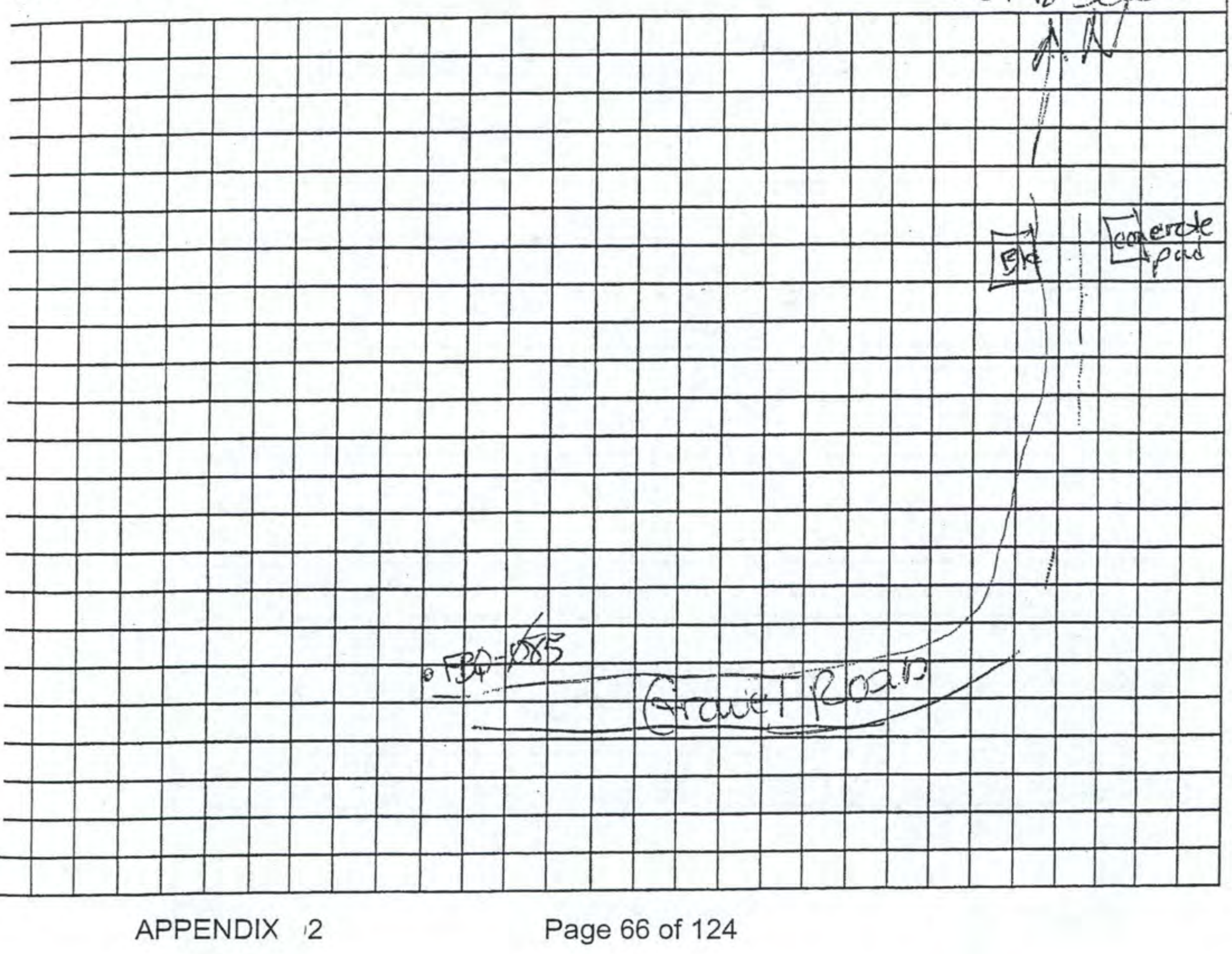
HTRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBQ-085
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR: n/A	SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL: n/A
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS barrel Spoon; SS 3½" auger bucket	8. HOLE LOCATION: FBQ-085
	9. SURFACE ELEVATION: n/A
	10. DATE STARTED: 11-13-03 11. DATE COMPLETED: 11-13-03
12. OVERBURDEN THICKNESS: n/A	15. DEPTH GROUNDWATER ENCOUNTERED: n/A
13. DEPTH DRILLED INTO ROCK: n/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/A
14. TOTAL DEPTH OF HOLE: 3 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/A

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES n/A			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
see act log						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
n/A	✓			Carroll		

LOCATION SKETCH/COMMENTS

SCALE: Not to Scale



HTRW DRILLING LOG

HOLE NUMBER: FBQ-085 | SHEET 1 OF 1 | 128

PROJECT: Fuze & Booster/RVAAP | INSPECTOR: C. Carroll

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	dk tan and brown organics, grading with med brown clay-silt, some sand; slag grading with a [illegible] brown [illegible] [illegible] [illegible] [illegible] clays, silts and gravel, one tip [illegible]	not working	n/a	FBQso-085-0169-SO	roots [illegible] throughout
	1-3	grading with a clay silt med plasticity, moist, heavy mottling of gray and reddish brown [illegible] ~~[illegible]~~	"	"	FBQso-085-0170-SO	
		3'				

11/17/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11-13-03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Steve King

Andre Leon

Chandra Candi

Narrative (include time and location):

1358 Arrive at location FBQ-084

1400 Begin to sample FBQSS-084-0167-SO for a full suite (exp/propel/PCB/Pest/SVOC/VOC and TAL Metals, Cr+6 and take a duplicate (FBQSS-084-0404-SO) after Steve cleared when arrived

1425 Stop due to refusal of rock at the 1 foot interval. Unable to get the 1-3 sample

1427 Go to next location

11/13/03

Daily Weather Conditions: A.M.

P.M. breezy, light snow flurries, 33-35°

Recorded By Chandra Candi QA Checked By [signature]

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TRW DRILLING LOG

TRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FB4-084
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR: n/A	SHEET 1 OF 1
3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond	
5. NAME OF DRILLER: Steve Kuns	6. MANUFACTURERS DESIGNATION OF DRILL: n/A	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS mini spoon; SS 3½" auger bucket	8. HOLE LOCATION: FB 084	
	9. SURFACE ELEVATION: n/A	
	10. DATE STARTED: 11-13-03	11. DATE COMPLETED: 11-13-03
12. OVERBURDEN THICKNESS: n/A	15. DEPTH GROUNDWATER ENCOUNTERED: n/A	
13. DEPTH DRILLED INTO ROCK: n/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/A	
14. TOTAL DEPTH OF HOLE: 1ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/A	

18. GEOTECHNICAL SAMPLES	DISTURBED		UNDISTURBED		19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %	
9le-Alt, 1 03							
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR			
n/A	✓			P. Carroll			

LOCATION SKETCH/COMMENTS

SCALE:

See to page 97 in the soil logbook #2 for the location

HTRW DRILLING LOG						HOLE NUMBER: FBP-034
PROJECT: Fuze & Booster/RVAAP			INSPECTOR C Canali			SHEET 1 OF 1
ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1'	mod. brown clayey silt, pebbles and sandstone pieces, some sand, moist grading into larger cobbles 75% rec. Refusal at 1' due to rock in center hole and all explosive holes (Refusal)	non-function PID	N/A	FBPss-034-1167-SO + dup	1200 hrs, grab - refusal in all expl holes at the 1 ft

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RAB 11/17/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11-13-03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Steve King

Chantelle Carroll

Andre Leon

Narrative (include time and location):

1429 Arrive at FBQ-076 (Steve Champion)

1430 Begin sample FBQ-076-9451-SO

for explosives and TAL metals at the 0-1

Refusal in all 3 explosive holes at

11-12". Center hole refusal at 1 ft.

Unable to take the 1-3 ft interval

1445 Finish up and go to next location

SK 11/17/03

Daily Weather Conditions: A.M.

P.M. Breezy, Show ... 30-35

Recorded By Chantelle Carroll QA Checked By [illegible]

DRILLING LOG

DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBQ-076
NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR: n/A	SHEET 1 OF 1

Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL: n/A
TYPES OF DRILLING EQUIPMENT: SS bowl/spoon; SS 3½" auger bucket	8. HOLE LOCATION: FBQ 076
	9. SURFACE ELEVATION: n/A
	10. DATE STARTED: 11-13-03 / 11. DATE COMPLETED: 11-13-03
OVERBURDEN THICKNESS: n/A	15. DEPTH GROUNDWATER ENCOUNTERED: n/A
DEPTH DRILLED INTO ROCK: n/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/A
TOTAL DEPTH OF HOLE: 1 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/A

GEOTECHNICAL SAMPLES	DISTURBED		UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES: n/A		
SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See soil log						
DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR: C Carl		
n/a	✓					

LOCATION SKETCH/COMMENTS

SCALE:

See page 97 in the soil logbook #2 on the location

HTRW DRILLING LOG

HOLE NUMBER: FBQ-47b 136

PROJECT: Fuze & Booster/RVAAP | INSPECTOR: [illegible] | SHEET 1 OF 1

ELEV.	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	[illegible]	[illegible] W/A		FBQ-47b [illegible]	roots; refusal in all 3 [illegible] 11-13

Refusal in center hole @ 1ft

11/17/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11-13-03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Steve King

Andy Anderson

Chantelle Carroll

Narrative (include time and location):

1509 Arrive at FBQ-070 (Steve clear prior)

1511 Begin to Sample FBQss-070-2139-50 for Explosives/TAL Metals at the 0-1 interval in explosive holes at 6", 8" and 8"; moved Center hole over a bit to see if better, it appears if ~~the area~~ was still on the base of an old road bed.

15:38 Unable to go past the 1 ft in the Center hole due to rock refusal, therefore unable to sample that interval

15:39 Finish sample and go to next location

CC 11/17/03

Daily Weather Conditions: A.M.

P.M. Breezy, Snow off/on 30-35's

Recorded By Chantelle Carroll QA Checked By [signature]

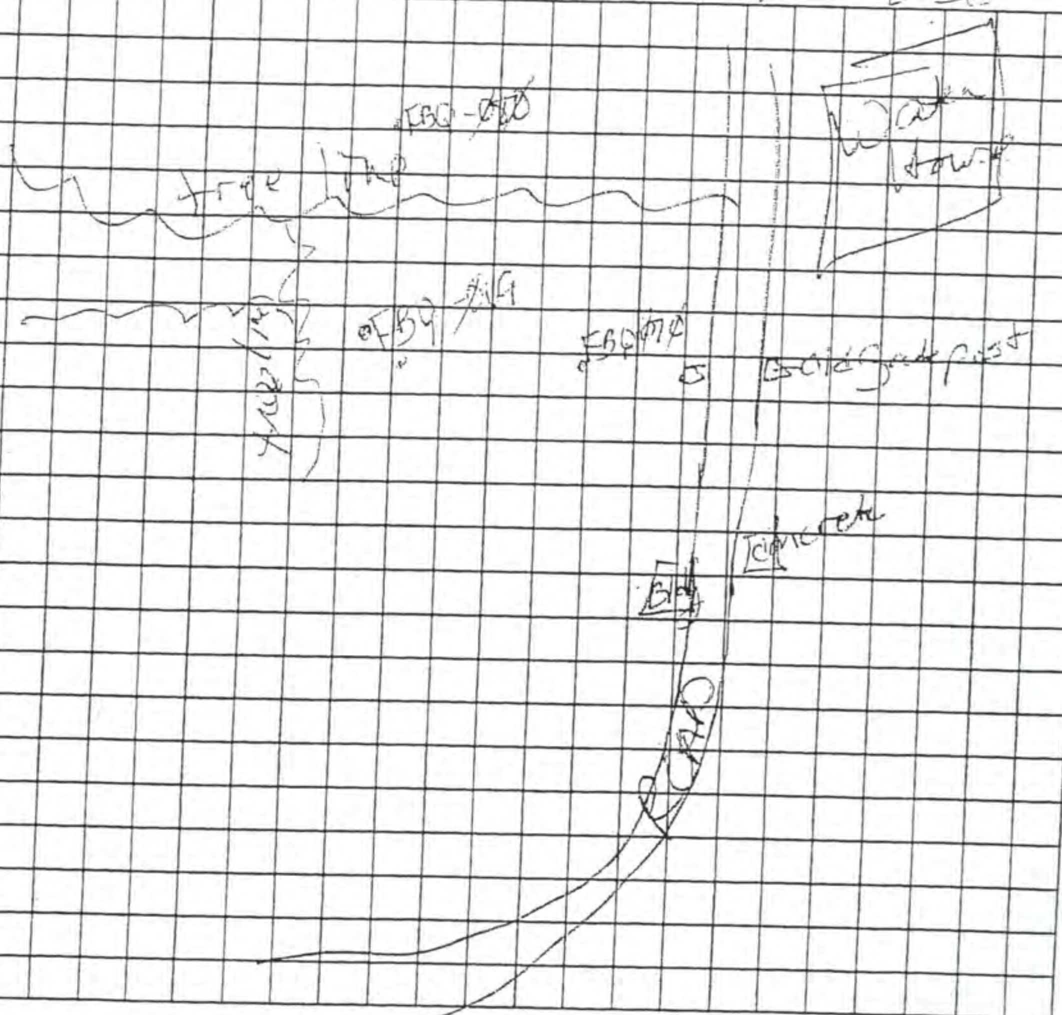
HTRW DRILLING LOG

HTRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER: FBQ-070
COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR: n/A	SHEET 1 OF 1
PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond	
NAME OF DRILLER: Andre Leon	6. MANUFACTURERS DESIGNATION OF DRILL: n/A	
SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS Bowl/Spoon; SS 3 1/2" auger Bucket	8. HOLE LOCATION: FBQ 070	
	9. SURFACE ELEVATION: n/A	
	10. DATE STARTED: 11-13-03	11. DATE COMPLETED: 11-13-03
OVERBURDEN THICKNESS: n/A	15. DEPTH GROUNDWATER ENCOUNTERED: n/A	
DEPTH DRILLED INTO ROCK: n/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/A	
TOTAL DEPTH OF HOLE: 1 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/A	

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See dict log						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
n/A	✓			C Carroll		

LOCATION SKETCH/COMMENTS

SCALE: Not to scale



HTRW DRILLING LOG

HOLE NUMBER: FBG-[illegible]

PROJECT: Fuze & Booster/RVAAP | INSPECTOR | SHEET 1 OF 1

ELEV (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO (F)	REMARKS (G)
	0-1'	dk brown topsoil 3" med brown silty-clay sand [illegible] moist, gravel [illegible] grading into [illegible]	not functioning n/p	FBGss-070-0139-SO	roots/stems Refusal at 3 step-out hole - 8" 8" 6"
		Refusal @ 1" in center hole				
	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

[illegible] 11/7/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11-13-03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Charles McCardell

Cendo Leon

Narrative (include time and location):

15:45 Arrive at FBQ-069 (Steve cleared prior)

1546 Begin to sample FBQss-069-0857-SO

for explosives and TAL metals

Hit refusal in all explosive and center hole

due to sandstone rocks (possible (Sharon sandstone)

1600 Finish up sample since unable to do the 1-3

interval

RCM3

11/17/03

Daily Weather Conditions: A.M.

P.M. Snow 80% / Mg Rang 30-35°s

Recorded By Charles McCardell QA Checked By [signature]

HTRW DRILLING LOG

COMPANY NAME: SpecPro, Inc.	DISTRICT: Louisville	HOLE NUMBER FBQ-069
	2. DRILL SUBCONTRACTOR: n/A	SHEET 1 OF 1
PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond	
NAME OF DRILLER: Andre Lam	6. MANUFACTURERS DESIGNATION OF DRILL: n/A	
SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS bowl/spoon, SS 3 1/2" auger bucket	8. HOLE LOCATION: FBQ-069	
	9. SURFACE ELEVATION: n/A	
	10. DATE STARTED: 11-13-03	11. DATE COMPLETED: 11-13-03
OVERBURDEN THICKNESS: n/A	15. DEPTH GROUNDWATER ENCOUNTERED: n/A	
DEPTH DRILLED INTO ROCK: n/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/A	
TOTAL DEPTH OF HOLE: 6" inches CC	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/A	

GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
Soil ACT 105						
DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
n/A	✓			C Carroll		

LOCATION SKETCH/COMMENTS

SCALE:

See page 139 in the Soil Log Book #2 for location

HTRW DRILLING LOG

HOLE NUMBER: FB?0-??		
PROJECT: Fuze & Booster/RVAAP	INSPECTOR: C Carroll	SHEET 1 OF 1

ELEV.	DEPTH (b)	DESCRIPTION OF MATERIALS (c)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (f)	REMARKS (G)
	0-1	Top organics, [illegible] brown clay, silt, some sand, [illegible] to [illegible], [illegible], mottled, [illegible] roots/substance	NA [illegible] N/A		FB?0-0?-0137-SO	Roots, stems, 2 plugs, hole refused at 9" 8"
	1	Center hole refusal @ 6"				
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

[illegible] 11/7/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond   DELIVERY ORDER: 0012

Date (mm/dd/yy): 11-13-03 Su M Tu W Th F Sa   PAGE 1 OF 1

Task Team Members:

Andre Leon

Chantelle Carroll

Steve King

Narrative (include time and location):

16:11 Arrive at FBQ-0870 (Steve Cleared prior)

1615 Begin to impl FBQss-0870-0159-SO

for Explosives & Trace metals

Refusal in explosives holes at 4" in all 3 holes

Refusal in center hole at 1 ft

Unable to take the 1-3 ft interval due to rock

1628 Leave site and return to building

Daily Weather Conditions: A.M.

P.M. Snow 2x-6/on, breezy 30/35

Recorded By Chantelle Carroll   QA Checked By [signature]

147

DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBQ-080
NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR: n/A	SHEET 1 OF 1

Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
DRILLER: Andy Lam	6. MANUFACTURERS DESIGNATION OF DRILL: n/A
TYPES OF DRILLING EQUIPMENT: SS hand/spoon SS 3.5" auger bucket	8. HOLE LOCATION: FBQ-080
	9. SURFACE ELEVATION: n/A
	10. DATE STARTED: 11/13/03 — 11. DATE COMPLETED: 11/13/03
BURDEN THICKNESS: n/A	15. DEPTH GROUNDWATER ENCOUNTERED: n/A
DRILLED INTO ROCK: n/A	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/A
DEPTH OF HOLE: 1 ft	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/A

TECHNICAL SAMPLES	DISTURBED		UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
ES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
all but VOC						
POSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
n/A	✓			C. Cannell		

TION SKETCH/COMMENTS — SCALE:

See page 139
for location in the
soil logbook #2

HTRW DRILLING LOG

HOLE NUMBER: [illegible]

PROJECT: Fuze & Booster/RVAAP | INSPECTOR: [illegible signature] | SHEET | OF

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
		TOP [illegible] Semi [illegible] med brown silty clay some sand grading into a bright brown-orange gravel to larger and [illegible] (red in color) [illegible]	non-functioning PID	N/A	FBQ55-[illegible] 015-50	[illegible] Exploratory hole [illegible] per hole Center hole [illegible]
	1	Drilled sandstone 7?6-7?0 mm dug up in center hole	Refusal @	ft		more hole [illegible]
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

[illegible signature] 11/13/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11/14/03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Andre Lee /
Randy Bailey
Stan King /

Narrative (include time and location):

0840 Arrive @ FBQ 061 Cleared by S King
Begin 0-1' sample
1055 1-3' interval cleared by S. King.
Begin 1-3' sample
1105 Leave site

Daily Weather Conditions: A.M. Mostly Cloudy, low 70s
P.M. —

Recorded By [signature] QA Checked By [signature]

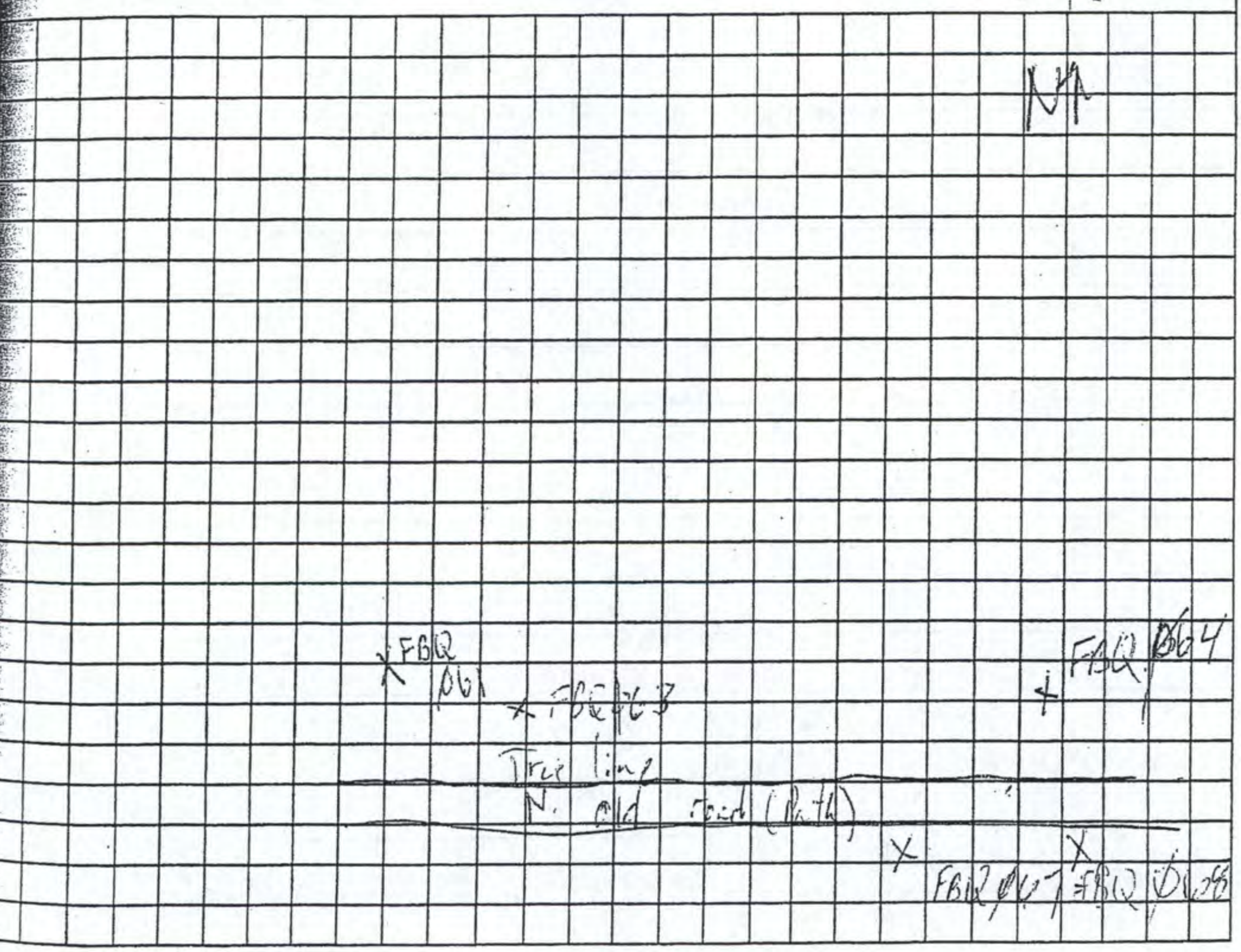
W DRILLING LOG

W DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER: FBQ 061
...NY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

...ECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
...OF DRILLER: Steve K...	6. MANUFACTURERS DESIGNATION OF DRILL:
...AND TYPES OF DRILLING ...ING EQUIPMENT: SS Auger / SS Lotwet / SS Spoon	8. HOLE LOCATION: FBQ 061
	9. SURFACE ELEVATION: n/a
	10. DATE STARTED: 11/14/03 / 11. DATE COMPLETED: 11-14-03
...ERBURDEN THICKNESS: n/a	15. DEPTH GROUNDWATER ENCOUNTERED: n/a
...TH DRILLED INTO ROCK: n/a	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/a
...TAL DEPTH OF HOLE: 3'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/a

...OTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
...PLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
MET 15						
...OSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	✓					

...ATION SKETCH/COMMENTS SCALE: No Scale



HTRW DRILLING LOG

PROJECT: Fuze & Booster RVAAP	INSPECTOR	HOLE NUMBER	SHEET 1 OF 1

152

ELEV (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	[illegible]				[illegible]
	1-3	[illegible]				
		3'				

11/14/03

APPENDIX 2

TASK TEAM ACTIVITY LOG SHEET

153

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11/14/03 Su M Tu W Th (F) Sa PAGE 1 OF 1

Task Team Members:

Andre Lee

Randy Bailey

Steve King

Narrative (include time and location):

0910 Arrive @ FBQ 063 Cleared by S. King
Began 0-1 sample

0925 1-3' interval cleared by S. King
Began 1-3' sample.

0942 Leave site

FBQ SS-063-0125-SO

FBQ SO-063-0126-SO

AB
12.4.03

Daily Weather Conditions: A.M. Mostly cloudy, low 70s

P.M.

Recorded By [signature] QA Checked By Amy Greenawald

TRW DRILLING LOG

DISTRICT: Louisville		HOLE NUMBER FBQ 063
COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:
SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	8. HOLE LOCATION: FBQ 061
SS Potm	9. SURFACE ELEVATION:
SS [illegible]	
SS [illegible]	10. DATE STARTED: 11/14/03 — 11. DATE COMPLETED: 11/14/03
OVERBURDEN THICKNESS n/c	15. DEPTH GROUNDWATER ENCOUNTERED: n/c
DEPTH DRILLED INTO ROCK n/c	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/c
TOTAL DEPTH OF HOLE 3'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/c

GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See all COC						
DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	✓			[illegible signature]		

LOCATION SKETCH/COMMENTS See Pg 151 SCALE:

HTRW DRILLING LOG

HOLE NUMBER: FBS-043

PROJECT: Fuze & Booster/RVAAP

INSPECTOR: [illegible]

SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
–	0–1	0-6" Med brn clayey silt trace sand and gravel - fine to coarse, loose - moist. 6-12 lt brn clayey silt trace sand and gravel, firm, damp, fine to coarse			FBQss-043 0125-SO ab	Organic material, roots, stems, leaves, grass
	1–3	lt. brn clayey silt mottled orange & gray trace sand and gravel fine to coarse, firm			FBQso-043 0126-SO ab	
	3		3'			
	4					
	5					
	6					
	7					
	8					
	9					
	10					

[illegible] 11/4/03

TASK TEAM ACTIVITY LOG SHEET

157

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11/14/13 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Narrative (include time and location):

0945 - Arrived @ FB050-067. Cleared by S. King. Began 0-1 sample FB055-067-0133-SO (06)

0955. 1-3' interval cleared by S.K.

1000. Refusal @ 18". / FB050-067-0134-SO (06)

1005 leave site

12.4.13

Daily Weather Conditions: A.M. Mostly Cloudy low 30s

P.M.

Recorded By

QA Checked By

159

RW DRILLING LOG

RW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER: FBQ Ø67
MPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

OJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
AME OF DRILLER: Steve Kr	6. MANUFACTURERS DESIGNATION OF DRILL:
ES AND TYPES OF DRILLING SAMPLING EQUIPMENT: SS bowl, SS spoon, SS Sample	8. HOLE LOCATION: FBQ Ø67
	9. SURFACE ELEVATION: n/a
	10. DATE STARTED: 11/14/03 — 11. DATE COMPLETED: 11/14/03
VERBURDEN THICKNESS: n/a	15. DEPTH GROUNDWATER ENCOUNTERED: n/a
EPTH DRILLED INTO ROCK: n/a	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/a
OTAL DEPTH OF HOLE: 1' 6"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/a

EOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
MPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See Log						
SPOSITION OF HOLE	BACKFILLED ✓	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

ATION SKETCH/COMMENTS See Pg 151 SCALE:

HTRW DRILLING LOG

HOLE NUMBER: FBC-065 160

PROJECT: Fuze & Booster/RVAAP | INSPECTOR [illegible] | SHEET 1 OF 1

ELEV (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	Lt Brn sandy silt some clay mottled orange and gray loose-firm moist trace gravel.			FBC065-067 0180-SO	Organic material root, stem, leaves grass
	1-3	Same as above			FBC065-067 0180-SO	
		Refusal @ 18"				

[illegible] 11/19/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11/14/03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Randy Bailey

Andre Lelon

Steve King

Narrative (include time and location):

1010 - Arrive at FBQ 10168. Observed by S. King. Begin sample interval of 1

1020 - 1-3' interval observed by S. King. Begin 1-3' sample

1025 - Refusal @ 24"

1031 - Depart site

FBQSS-068-0135-SO

FBQSS-068-0136-SO

AG 12.4.03

Daily Weather Conditions: A.M. Mostly cloudy low 30s

P.M.

Recorded By [signature] QA Checked By Amy Groenwald

[cut off]W DRILLING LOG

DISTRICT: Louisville	HOLE NUMBER FBQ 968	
[cut off]ANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

[cut off]ECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
[cut off]OF DRILLER: Steve Kn[illegible]	6. MANUFACTURERS DESIGNATION OF DRILL:
[cut off]AND TYPES OF DRILLING [cut off]PLING EQUIPMENT: SS [illegible] / SS [illegible] / SS Spoon	8. HOLE LOCATION: FBQ 968
	9. SURFACE ELEVATION: n/a
	10. DATE STARTED: 11-14-03 / 11. DATE COMPLETED: 11-14-03
[cut off]ERBURDEN THICKNESS: n/a	15. DEPTH GROUNDWATER ENCOUNTERED: n/a
[cut off]PTH DRILLED INTO ROCK: n/a	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/a
[cut off]OTAL DEPTH OF HOLE: 20"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/a

[cut off]EOTECHNICAL SAMPLES	DISTURBED		UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
[cut off]MPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
[illegible]						
[cut off]SPOSITION OF HOLE	BACKFILLED ✓	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR [signature]		

[cut off]CATION SKETCH/COMMENTS See Pg 151 SCALE:

HTRW DRILLING LOG

PROJECT: Fuze & Booster RVAAP | INSPECTOR [illegible] | HOLE NUMBER [illegible] | SHEET OF

ELEV (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	Wet brn sandy silt some clay and gravel - [illegible] pebbles fine to pebbles loose [illegible]			FBQ50-DW[illegible] 0155-SO	Organic [illegible] roots, grass leaves, sticks
	1-3	Same as above			FBQ50-DW[illegible] 0156-SO	
		Refusal @ 2.0'				

[illegible] 11/14/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11/14/03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Ronald Bagby
Andrew Cox
Steve King

Narrative (include time and location):

1035 - Arrive @ FBQ 004 Cleared by S King Begin 0-1 Sample
1045 1-3 cleared by S King Begin 1-3 Sample
1050 Refusal @ 2'6" FBQSO-064-0128-SO
1055 Leave site to ~~retu~~ haul equipment out

AC 12/4/03

Daily Weather Conditions: A.M. Mostly cloudy low 50s

P.M.

Recorded By [signature] QA Checked By [signature]

HTRW DRILLING LOG

HTRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER: FBQ 064
COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:
SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS bowl, SS auger, SS spoon	8. HOLE LOCATION: FBQ 064
	9. SURFACE ELEVATION:
	10. DATE STARTED: 11/14/03 — 11. DATE COMPLETED: 11-14-03
OVERBURDEN THICKNESS: n/c	15. DEPTH GROUNDWATER ENCOUNTERED: n/c
DEPTH DRILLED INTO ROCK: n/c	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/c
TOTAL DEPTH OF HOLE: 2' 6"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/c

GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See Act. Log						
DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	✓			[signature]		

LOCATION SKETCH/COMMENTS See pg 151 SCALE: n/a

HTRW DRILLING LOG						HOLE NUMBER: FBQ-41
PROJECT: Fuze & Booster/RVAAP		INSPECTOR				SHEET 1 OF 1
ELEV (f)	DEPTH (ft)	DESCRIPTION OF MATERIALS (c)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (f)	REMARKS (G)
0-1		It brown sandy silt, some clay, trace gravel, loose, fine to med, damp			FBQSS-064 0127-SO	Organic material roots, brown stains
1-2	1	Same as above, gravel fine to pebble S/S.			FBQSO-064 0128-SO	
	2	Refusal @ 2'6"				
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

11/14/03

168

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11 17 03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Ronda Bailey
Andrew Leon
Steve King

Narrative (include time and location):

0845 Arrive (a) FBQ [illegible]. Cleared by S. King. Begin 0-1 sample and duplicate.

0901 - ~~[illegible]~~ 1'-3' interval cleared by S. King. Begin 1'-3' sample and duplicate.

0915 - Leave site

12.4.03

Daily Weather Conditions: A.M. Overcast, low 50

P.M.

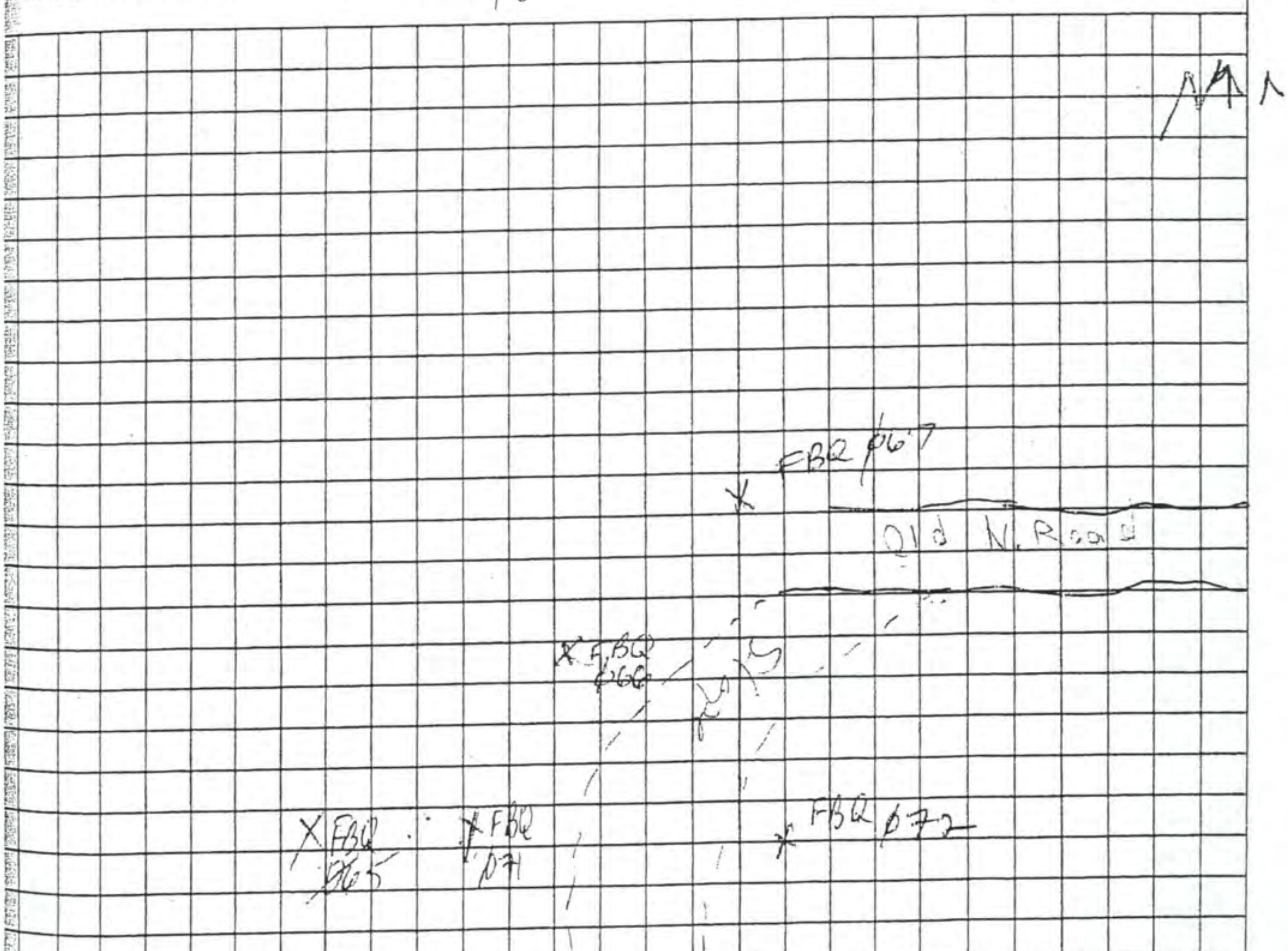
Recorded By [signature] QA Checked By [signature]

W DRILLING LOG

DISTRICT: Louisville		HOLE NUMBER FBQ-067
ANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1
ECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond	
OF DRILLER: Steve K...	6. MANUFACTURERS DESIGNATION OF DRILL:	
ND TYPES OF DRILLING PLING EQUIPMENT: SS spoon, SS bowl, SS auger	8. HOLE LOCATION: FBQ 067	
	9. SURFACE ELEVATION: n/c	
	10. DATE STARTED: 11 17 03	11. DATE COMPLETED: 11-17-03
RBURDEN THICKNESS: n/c	15. DEPTH GROUNDWATER ENCOUNTERED: n/c	
TH DRILLED INTO ROCK: n/c	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/c	
L DEPTH OF HOLE: 3'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/c	

TECHNICAL SAMPLES	DISTURBED		UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
ES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
Part. Log						
SITION OF HOLE	BACKFILLED ✓	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

TION SKETCH/COMMENTS See also Pg 99 SCALE: n/c



171

HTRW DRILLING LOG

PROJECT: Fuze & Booster/RVAAP	INSPECTOR		HOLE NUMBER: FBQ #067	SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	0-8" Med Brn, silty clay, soft, moist, trace sand & gravel fine to coarse. 8" to lt brn silt, some clay, trace sand and gravel, firm, moist				Organics roots, stems, grass, leaves
	1-3'	lt brn silt, some clay and sand, trace gravel fine to coarse. Mottled gray & orange.				
	2					
		@ 2.5' to lt brn sandy silt some clay, mottled orange & gray, trace gravel				
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

11/17/93

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11/7/02 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Randy Banfly
Andre Leon
Steve King

Narrative (include time and location):

0920 - Arrive @ FBQ 066. Cleared by S King. Begin 0-1 Sample FBQSS-066-0131-SO
0940 - 1-3' interval cleared by S King. Begin 1-3' sample FBQSO-066-0132-SO
0945 - Refusal @ 2'6".
0948 - Leave site

~~RB 12.4 03~~

Daily Weather Conditions: A.M. Overcast low 50s

P.M.

Recorded By RB QA Checked By Amy Hoeneward

HTRW DRILLING LOG

HTRW DRILLING LOG	DISTRICT: **Louisville**	HOLE NUMBER FBQ 066
1. COMPANY NAME: **SpecPro, Inc.**	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

3. PROJECT: **Fuze & Booster/RVAAP**	4. LOCATION: **Fuze & Booster Quarry Landfill/Pond**
5. NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS auger, SS spoon, SS bowl	8. HOLE LOCATION: FBQ 066
	9. SURFACE ELEVATION: n/c
	10. DATE STARTED: 11/17/03 — 11. DATE COMPLETED: 11-17-03
12. OVERBURDEN THICKNESS: n/c	15. DEPTH GROUNDWATER ENCOUNTERED: n/c
13. DEPTH DRILLED INTO ROCK: n/c	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/c
14. TOTAL DEPTH OF HOLE: 2' 6"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/c

18. GEOTECHNICAL SAMPLES	DISTURBED		UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See att. Log						
22. DISPOSITION OF HOLE	BACKFILLED ✓	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

LOCATION SKETCH/COMMENTS: See pg ~~99~~ 171 — SCALE: n/c

HTRW DRILLING LOG

HOLE NUMBER: FBR 066

PROJECT: Fuze & Booster/RVAAP | INSPECTOR: [signature] | SHEET | OF

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	Moist brn silty clay trace sand & gravel fine to coarse, soft, & @ 6" to 1' becoming silt some sand + gravel. Moist firm.			FBBSS-066 0131-SO	Organic material roots, stems, leaves, grass
	1-3	lt brn silt some sand and clay, mottled gray and orange trace gravel (fine to coarse) firm moist to damp sand increasing with depth.			FBBSO-066 0132-SO	

Refusal @ 2'6"

JGB 11/17/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II RI Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER NO: 0012

Date (mm/dd/yy): 11 17 03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Ronnie Bailey

Andrei Tooch

Steve King

Narrative (include time and location):

0955 - Arrive on FBQ 072. Cleared by S King FBQ55-072-0143-SO

1016 - Refusal @ 1'.

1020 Leave Site

AL 12.4.03

Daily Weather Conditions: A.M. Overcast, mid 50s

P.M.

Recorded By [signature] QA Checked By Amy Hannawald

HTRW DRILLING LOG

DISTRICT: Louisville		HOLE NUMBER FBQ 072
COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
NAME OF DRILLER: Angelina Leon	6. MANUFACTURERS DESIGNATION OF DRILL:
SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS spoon; SS bowl; SS auger	8. HOLE LOCATION: FBQ 072
	9. SURFACE ELEVATION: n/c
	10. DATE STARTED: 11 17 03 — 11. DATE COMPLETED: 11-17-03
OVERBURDEN THICKNESS: n/c	15. DEPTH GROUNDWATER ENCOUNTERED: n/c
DEPTH DRILLED INTO ROCK: n/c	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/c
TOTAL DEPTH OF HOLE: 1'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/c

GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See Cert. Log						
DISPOSITION OF HOLE	BACKFILLED ✓	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

LOCATION SKETCH/COMMENTS See Pg 171 SCALE:

HTRW DRILLING LOG

HOLE NUMBER: FBQ072

180

PROJECT: Fuze & Booster/RVAAP	INSPECTOR: [illegible]	SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	Med brn silty sand, gravel loose, fine to pebble moist trace clay. Red SS in sand			FBQ55-022 0143-SO	Organic material roots, stems, leaves grass.
	1	Refusal @ 1'				

[illegible] 11/17/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II RI Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER NO: 0012

Date (mm/dd/yy): 11/3/03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Ronald Bailey

Andre Leon

Steve King

Narrative (include time and location):

1025 - Arrive @ FBQ 071. Cleared by S. King Began 0-1 Sample FBQSS-071-0141-SO

1040 - 1-3 interval cleared by S. King

1043 - Refusal @ 18" FBQSO-071-0142-SO

1045 - Leave Site

AE

11-4-03

Daily Weather Conditions: A.M. Mostly cloudy mid 50s

P.M.

Recorded By [signature] QA Checked By [signature]

HTRW DRILLING LOG

HTRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBQ 071
COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1
PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond	
NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:	
SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS spoon, SS auger, SS bowl	8. HOLE LOCATION: FBQ 071	
	9. SURFACE ELEVATION: n/c	
	10. DATE STARTED: 11/17/03	11. DATE COMPLETED: 11-17-03
OVERBURDEN THICKNESS: n/c	15. DEPTH GROUNDWATER ENCOUNTERED: n/c	
DEPTH DRILLED INTO ROCK: n/c	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/c	
TOTAL DEPTH OF HOLE: 18"	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/c	

GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES			
SAMPLES FOR CHEMICAL ANALYSIS: see act. log	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
DISPOSITION OF HOLE	BACKFILLED ✓	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR [signature]		

LOCATION SKETCH/COMMENTS: See pg 171

SCALE:

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HTRW DRILLING LOG

PROJECT: Fuze & Booster/RVAAP	INSPECTOR [illegible signature]	HOLE NUMBER: FBQ#71	SHEET	OF

ELEV (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1'	Lt brn Silt, some sand & gravel, trace clay, firm, mottled orange, finite pebble. Damp. Increase sand w/ depth			FBQss-071-0141-SO	Organic material, leaves, stems, grass, roots
	1-3	Same as above. Red sand & ss pebbles.			FBQso-071-0152-SO	

Refusal @ 18"

[illegible initials]

1-17-03 [illegible initials]

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase III RI Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER NO: 0012

Date (mm/dd/yy): 11/7/03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Randi Bailey

Andre Leon

Steve King

Narrative (include time and location):

1047 arrive @ FBQ #65 Cleared by S. King. Begin 0-1 sample FBQSS-065-0129-
1052 - Refusal @ 10" in 2nd perimeter hole
1055 - 1-3' ~~[illegible]~~ interval cleared by S. King. Boring 1-3 Sample FBQ SD-065-0130-
1100 - Refusal @ 2'
1105 - Leave site & haul equipment to Road

AL 12.4.03

Daily Weather Conditions: A.M. Overcast mid 50s

P.M.

Recorded By [signature] QA Checked By Amy Greenwald

TRW DRILLING LOG

TRW DRILLING LOG	DISTRICT: Louisville	HOLE NUMBER FBQ Ø65
COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:
SIZES AND TYPES OF DRILLING & SAMPLING EQUIPMENT: SS Spoon, SS Bowl, SS auger	8. HOLE LOCATION: FBQ Ø65
	9. SURFACE ELEVATION: n/c
	10. DATE STARTED: 11/17/03 — 11. DATE COMPLETED: 11-17-03
OVERBURDEN THICKNESS: n/c	15. DEPTH GROUNDWATER ENCOUNTERED: n/c
DEPTH DRILLED INTO ROCK: n/c	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/c
TOTAL DEPTH OF HOLE: 2'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/c

GEOTECHNICAL SAMPLES	DISTURBED		UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
file CofC log						
DISPOSITION OF HOLE	BACKFILLED ✓	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR	[illegible signature]	

LOCATION SKETCH/COMMENTS See pg 171 SCALE:

HTRW DRILLING LOG

HOLE NUMBER: FBB065

PROJECT: Fuze & Booster/RVAAP | INSPECTOR | SHEET 1 OF 1

ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	Red brn sandy silt, some clay and gravel. Fine to coarse. Firm. Moist			FBGSS-065 0129-SO	Refusal @ 1' E Remainder Organic material. Root, leaves, grass.
	1-3	Same as above Increase in sand + gravel. tan + Red SS. fine - Pebble			FBGSS-065 0130-SO	

Refusal @ 2'

11/17/03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11/7/03 Su (M) Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Randle Bailey

Andre Labar

Steve King

Narrative (include time and location):

1300 - Arrive @ FBQ 086. Cleared by S. King. Begin 0-1 Sample for FBQ-086 (0-1') [illegible]

1310 - 1'-3' cleared by S King. Begin Sample of Full Suite with Duplicate

1326 - Refusal @ 2 FBQ-086-0172-SD, FBQ-086-0486-SD

1334 - Leave Site

[illegible] 12.4.03

Daily Weather Conditions: A.M.

P.M. Overcast low 50s

Recorded By [signature] QA Checked By Amy Groenewold

HTRW DRILLING LOG

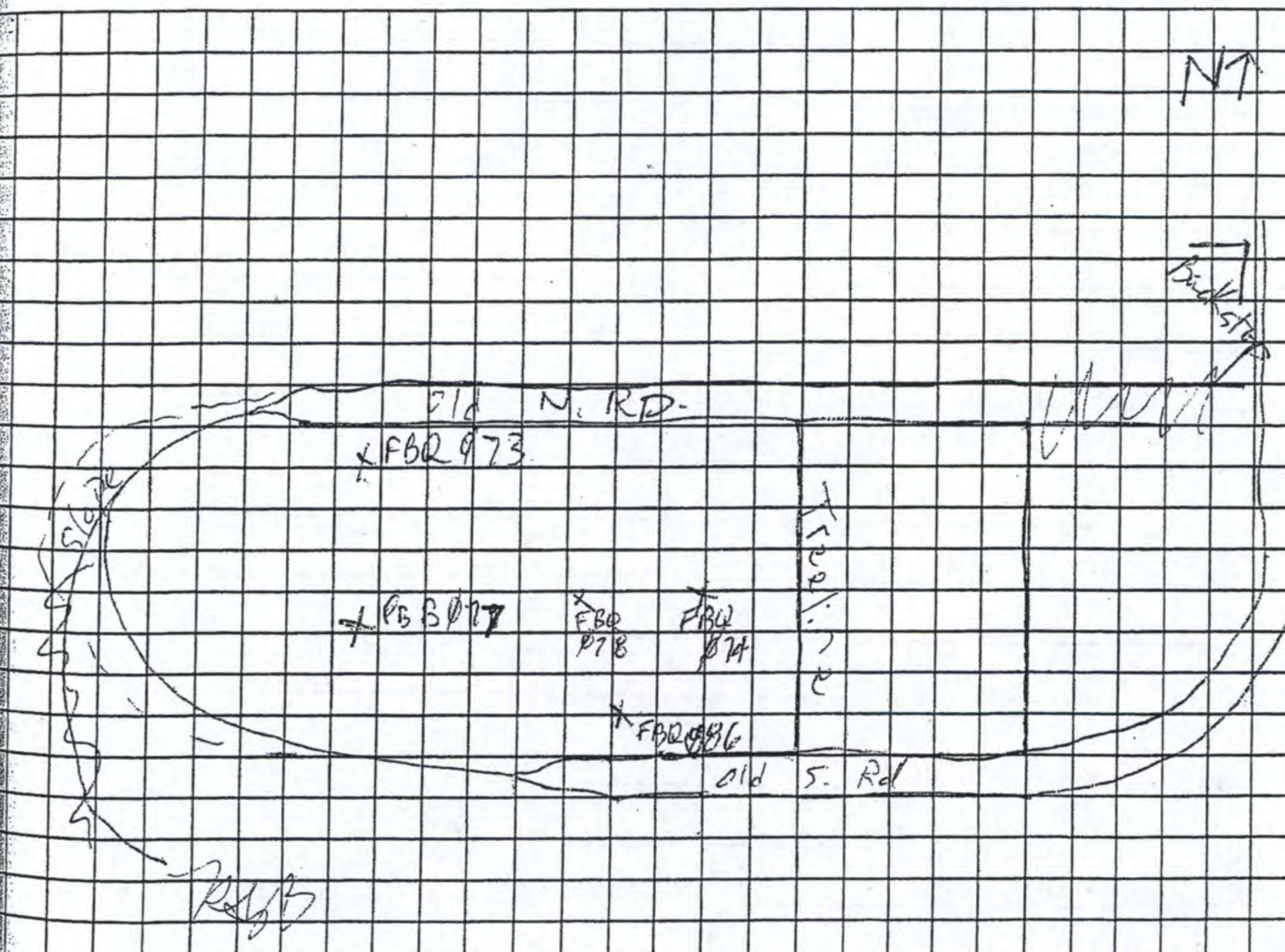
DISTRICT: Louisville		HOLE NUMBER FBQ 086
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS spoon, SS bowl, SS auger	8. HOLE LOCATION: FBQ 086
	9. SURFACE ELEVATION: n/c
	10. DATE STARTED: 111703 — 11. DATE COMPLETED: 11-17-03
12. OVERBURDEN THICKNESS: n/c	15. DEPTH GROUNDWATER ENCOUNTERED: n/c
13. DEPTH DRILLED INTO ROCK: n/c	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/c
14. TOTAL DEPTH OF HOLE: 2'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/c

18. GEOTECHNICAL SAMPLES	DISTURBED		UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See Geo't log						
22. DISPOSITION OF HOLE	BACKFILLED ✓	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

LOCATION SKETCH/COMMENTS

SCALE: no Scale



APPENDIX 2

HTRW DRILLING LOG

HOLE NUMBER: FBK PB6

SHEET 1 OF 1

PROJECT: Fuze & Booster/RVAAP

INSPECTOR: [signature]

ELEV (A)	DEPTH (B)	DESCRIPTION OF MATERIALS C	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	lt brn Sandy silt Orange to grey mottling Trace clay and gravel fine to coarse, loose damp.			FBaas-bbb 0172-00	Organic material leaves, grass, stem, roots
	1 - 1.5	Same as above			FBaa0-bbb 0120-00	
	2	Refusal @ 2'				

SEAS 11/7/03

TASK TEAM ACTIVITY LOG SHEET

193

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11/17/03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Andrea Leon
Randi Bailey
Steve King

Narrative (include time and location):

1350 - Arrive @ FBQ 078. Cleared by S. King.
Begin 0-1' Sample FBQSS078-0155-SO
1357 - 1-3' interval cleared by S. King.
Begin 1-3' sample & split
1358 - Refusal @ 1': No 1-3' sample or split.
1403 - leave site

AG
12-4-03

Daily Weather Conditions: A.M. ______

P.M. Overcast, mid 50s

Recorded By: [signature] QA Checked By: Amy Grunewald

HTRW DRILLING LOG

COMPANY NAME: SpecPro, Inc.	DISTRICT: Louisville 2. DRILL SUBCONTRACTOR:	HOLE NUMBER FBQ Ø78 SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Steve King	6. MANUFACTURERS DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS spoon, SS bowl, SS auger	8. HOLE LOCATION: FBQ Ø78
	9. SURFACE ELEVATION: n/c
	10. DATE STARTED: 1117Ø3 / 11. DATE COMPLETED: 11-17-03
12. OVERBURDEN THICKNESS: n/c	15. DEPTH GROUNDWATER ENCOUNTERED: n/c
13. DEPTH DRILLED INTO ROCK: n/c	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/c
14. TOTAL DEPTH OF HOLE: 1'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/c

18. GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED		19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See art log						
22. DISPOSITION OF HOLE	BACKFILLED ✓	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		

LOCATION SKETCH/COMMENTS See pg 191

SCALE:

HTRW DRILLING LOG

196

PROJECT: Fuze & Booster/RVAAP			INSPECTOR			HOLE NUMBER: FBQ-078 / SHEET 1 OF 1
ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	Med brn silty sand, some clay, moist, some gravel fine to coarse. lobsg			FBQ-078 0.5-1'	Organic material roots, stems, grass leaves
	1	Refusal @ 1'				

AK 12-4-03

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy). 11 17 03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Randi Bailey

Andre Leon

Steve King

Narrative (include time and location):

1405 - Arrive @ FBQ 077. Cleared by S.King Begin 0-1 sample FBQSS-077-0153-SO

1435 - 1-3' interval cleared by S.King, Begin 1-3 sample FBQSS-077-0154-SO

1443 - Leave site

RB 12-4-03

Daily Weather Conditions: A.M.

P.M. Overcast low 50s

Recorded By RLB QA Checked By [illegible]

HTRW DRILLING LOG

DISTRICT: Louisville		HOLE NUMBER FBQ Ø77
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1
3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond	
5. NAME OF DRILLER: Andre Leon	6. MANUFACTURERS DESIGNATION OF DRILL:	
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS spoon, SS bucket, SS bowl	8. HOLE LOCATION: FBQ Ø77	
	9. SURFACE ELEVATION:	
	10. DATE STARTED: 11170 3	11. DATE COMPLETED: 11-17-03
12. OVERBURDEN THICKNESS: n/c	15. DEPTH GROUNDWATER ENCOUNTERED: n/c	
13. DEPTH DRILLED INTO ROCK: n/c	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/c	
14. TOTAL DEPTH OF HOLE: 3'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/c	

18. GEOTECHNICAL SAMPLES	DISTURBED		UNDISTURBED		19. TOTAL NUMBER OF CORE BOXES	
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See act. log						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	✓			[signature]		

LOCATION SKETCH/COMMENTS See pg. 191 SCALE:

HTRW DRILLING LOG

HOLE NUMBER: FBQ [illegible]

SHEET 1 OF 1

PROJECT: Fuze & Booster/RVAAP

INSPECTOR: [illegible]

ELEV (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO (F)	REMARKS (G)
	0	6" lt brn clayey silt trace small gravel fine pebble [illegible] plastic moist 1' [illegible] silt w/increase to some sand & gravel			FBQ-[illegible] [illegible] .0	Organic material Roots grass stems leaves
	1	Same as above Increasing sand with depth to lt brn sandy silt some clay & gravel [illegible] tan sand and SS			FBQ-0??-[illegible] .5	

1111703

TASK TEAM ACTIVITY LOG SHEET

PROJECT NAME: Phase I/II Fuze & Booster Quarry Landfill/Pond DELIVERY ORDER: 0012

Date (mm/dd/yy): 11/17/03 Su M Tu W Th F Sa PAGE 1 OF 1

Task Team Members:

Ronald Bailey

Andre Leon

Steve King

Narrative (include time and location):

1445- Arrive @ FBQ 073. Cleared by S. King. Begin 0-1 sample FBQSS-073-0145-SO

1500- 1-3' interval cleared by S King. Begin sample for 1-3' FBQSO-073-0146-SO

1514- Leave site to haul out equipment.

AG 12-4-03

Daily Weather Conditions: A.M.

P.M. Overcast and 50s

Recorded By [signature] QA Checked By Amy Hemmeward

HTRW DRILLING LOG

DISTRICT: Louisville		HOLE NUMBER FBQ Ø73
1. COMPANY NAME: SpecPro, Inc.	2. DRILL SUBCONTRACTOR:	SHEET 1 OF 1

3. PROJECT: Fuze & Booster/RVAAP	4. LOCATION: Fuze & Booster Quarry Landfill/Pond
5. NAME OF DRILLER: Andre Loon	6. MANUFACTURERS DESIGNATION OF DRILL:
7. SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT: SS Spoon, SS [illegible], SS Auger	8. HOLE LOCATION: FBQ Ø73
	9. SURFACE ELEVATION: n/c
	10. DATE STARTED: 11/17/03 — 11. DATE COMPLETED: 11-17-03
12. OVERBURDEN THICKNESS: n/c	15. DEPTH GROUNDWATER ENCOUNTERED: n/c
13. DEPTH DRILLED INTO ROCK: n/c	16. DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED: n/c
14. TOTAL DEPTH OF HOLE: 3'	17. OTHER WATER LEVEL MEASUREMENTS (SPECIFY): n/c

18. GEOTECHNICAL SAMPLES	DISTURBED		UNDISTURBED	19. TOTAL NUMBER OF CORE BOXES		
20. SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	OTHER (SPECIFY)	OTHER (SPECIFY)	OTHER (SPECIFY)	21. TOTAL CORE RECOVERY %
See COC log						
22. DISPOSITION OF HOLE	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23. SIGNATURE OF INSPECTOR		
	✓			[signature]		

LOCATION SKETCH/COMMENTS See Pg 191 SCALE:

FIELD DRILLING LOG

PROJECT: Fuze & Booster/RVAAP | INSPECTOR [illegible] | HOLE NUMBER: FBQ/4/3 | SHEET 1 OF 1

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ELEV. (A)	DEPTH (B)	DESCRIPTION OF MATERIALS (C)	HEADSPACE SCREENING RESULTS	GEOTECH SAMPLE OR CORE BOX	ANALYTICAL SAMPLE NO. (F)	REMARKS (G)
	0-1	med brn silty sand, loose & gravel change to sandy silt @ 8". Some clay & gravel. Fine to pebble. Moist. Firm.			FBQ 30-072 @1-5-50	Organic Material roots, stems, grass
	1					
	2	Lt brn clayey silt orange & gray mottling firm, moist, trace sand & gravel, fine to coarse. Increase in density and sand with depth to lt brn silt, some clay & sand, trace gravel, stiff			FBQ 30-073 @45-50	
	3	3'				
	4					
	5					
	6					
	7					
	8					
	9					
	10					

[illegible] 11/7/03

APPENDIX A-3

LABORATORY ANALYTICAL DATA

urface Soil Explosives and Propellants Analytical Results S ary Table
Fuze and Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 061	FBQ 062	FBQ 063	FBQ 064	FBQ 065
Sample ID		FBQSS-061-0121-SO	FBQSS-062-0123-SO	FBQSS-063-0125-SO	FBQSS-064-0127-SO	FBQSS-065-0129-SO
Date Collected		11/14/2003	11/17/2003	11/14/2003	11/14/2003	11/17/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
1,3,5-Trinitrobenzene	µg/kg	100U	100U	100U	100U	100U
1,3-Dinitrobenzene	µg/kg	100U	100U	100U	100U	100U
2,4,6-Trinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,6-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2-Amino-4,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Amino-2,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Nitroaniline	µg/kg	N/A	N/A	N/A	N/A	N/A
HMX	µg/kg	200U	200U	280	200U	200U
m-Nitrotoluene	µg/kg	100J	200U	200U	200U	200U
Nitrobenzene	µg/kg	100U	33J	100U	100U	100U
Nitrobenzene	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitrocellulose	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroglycerine	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroguanidine	µg/kg	N/A	N/A	N/A	N/A	N/A
o-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
p-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
RDX	µg/kg	200U	200U	200U	200U	200U
Tetryl	µg/kg	200U	200U	200U	200U	200U

Surface Soil Explosives and Propellants Analytical Results Summary Table
Fuze and Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 066	FBQ 067	FBQ 068	FBQ 069	FBQ 070
Sample ID		FBQSS-066-0131-SO	FBQSS-067-0133-SO	FBQSS-068-0135-SO	FBQSS-069-0137-SO	FBQSS-070-0139-SO
Date Collected		11/17/2003	11/14/2003	11/14/2003	11/13/2003	11/13/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
1,3,5-Trinitrobenzene	µg/kg	100U	100U	100U	100U	100U
1,3-Dinitrobenzene	µg/kg	100U	100U	100U	100U	100U
2,4,6-Trinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,6-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2-Amino-4,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Amino-2,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Nitroaniline	µg/kg	N/A	N/A	N/A	N/A	N/A
HMX	µg/kg	200U	200U	200U	200U	200U
m-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
Nitrobenzene	µg/kg	100U	100U	100U	100U	100U
Nitrobenzene	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitrocellulose	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroglycerine	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroguanidine	µg/kg	N/A	N/A	N/A	N/A	N/A
o-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
p-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
RDX	µg/kg	200U	200U	200U	200U	200U
Tetryl	µg/kg	200U	200U	200U	200U	200U

urface Soil Explosives and Propellants Analytical Results S ary Table
Fuze and Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 071	FBQ 072	FBQ 073	FBQ 074	FBQ 075
Sample ID		FBQSS-071-0141-SO	FBQSS-072-0143-SO	FBQSS-073-0145-SO	FBQSS-074-0147-SO	FBQSS-075-0149-SO
Date Collected		11/17/2003	11/17/2003	11/17/2003	11/11/2003	11/13/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
1,3,5-Trinitrobenzene	µg/kg	100U	100U	100U	100U	100U
1,3-Dinitrobenzene	µg/kg	100U	100U	100U	100U	100U
2,4,6-Trinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,6-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2-Amino-4,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Amino-2,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Nitroaniline	µg/kg	N/A	N/A	N/A	N/A	N/A
HMX	µg/kg	200U	200U	200U	200U	200U
m-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
Nitrobenzene	µg/kg	100U	100U	62J	100U	100U
Nitrobenzene	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitrocellulose	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroglycerine	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroguanidine	µg/kg	N/A	N/A	N/A	N/A	N/A
o-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
p-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
RDX	µg/kg	200U	200U	200U	200U	200U
Tetryl	µg/kg	200U	200U	200U	200U	170J

Surface Soil Explosives and Propellants Analytical Results Summary Table
Fuze and Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 076	FBQ 077	FBQ 078	FBQ 079	FBQ 080
Sample ID		FBQSS-076-0151-SO	FBQSS-077-0153-SO	FBQSS-078-0155-SO	FBQSS-079-0157-SO	FBQSS-080-0159-SO
Date Collected		11/13/2003	11/17/2003	11/17/2003	11/12/2003	11/13/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
1,3,5-Trinitrobenzene	µg/kg	100U	100U	100U	100U	100U
1,3-Dinitrobenzene	µg/kg	100U	100U	100U	100U	100U
2,4,6-Trinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	100U	100U	100U	470U	100U
2,4-Dinitrotoluene	µg/kg	N/A	N/A	N/A	100U	N/A
2,6-Dinitrotoluene	µg/kg	100U	100U	100U	470U	100U
2,6-Dinitrotoluene	µg/kg	N/A	N/A	N/A	100U	N/A
2-Amino-4,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Amino-2,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Nitroaniline	µg/kg	N/A	N/A	N/A	470U	N/A
HMX	µg/kg	200U	200U	200U	200U	200U
m-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
Nitrobenzene	µg/kg	100U	50J	66J	470U	100U
Nitrobenzene	µg/kg	N/A	N/A	N/A	100U	N/A
Nitrocellulose	µg/kg	N/A	N/A	N/A	38	N/A
Nitroglycerine	µg/kg	N/A	N/A	N/A	10000U	N/A
Nitroguanidine	µg/kg	N/A	N/A	N/A	130U	N/A
o-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
p-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
RDX	µg/kg	200U	200U	200U	200U	200U
Tetryl	µg/kg	200U	200U	200U	200U	200U

rface Soil Explosives and Propellants Analytical Results S ary Table
Fuze and Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 081	FBQ 082	FBQ 083	FBQ 084	FBQ 085
Sample ID		FBQSS-081-0161-SO	FBQSS-082-0163-SO	FBQSS-083-0165-SO	FBQSS-084-0167-SO	FBQSS-085-0169-SO
Date Collected		11/11/2003	11/11/2003	11/13/2003	11/13/2003	11/13/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
1,3,5-Trinitrobenzene	µg/kg	100U	100U	100U	100U	100U
1,3-Dinitrobenzene	µg/kg	100U	100U	100U	100U	100U
2,4,6-Trinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	100U	100U	410U	390U	100U
2,4-Dinitrotoluene	µg/kg	N/A	N/A	100U	100U	N/A
2,6-Dinitrotoluene	µg/kg	100U	100U	410U	390U	100U
2,6-Dinitrotoluene	µg/kg	N/A	N/A	100U	100U	N/A
2-Amino-4,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Amino-2,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Nitroaniline	µg/kg	N/A	N/A	410U	390U	N/A
HMX	µg/kg	200U	200U	200U	200U	200U
m-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
Nitrobenzene	µg/kg	70JB	37JB	410U	390U	100U
Nitrobenzene	µg/kg	N/A	N/A	100U	100U	N/A
Nitrocellulose	µg/kg	N/A	N/A	44	20	N/A
Nitroglycerine	µg/kg	N/A	N/A	10000U	10000U	N/A
Nitroguanidine	µg/kg	N/A	N/A	130U	130U	N/A
o-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
p-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
RDX	µg/kg	200U	200U	200U	200U	200U
Tetryl	µg/kg	200U	200U	200U	200U	200U

Surface Soil Explosives and Propellants Analytical Results Summary Table
Fuze and Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 086	FBQ 087	FBQ 088	FBQ 089	FBQ 090
Sample ID		FBQSS-086-0171-SO	FBQSS-087-0173-SO	FBQSS-088-0175-SO	FBQSS-089-0177-SO	FBQSS-090-0179-SO
Date Collected		11/17/2003	11/17/2003	11/11/2003	11/11/2003	11/11/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
1,3,5-Trinitrobenzene	µg/kg	100U	100U	100U	100U	100U
1,3-Dinitrobenzene	µg/kg	100U	100U	100U	100U	100U
2,4,6-Trinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,6-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2-Amino-4,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Amino-2,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Nitroaniline	µg/kg	N/A	N/A	N/A	N/A	N/A
HMX	µg/kg	200U	200U	200U	200U	200U
m-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
Nitrobenzene	µg/kg	100U	100U	100U	100U	100U
Nitrobenzene	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitrocellulose	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroglycerine	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroguanidine	µg/kg	N/A	N/A	N/A	N/A	N/A
o-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
p-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
RDX	µg/kg	200U	200U	200U	200U	200U
Tetryl	µg/kg	200U	200U	200U	200U	200U

urface Soil Explosives and Propellants Analytical Results S ary Table
Fuze and Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 091	FBQ 092	FBQ 093	FBQ 094	FBQ 095
Sample ID		FBQSS-091-0181-SO	FBQSS-092-0183-SO	FBQSS-093-0185-SO	FBQSS-094-0187-SO	FBQSS-095-0189-SO
Date Collected		11/11/2003	11/11/2003	11/11/2003	11/12/2003	11/12/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
1,3,5-Trinitrobenzene	µg/kg	100U	100U	100U	100U	100U
1,3-Dinitrobenzene	µg/kg	100U	100U	100U	100U	100U
2,4,6-Trinitrotoluene	µg/kg	110	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	96J	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,6-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2-Amino-4,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Amino-2,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Nitroaniline	µg/kg	N/A	N/A	N/A	N/A	N/A
HMX	µg/kg	200U	200U	200U	200U	200U
m-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
Nitrobenzene	µg/kg	100U	100U	100U	100U	100U
Nitrobenzene	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitrocellulose	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroglycerine	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroguanidine	µg/kg	N/A	N/A	N/A	N/A	N/A
o-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
p-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
RDX	µg/kg	200U	200U	200U	200U	200U
Tetryl	µg/kg	200U	200U	200U	200U	200U

Surface Soil Explosives and Propellants Analytical Results Summary Table
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Station ID		FBQ 096	FBQ 097	FBQ 098	FBQ 099	FBQ 100
Sample ID		FBQSS-096-0191-SO	FBQSS-097-0193-SO	FBQSS-098-0195-SO	FBQSS-099-0197-SO	FBQSS-100-0199-SO
Date Collected		11/12/2003	11/12/2003	11/12/2003	11/11/2003	11/11/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
1,3,5-Trinitrobenzene	µg/kg	100U	100U	100U	100U	100U
1,3-Dinitrobenzene	µg/kg	100U	100U	100U	100U	100U
2,4,6-Trinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	N/A	N/A	100U	N/A	N/A
2,6-Dinitrotoluene	µg/kg	100U	100U	410U	100U	100U
2,6-Dinitrotoluene	µg/kg	N/A	N/A	100U	N/A	N/A
2-Amino-4,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Amino-2,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Nitroaniline	µg/kg	N/A	N/A	410U	N/A	N/A
HMX	µg/kg	200U	200U	200U	200U	200U
m-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
Nitrobenzene	µg/kg	100U	100U	410U	100U	100U
Nitrobenzene	µg/kg	N/A	N/A	37JB	N/A	N/A
Nitrocellulose	µg/kg	N/A	N/A	64	N/A	N/A
Nitroglycerine	µg/kg	N/A	N/A	10000U	N/A	N/A
Nitroguanidine	µg/kg	N/A	N/A	130U	N/A	N/A
o-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
p-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
RDX	µg/kg	200U	200U	200U	200U	200U
Tetryl	µg/kg	200U	200U	200U	200U	200U

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Station ID		FBQ 061	FBQ 062	FBQ 063	FBQ 064	FBQ 065
Sample ID		FBQSS-061-0121-SO	FBQSS-062-0123-SO	FBQSS-063-0125-SO	FBQSS-064-0127-SO	FBQSS-065-0129-SO
Date Collected		11/14/2003	11/17/2003	11/14/2003	11/14/2003	11/17/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Aluminum	mg/kg	16400	16600	16200	11500	11200
Antimony	mg/kg	0.5BN	0.28UN	0.48BN	0.24BN	0.3UN
Arsenic	mg/kg	12.7	11N	9.8	7.5	12.5N
Barium	mg/kg	78.8N	90.3	96.8N	66.5N	55.7
Beryllium	mg/kg	0.62E	0.73	0.73E	0.57E	0.52
Cadmium	mg/kg	0.03U*	0.07	0.03U*	0.03U*	0.07B
Calcium	mg/kg	385	553	471	211	246
Chromium	mg/kg	22.8N	22.9	21.4N	14.6N	14.3
Chromium, Hexavalent	mg/kg	N/A	N/A	N/A	N/A	N/A
Cobalt	mg/kg	9.3	9.5	10.9	10.4	10.2
Copper	mg/kg	21.6	14.6	14.8	10.1	11.1
Iron	mg/kg	27600	25100	24700	16500	18800
Lead	mg/kg	21.3	15.8	18.5	17	13.7
Magnesium	mg/kg	2760N	3210N	2900N	1850N	2170N
Manganese	mg/kg	672	634	764	716	537
Mercury	mg/kg	0.03B	0.02B	0.03B	0.03B	0.01B
Nickel	mg/kg	17.8	20.7	18.8	15	16.2
Potassium	mg/kg	1480N	1460N	1350N	755N	967N
Selenium	mg/kg	0.68B	0.3U	0.67B	0.51B	0.31U
Silver	mg/kg	0.05U	0.06U	0.05U	0.05U	0.06U
Sodium	mg/kg	74.4	71.2	83.3	69.3	52.3B
Thallium	mg/kg	0.42U	2.1	0.44U	0.41U	1.7B
Vanadium	mg/kg	30	28.6	28.2	22.5	21.3
Zinc	mg/kg	59	55	66.9	55	46.9

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Station ID		FBQ 066	FBQ 067	FBQ 068	FBQ 069	FBQ 070
Sample ID		FBQSS-066-0131-SO	FBQSS-067-0133-SO	FBQSS-068-0135-SO	FBQSS-069-0137-SO	FBQSS-070-0139-SO
Date Collected		11/17/2003	11/14/2003	11/14/2003	11/13/2003	11/13/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Aluminum	mg/kg	16100	12400	11700	3470	5120
Antimony	mg/kg	0.3UN	0.22BN	0.42BN	0.35BN	0.25BN
Arsenic	mg/kg	11.1N	17.8	9.6	6.2	8.4
Barium	mg/kg	93.3	49.6N	72.3N	37.7N	34.4N
Beryllium	mg/kg	0.75	0.58E	0.58E	0.47E	0.45E
Cadmium	mg/kg	0.25	0.02U*	0.02U*	0.02U*	0.02U*
Calcium	mg/kg	613	307	1160	924	1420
Chromium	mg/kg	22	18.5N	16.8N	10N	10.4N
Chromium, Hexavalent	mg/kg	N/A	N/A	N/A	N/A	N/A
Cobalt	mg/kg	10.4	8.4	10.8	5.3	6.1
Copper	mg/kg	18.8	23.7	9.8	6.4	9.6
Iron	mg/kg	24400	27800	20600	25800	21100
Lead	mg/kg	17.1	13.7	14.4	11.8	11.6
Magnesium	mg/kg	2990N	2680N	2050N	716N	1220N
Manganese	mg/kg	834	265	709	489	396
Mercury	mg/kg	0.01U	0.02B	0.03B	0.01U	0.01U
Nickel	mg/kg	18.9	20.5	14.8	11.2	13
Potassium	mg/kg	1390N	1310N	831N	674N	813N
Selenium	mg/kg	0.32U	0.42B	0.45B	0.5B	0.28B
Silver	mg/kg	0.06U	0.04U	0.04U	0.04U	0.04U
Sodium	mg/kg	64.6	69.9	68.6	49.2	56.7
Thallium	mg/kg	2.3	0.37U	0.39U	0.41B	0.37U
Vanadium	mg/kg	28.6	21.8	26.1	10	11.3
Zinc	mg/kg	70.1	58.3	47	55.8	58.4

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Station ID		FBQ 071	FBQ 072	FBQ 073	FBQ 074	FBQ 075
Sample ID		FBQSS-071-0141-SO	FBQSS-072-0143-SO	FBQSS-073-0145-SO	FBQSS-074-0147-SO	FBQSS-075-0149-SO
Date Collected		11/17/2003	11/17/2003	11/17/2003	11/11/2003	11/13/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Aluminum	mg/kg	12100	8250	14400	13900	13100
Antimony	mg/kg	0.28UN	0.25UN	0.28UN	0.29UN	0.64BN
Arsenic	mg/kg	18.8N	8.4N	11.4N	18.7	10.9
Barium	mg/kg	40.6	46.4	72.5	53N	104N
Beryllium	mg/kg	0.7	0.92	0.63	0.77	0.7E
Cadmium	mg/kg	0.01U	0.87	0.46	0.01U	0.94*
Calcium	mg/kg	413	1650	1510	358	531
Chromium	mg/kg	16.7	16.4	20.1	18.8N	18.1N
Chromium, Hexavalent	mg/kg	N/A	N/A	N/A	N/A	N/A
Cobalt	mg/kg	13	10.9	10.7	8.9	10.3
Copper	mg/kg	21.6	68.6	49.7	24.6	28.5
Iron	mg/kg	26800	30100	23000	30600	22800
Lead	mg/kg	17.1	20.3	13.5	17.1	14.5
Magnesium	mg/kg	2570N	2180N	3130N	2880N	2180N
Manganese	mg/kg	368	609	408	312	880
Mercury	mg/kg	0.02B	0.01U	0.01U	0.01U	0.02B
Nickel	mg/kg	21.6	19.2	18.8	21.4	18.6
Potassium	mg/kg	1270N	1040N	1300N	1370N	1210N
Selenium	mg/kg	0.3U	0.27U	0.3U	0.31U	0.48B
Silver	mg/kg	0.06U	0.05U	0.06U	0.06U	0.04U
Sodium	mg/kg	63	55.3	70.9	73.5	100
Thallium	mg/kg	2	2.6	1.8B	0.49U	0.38U
Vanadium	mg/kg	20.4	16.4	24.3	23.5N	22.4
Zinc	mg/kg	61.8	114	53.6	59.7	77.1

? Suface Soil Inorganics Analytical Results Summary Table
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Station ID		FBQ 076	FBQ 077	FBQ 078	FBQ 079	FBQ 080
Sample ID		FBQSS-076-0151-SO	FBQSS-077-0153-SO	FBQSS-078-0155-SO	FBQSS-079-0157-SO	FBQSS-080-0159-SO
Date Collected		11/13/2003	11/17/2003	11/17/2003	11/12/2003	11/13/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Aluminum	mg/kg	12700	16000	8480	16500	3740
Antimony	mg/kg	0.31UN	0.27UN	0.28UN	0.31B	0.28UN
Arsenic	mg/kg	11.4	12.1N	16.8N	13.5	5.7
Barium	mg/kg	80.7N	72.2	63	81N	29.8N
Beryllium	mg/kg	0.62	0.62	0.56	0.78	0.6
Cadmium	mg/kg	0.19	0.05B	0.11	0.02U	0.17
Calcium	mg/kg	944	970	1330	814	197
Chromium	mg/kg	15.3N	21.4	13.4	23.8	7.5N
Chromium, Hexavalent	mg/kg	N/A	N/A	N/A	3.4U	N/A
Cobalt	mg/kg	9	10	8.7	12.2	5.8
Copper	mg/kg	13.8	27.1	19.5	22N	6
Iron	mg/kg	21100	24500	21400	30400	24800
Lead	mg/kg	13.6	12.7	11.8	18.5N	24.7
Magnesium	mg/kg	2200N	3100N	2610N	3410	575N
Manganese	mg/kg	607	347	374	524	625
Mercury	mg/kg	0.02B	0.01U	0.04B	0.02B	0.02B
Nickel	mg/kg	16.3	17.9	28.2	23.5	9.7
Potassium	mg/kg	1010N	1480N	1100N	1700N	578N
Selenium	mg/kg	0.5B	0.29U	0.3U	0.68B	0.3U
Silver	mg/kg	0.06U	0.06U	0.06U	0.04U	0.06U
Sodium	mg/kg	73.7	66.5	76	43.8	56.5
Thallium	mg/kg	0.51U	1.7B	2	1.1B	0.47U
Vanadium	mg/kg	22N	27	15.3	31.6	9.7N
Zinc	mg/kg	57.1	49.7	59.5	59N	55

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Station ID		FBQ 081	FBQ 082	FBQ 083	FBQ 084	FBQ 085
Sample ID		FBQSS-081-0161-SO	FBQSS-082-0163-SO	FBQSS-083-0165-SO	FBQSS-084-0167-SO	FBQSS-085-0169-SO
Date Collected		11/11/2003	11/11/2003	11/13/2003	11/13/2003	11/13/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Aluminum	mg/kg	7380	6740	13500	7320	13700
Antimony	mg/kg	0.28BN	0.45BN	0.25B	0.18U	0.27BN
Arsenic	mg/kg	14.1	11.3	13.1	7.9	12.3
Barium	mg/kg	144	49.3	61.5N	44.7N	71.9N
Beryllium	mg/kg	0.73	0.61	0.43	0.54	0.57E
Cadmium	mg/kg	0.2	0.13	0.02U	0.02U	0.03U*
Calcium	mg/kg	6380	4420	176	239	497
Chromium	mg/kg	11.3	10.4	18.3	11.6	21.9N
Chromium, Hexavalent	mg/kg	N/A	N/A	5.8U	2.9U	N/A
Cobalt	mg/kg	6.7	6.7	8.4	8.6	9.3
Copper	mg/kg	14	14.1	13.6N	15.7N	15.3
Iron	mg/kg	21400	18300	26100	23000	25000
Lead	mg/kg	19.1	15.1	12.7N	13.8N	15.1
Magnesium	mg/kg	2180N	1870N	2260	1380	2250N
Manganese	mg/kg	635	383	437	519	489
Mercury	mg/kg	0.01B	0.01B	0.01B	0.01U	0.02B
Nickel	mg/kg	14.9	15.2	14.9	14.2	14.8
Potassium	mg/kg	1020N	914N	1100N	881N	1160N
Selenium	mg/kg	0.27U	0.45B	0.71B	0.47B	0.57B
Silver	mg/kg	0.05U	0.05U	0.04U	0.03U	0.05U
Sodium	mg/kg	102	70.2	51.6	30.4	76.2
Thallium	mg/kg	0.43U	0.42U	0.69B	0.76B	0.41U
Vanadium	mg/kg	12.4	11.8	25.7	14.4	27.5
Zinc	mg/kg	78.5	60.7	48.8N	72.4N	44.2

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Station ID		FBQ 086	FBQ 087	FBQ 088	FBQ 089	FBQ 090
Sample ID		FBQSS-086-0171-SO	FBQSS-087-0173-SO	FBQSS-088-0175-SO	FBQSS-089-0177-SO	FBQSS-090-0179-SO
Date Collected		11/17/2003	11/17/2003	11/11/2003	11/11/2003	11/11/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Aluminum	mg/kg	16200	21000	17600	3990	4080
Antimony	mg/kg	0.3UN	0.34BN	0.23BN	0.3UN	0.28UN
Arsenic	mg/kg	20.5N	17.7	12.1	8.9	7.3
Barium	mg/kg	55.7	79.8	68.5N	25.7	21.9
Beryllium	mg/kg	0.73	0.9	0.67	0.48	0.42
Cadmium	mg/kg	0.05B	0.05B	0.05	0.09	0.07B
Calcium	mg/kg	548	575	939	425	252
Chromium	mg/kg	21.7	27.2	21.6N	8.5	7.8
Chromium, Hexavalent	mg/kg	N/A	N/A	N/A	N/A	N/A
Cobalt	mg/kg	8	9.7	8.1	5.4	4.7
Copper	mg/kg	24	27.2	23.2	8.5	8.7
Iron	mg/kg	30400	34700	26500	20100	15200
Lead	mg/kg	15.5	15.6	13.1	14.6	16.9
Magnesium	mg/kg	3310N	4290N	2920N	771N	837N
Manganese	mg/kg	217	243	204	320	251
Mercury	mg/kg	0.06B	0.02B	0.02B	0.03B	0.02B
Nickel	mg/kg	21.8	26.6	17.5	9.8	9.2
Potassium	mg/kg	1600N	2010N	1270N	777N	614N
Selenium	mg/kg	0.32U	0.51B	0.79B	0.5B	0.37B
Silver	mg/kg	0.06U	0.06U	0.04U	0.06U	0.06U
Sodium	mg/kg	70.2	78.9	68	52.2B	49.1B
Thallium	mg/kg	2.4	0.45U	0.36U	0.51U	0.47U
Vanadium	mg/kg	27.6	34.1	33.8N	10.6	9.3
Zinc	mg/kg	57.1	65.5	49.3	55.1	57.8

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Station ID		FBQ 091	FBQ 092	FBQ 093	FBQ 094	FBQ 095
Sample ID		FBQSS-091-0181-SO	FBQSS-092-0183-SO	FBQSS-093-0185-SO	FBQSS-094-0187-SO	FBQSS-095-0189-SO
Date Collected		11/11/2003	11/11/2003	11/11/2003	11/12/2003	11/12/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Aluminum	mg/kg	10100	4510	4870	12900	14300
Antimony	mg/kg	0.52BN	0.29UN	0.27UN	0.31UN	0.36BN
Arsenic	mg/kg	12.3	6.7	10.7	8.3	10.3
Barium	mg/kg	96.3	30.8	29.3	88.6N	97.6N
Beryllium	mg/kg	1	0.61	0.53	0.75	0.86
Cadmium	mg/kg	0.3	0.2	0.19	0.06B	0.18
Calcium	mg/kg	9250	2860	1510	153	743
Chromium	mg/kg	19.6	8.3	9.9	14.5N	429N
Chromium, Hexavalent	mg/kg	N/A	N/A	N/A	N/A	N/A
Cobalt	mg/kg	7.2	4.4	6.2	11.8	12.3
Copper	mg/kg	18.5	7.6	10.2	8.9	10.4
Iron	mg/kg	20900	17800	23200	18600	19700
Lead	mg/kg	49.5	19.1	20.3	18.3	18.4
Magnesium	mg/kg	2670N	1050N	1370N	1850N	2150N
Manganese	mg/kg	737	329	414	1000	1300
Mercury	mg/kg	0.03B	0.02B	0.03B	0.03B	0.02B
Nickel	mg/kg	14.8	9.2	13.2	14.3	16.7
Potassium	mg/kg	1080N	692N	858N	796N	878N
Selenium	mg/kg	0.93B	0.53B	0.83B	0.57B	0.65U
Silver	mg/kg	0.06U	0.06U	0.06U	0.17B	0.14U
Sodium	mg/kg	118	57.9	52.1	114	80.6
Thallium	mg/kg	0.48U	0.49U	0.45U	0.52U	1U
Vanadium	mg/kg	16.9	9.2	11.3	23.1N	23.5N
Zinc	mg/kg	69.3	63.1	69.5	49.7	60.7

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Station ID		FBQ 096	FBQ 097	FBQ 098	FBQ 099	FBQ 100
Sample ID		FBQSS-096-0191-SO	FBQSS-097-0193-SO	FBQSS-098-0195-SO	FBQSS-099-0197-SO	FBQSS-100-0199-SO
Date Collected		11/12/2003	11/12/2003	11/12/2003	11/11/2003	11/11/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Composite	Composite	Composite	Composite	Composite
Aluminum	mg/kg	12200	12600	13200	3530	6340
Antimony	mg/kg	0.3UN	0.35BN	0.33B	0.29UN	0.35BN
Arsenic	mg/kg	10	9.1	8.5	7	11.9
Barium	mg/kg	137N	86.6N	64.2N	25.4	34.4
Beryllium	mg/kg	0.82	0.67	0.42	0.81	0.48
Cadmium	mg/kg	0.12	0.08	0.02U	0.23	0.12
Calcium	mg/kg	279	196	326	663	671
Chromium	mg/kg	15N	18.9N	16.3	9.4	13.5
Chromium, Hexavalent	mg/kg	N/A	N/A	3U	N/A	N/A
Cobalt	mg/kg	11.3	10.9	10.7	4.6	6.5
Copper	mg/kg	11.5	8.8	9.8N	7.6	12.2
Iron	mg/kg	20200	18600	20500	26700	19300
Lead	mg/kg	19.4	14.5	11.7N	15.2	16.7
Magnesium	mg/kg	2090N	1680N	2090	757N	1390N
Manganese	mg/kg	1200	958	456	271	334
Mercury	mg/kg	0.02B	0.02B	0.02B	0.02B	0.02B
Nickel	mg/kg	16.2	15.8	14.6	9.4	13.7
Potassium	mg/kg	930N	739N	998N	694N	1010N
Selenium	mg/kg	0.64U	0.75B	0.5B	0.73B	0.32U
Silver	mg/kg	0.14U	0.13B	0.04U	0.06U	0.06U
Sodium	mg/kg	102	101	54.3	47.7B	59.6
Thallium	mg/kg	1U	0.49U	0.61B	0.48U	0.5U
Vanadium	mg/kg	21.2N	23.2N	25.6	12.3	12.8
Zinc	mg/kg	51.5	51.8	51.7N	82.9	63.5

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Station ID		FBQ 032	FBQ 045	FBQ 060	FBQ 079	FBQ 083
Sample ID		FBQSS-032-0063-SO	FBQSS-045-0089-SO	FBQSS-060-0119-SO	FBQSS-079-0157-SO	FBQSS-083-0165-SO
Date Collected		10/8/2003	10/13/2003	10/13/2003	11/12/2003	11/13/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Grab	Grab	Grab	Grab	Grab
Analyte	Units					
1,1- Biphenyl	µg/kg	420U	380U	430U	470U	410U
2,2-Oxybis(1-Chloroprop	µg/kg	420U	380U	430U	470U	410U
2,4,5-Trichlorophenol	µg/kg	420U	380U	430U	470U	410U
2,4,6-Trichlorophenol	µg/kg	420U	380U	430U	470U	410U
2,4-Dichlorophenol	µg/kg	420U	380U	430U	470U	410U
2,4-Dimethylphenol	µg/kg	420U	380U	430U	470U	410U
2,4-Dinitrophenol	µg/kg	840U	760U	870U	940U	820U
2,4-Dinitrotoluene	µg/kg	420U	380U	430U	470U	410U
2,4-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,6-Dinitrotoluene	µg/kg	420U	380U	430U	470U	410U
2,6-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2-Chloronaphthalene	µg/kg	420U	380U	430U	470U	410U
2-Chlorophenol	µg/kg	420U	380U	430U	470U	410U
2-Methylnaphthalene	µg/kg	420U	380U	430U	470U	410U
2-methylphenol	µg/kg	420U	380U	430U	470U	410U
2-Nitroaniline	µg/kg	420U	380U	430U	470U	410U
2-Nitrophenol	µg/kg	420U	380U	430U	470U	410U
3,3-Dichlorobenzidine	µg/kg	840U	760U	870U	940U	820U
3-Nitroaniline	µg/kg	420U	380U	430U	470U	410U
4,6-dinitro-2-methyl phen	µg/kg	840U	760U	870U	940U	820U
4-Bromophenyl-phenylet	µg/kg	420U	380U	430U	470U	410U
4-chloro-3-methylphenol	µg/kg	420U	380U	430U	470U	410U
4-Chloroaniline	µg/kg	420U	380U	430U	470U	410U
4-Chlorophenyl Phenyl E	µg/kg	420U	380U	430U	470U	410U
4-methylphenol	µg/kg	420U	380U	430U	470U	410U

↓ Surface Soil SVOCs Analytical Results Summary Table

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Station ID		FBQ 032	FBQ 045	FBQ 060	FBQ 079	FBQ 083
Sample ID		FBQSS-032-0063-SO	FBQSS-045-0089-SO	FBQSS-060-0119-SO	FBQSS-079-0157-SO	FBQSS-083-0165-SO
Date Collected		10/8/2003	10/13/2003	10/13/2003	11/12/2003	11/13/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Grab	Grab	Grab	Grab	Grab
Analyte	Units					
4-Nitroaniline	µg/kg	420U	380U	430U	470U	410U
4-Nitrophenol	µg/kg	840U	760U	870U	940U	820U
Acenaphthene	µg/kg	420U	380U	430U	470U	410U
Acenaphthylene	µg/kg	420U	380U	430U	470U	410U
Acetophenone	µg/kg	420U	380U	430U	470U	410U
Anthracene	µg/kg	420U	380U	430U	470U	410U
Atrazine	µg/kg	420U	380U	430U	470U	410U
Benzaldehyde	µg/kg	420U	380U	430U	470U	410U
Benzo(a)anthracene	µg/kg	420U	380U	190J	470U	410U
Benzo(a)pyrene	µg/kg	420U	380U	84J	470U	410U
Benzo(b)fluoranthene	µg/kg	420U	380U	260J	470U	410U
Benzo(g,h,i)perylene	µg/kg	420U	380U	430U	470U	410U
Benzo(k)fluoranthene	µg/kg	420U	380U	85J	470U	410U
Benzyl Butyl Phthalate	µg/kg	420U	380U	430U	470U	410U
bis(2-chloroethoxy) meth	µg/kg	420U	380U	430U	470U	410U
bis(2-chloroethyl) ether	µg/kg	420U	380U	430U	470U	410U
bis(2-ethylhexyl) phthala	µg/kg	420U	380U	430U	470U	410U
Caprolactam	µg/kg	420U	380U	430U	470U	410U
Carbazole	µg/kg	420U	380U	430U	470U	410U
Chrysene	µg/kg	420U	380U	370J	470U	410U
Dibenz(a,h)Anthracene	µg/kg	420U	380U	430U	470U	410U
Dibenzofuran	µg/kg	420U	380U	430U	470U	410U
Diethyl Phthalate	µg/kg	420U	380U	430U	470U	410U
Dimethyl Phthalate	µg/kg	420U	380U	430U	470U	410U
di-n-Butyl Phthalate	µg/kg	240J	380U	430U	470U	410U

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Station ID		FBQ 032	FBQ 045	FBQ 060	FBQ 079	FBQ 083
Sample ID		FBQSS-032-0063-SO	FBQSS-045-0089-SO	FBQSS-060-0119-SO	FBQSS-079-0157-SO	FBQSS-083-0165-SO
Date Collected		10/8/2003	10/13/2003	10/13/2003	11/12/2003	11/13/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Grab	Grab	Grab	Grab	Grab
Analyte	Units					
di-n-Octyl Phthalate	µg/kg	420U	380U	430U	470U	410U
Fluoranthene	µg/kg	420U	380U	870	470U	410U
Fluorene	µg/kg	420U	380U	430U	470U	410U
Hexachlorobenzene	µg/kg	420U	380U	430U	470U	410U
Hexachlorobutadiene	µg/kg	420U	380U	430U	470U	410U
Hexachlorocyclopentadie	µg/kg	420U	380U	430U	470U	410U
Hexachloroethane	µg/kg	420U	380U	430U	470U	410U
Indeno(1,2,3-c,d)Pyrene	µg/kg	420U	380U	430U	470U	410U
Isophorone	µg/kg	420U	380U	430U	470U	410U
Naphthalene	µg/kg	420U	380U	430U	470U	410U
Nitrobenzene	µg/kg	420U	380U	430U	470U	410U
Nitrobenzene	µg/kg	100U	100U	100U	100U	100U
n-Nitrosodi-n-Propylamir	µg/kg	420U	380U	430U	470U	410U
n-Nitrosodiphenylamine	µg/kg	420U	380U	430U	470U	410U
Pentachlorophenol	µg/kg	840U	760U	870U	940U	820U
Phenanthrene	µg/kg	420U	380U	430U	470U	410U
Phenol	µg/kg	420U	380U	430U	470U	410U
Pyrene	µg/kg	420U	380U	640	470U	410U

Surface Soil SVOCs Analytical Results Summary Table
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Station ID		FBQ 084	FBQ 098
Sample ID		FBQSS-084-0167-SO	FBQSS-098-0195-SO
Date Collected		11/13/2003	11/12/2003
Depth (ft)		0-1'	0-1'
Sample Type		Grab	Grab
Analyte	Units		
1,1- Biphenyl	µg/kg	390U	410U
2,2-Oxybis(1-Chloroprop	µg/kg	390U	410U
2,4,5-Trichlorophenol	µg/kg	390U	410U
2,4,6-Trichlorophenol	µg/kg	390U	410U
2,4-Dichlorophenol	µg/kg	390U	410U
2,4-Dimethylphenol	µg/kg	390U	410U
2,4-Dinitrophenol	µg/kg	780U	810U
2,4-Dinitrotoluene	µg/kg	390U	410U
2,4-Dinitrotoluene	µg/kg	100U	100U
2,6-Dinitrotoluene	µg/kg	390U	410U
2,6-Dinitrotoluene	µg/kg	100U	100U
2-Chloronaphthalene	µg/kg	390U	410U
2-Chlorophenol	µg/kg	390U	410U
2-Methylnaphthalene	µg/kg	390U	410U
2-methylphenol	µg/kg	390U	410U
2-Nitroaniline	µg/kg	390U	410U
2-Nitrophenol	µg/kg	390U	410U
3,3-Dichlorobenzidine	µg/kg	780U	810U
3-Nitroaniline	µg/kg	390U	410U
4,6-dinitro-2-methyl pher	µg/kg	780U	810U
4-Bromophenyl-phenylet	µg/kg	390U	410U
4-chloro-3-methylphenol	µg/kg	390U	410U
4-Chloroaniline	µg/kg	390U	410U
4-Chlorophenyl Phenyl E	µg/kg	390U	410U
4-methylphenol	µg/kg	390U	410U

Station ID		FBQ 084	FBQ 098
Sample ID		FBQSS-084-0167-SO	FBQSS-098-0195-SO
Date Collected		11/13/2003	11/12/2003
Depth (ft)		0-1'	0-1'
Sample Type		Grab	Grab
Analyte	Units		
4-Nitroaniline	µg/kg	390U	410U
4-Nitrophenol	µg/kg	780U	810U
Acenaphthene	µg/kg	390U	410U
Acenaphthylene	µg/kg	390U	410U
Acetophenone	µg/kg	390U	410U
Anthracene	µg/kg	390U	410U
Atrazine	µg/kg	390U	410U
Benzaldehyde	µg/kg	390U	410U
Benzo(a)anthracene	µg/kg	390U	410U
Benzo(a)pyrene	µg/kg	390U	410U
Benzo(b)fluoranthene	µg/kg	390U	410U
Benzo(g,h,i)perylene	µg/kg	390U	410U
Benzo(k)fluoranthene	µg/kg	390U	410U
Benzyl Butyl Phthalate	µg/kg	390U	410U
bis(2-chloroethoxy) meth	µg/kg	390U	410U
bis(2-chloroethyl) ether	µg/kg	390U	410U
bis(2-ethylhexyl) phthala	µg/kg	390U	150J
Caprolactam	µg/kg	390U	410U
Carbazole	µg/kg	390U	410U
Chrysene	µg/kg	390U	410U
Dibenz(a,h)Anthracene	µg/kg	390U	410U
Dibenzofuran	µg/kg	390U	410U
Diethyl Phthalate	µg/kg	390U	5600
Dimethyl Phthalate	µg/kg	390U	410U
di-n-Butyl Phthalate	µg/kg	390U	410U

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Station ID		FBQ 084	FBQ 098
Sample ID		FBQSS-084-0167-SO	FBQSS-098-0195-SO
Date Collected		11/13/2003	11/12/2003
Depth (ft)		0-1'	0-1'
Sample Type		Grab	Grab
Analyte	Units		
di-n-Octyl Phthalate	µg/kg	390U	410U
Fluoranthene	µg/kg	390U	410U
Fluorene	µg/kg	390U	410U
Hexachlorobenzene	µg/kg	390U	410U
Hexachlorobutadiene	µg/kg	390U	410U
Hexachlorocyclopentadie	µg/kg	390U	410U
Hexachloroethane	µg/kg	390U	410U
Indeno(1,2,3-c,d)Pyrene	µg/kg	390U	410U
Isophorone	µg/kg	390U	410U
Naphthalene	µg/kg	390U	410U
Nitrobenzene	µg/kg	390U	410U
Nitrobenzene	µg/kg	100U	37JB
n-Nitrosodi-n-Propylamir	µg/kg	390U	410U
n-Nitrosodiphenylamine	µg/kg	390U	410U
Pentachlorophenol	µg/kg	780U	810U
Phenanthrene	µg/kg	390U	410U
Phenol	µg/kg	390U	410U
Pyrene	µg/kg	390U	410U

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Station ID		FBQ 032	FBQ 045	FBQ 060	FBQ 079	FBQ 083
Sample ID		FBQSS-032-0063-SO	FBQSS-045-0089-SO	FBQSS-060-0119-SO	FBQSS-079-0157-SO	FBQSS-083-0165-SO
Date Collected		10/8/2003	10/13/2003	10/13/2003		11/13/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Grab	Grab	Grab	Grab	Grab
Analyte	Units					
1,1,1-Trichloroethane	µg/kg	6.3U	5.7U	6.5U	6.1U	13
1,1,2,2-Tetrachloroethane	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
1,1,2-Trichloroethane	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
1,1-Dichloroethane	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
1,1-Dichloroethene	µg/kg	6.3U	5.7U	6.5U	6.1U	7.4
1,2,4-Trichlorobenzene	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
1,2-Dibromo-3-Chloropropan	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
1,2-Dichlorobenzene	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
1,2-Dichloroethane	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
1,2-Dichloropropane	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
1,3-Dichlorobenzene	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
1,4-Dichlorobenzene	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
2-Butanone	µg/kg	13U	11U	13U	12U	12U
2-Hexanone	µg/kg	13U	11U	13U	12U	12U
4-Methyl-2-Pentanone	µg/kg	13U	11U	13U	12U	12U
Acetone	µg/kg	9.8JB	11U	9.6JB	6.6JB	9.7JB
Benzene	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Bromoform	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Bromomethane	µg/kg	13U	11U	13U	12U	12U
Carbon Disulfide	µg/kg	6.3U	5.7U	69	6.1U	6.1U
Carbon Tetrachloride	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Chlorobenzene	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Chloroethane	µg/kg	13U	11U	13U	12U	12U
Chloroform	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Chloromethane	µg/kg	13U	11U	13U	12U	12U

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Station ID		FBQ 032	FBQ 045	FBQ 060	FBQ 079	FBQ 083
Sample ID		FBQSS-032-0063-SO	FBQSS-045-0089-SO	FBQSS-060-0119-SO	FBQSS-079-0157-SO	FBQSS-083-0165-SO
Date Collected		10/8/2003	10/13/2003	10/13/2003		11/13/2003
Depth (ft)		0-1'	0-1'	0-1'	0-1'	0-1'
Sample Type		Grab	Grab	Grab	Grab	Grab
Analyte	Units					
cis-1,2-Dichloroethene	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
cis-1,3-Dichloropropene	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Cyclohexane	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Dibromochloromethane	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Dichlorodifluoromethane	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Ethylbenzene	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Ethylene Dibromide	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Freon 113	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Isopropylbenzene	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
m,p-Xylenes	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Methyl Acetate	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Methylcyclohexane	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Methylene Chloride	µg/kg	9.7JB	5.6JB	10JB	12JB	12B
o-Xylene	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Styrene	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
tert-butyl methyl ether	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Tetrachloroethylene	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Toluene	µg/kg	6.3U	5.7U	6.5U	6.1U	2J
trans-1,2-dichloroethene	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
trans-1,3-dichloropropene	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Trichloroethene	µg/kg	4.1J	5.7U	6.5U	6.1U	6.1U
Trichlorofluoromethane	µg/kg	6.3U	5.7U	6.5U	6.1U	6.1U
Vinyl Chloride	µg/kg	13U	11U	13U	12U	12U

Station ID		FBQ 084	FBQ 098
Sample ID		FBQSS-084-0167-SO	FBQSS-098-0195-SO
Date Collected		11/13/2003	11/12/2003
Depth (ft)		0-1'	0-1'
Sample Type		Grab	Grab
Analyte	Units		
1,1,1-Trichloroethane	µg/kg	5.9U	6.9U
1,1,2,2-Tetrachloroethane	µg/kg	5.9U	6.9U
1,1,2-Trichloroethane	µg/kg	5.9U	6.9U
1,1-Dichloroethane	µg/kg	5.9U	6.9U
1,1-Dichloroethene	µg/kg	5.9U	6.9U
1,2,4-Trichlorobenzene	µg/kg	5.9U	6.9U
1,2-Dibromo-3-Chloropropan	µg/kg	5.9U	6.9U
1,2-Dichlorobenzene	µg/kg	5.9U	6.9U
1,2-Dichloroethane	µg/kg	5.9U	6.9U
1,2-Dichloropropane	µg/kg	5.9U	6.9U
1,3-Dichlorobenzene	µg/kg	5.9U	6.9U
1,4-Dichlorobenzene	µg/kg	5.9U	6.9U
2-Butanone	µg/kg	12U	14U
2-Hexanone	µg/kg	12U	14U
4-Methyl-2-Pentanone	µg/kg	12U	14U
Acetone	µg/kg	10JB	7.4JB
Benzene	µg/kg	5.9U	6.9U
Bromoform	µg/kg	5.9U	6.9U
Bromomethane	µg/kg	12U	14U
Carbon Disulfide	µg/kg	5.9U	6.9U
Carbon Tetrachloride	µg/kg	5.9U	6.9U
Chlorobenzene	µg/kg	5.9U	6.9U
Chloroethane	µg/kg	12U	14U
Chloroform	µg/kg	5.9U	6.9U
Chloromethane	µg/kg	12U	14U

Surface Soil VOCs Analytical REsults Summary Table
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Station ID		FBQ 084	FBQ 098
Sample ID		FBQSS-084-0167-SO	FBQSS-098-0195-SO
Date Collected		11/13/2003	11/12/2003
Depth (ft)		0-1'	0-1'
Sample Type		Grab	Grab
Analyte	Units		
cis-1,2-Dichloroethene	µg/kg	5.9U	6.9U
cis-1,3-Dichloropropene	µg/kg	5.9U	6.9U
Cyclohexane	µg/kg	5.9U	6.9U
Dibromochloromethane	µg/kg	5.9U	6.9U
Dichlorodifluoromethane	µg/kg	5.9U	6.9U
Ethylbenzene	µg/kg	5.9U	6.9U
Ethylene Dibromide	µg/kg	5.9U	6.9U
Freon 113	µg/kg	5.9U	6.9U
Isopropylbenzene	µg/kg	5.9U	6.9U
m,p-Xylenes	µg/kg	5.9U	6.9U
Methyl Acetate	µg/kg	5.9U	6.9U
Methylcyclohexane	µg/kg	5.9U	6.9U
Methylene Chloride	µg/kg	6.5JB	12JB
o-Xylene	µg/kg	5.9U	6.9U
Styrene	µg/kg	5.9U	6.9U
tert-butyl methyl ether	µg/kg	5.9U	6.9U
Tetrachloroethylene	µg/kg	5.9U	6.9U
Toluene	µg/kg	3.9J	6.9U
trans-1,2-dichloroethene	µg/kg	5.9U	6.9U
trans-1,3-dichloropropene	µg/kg	5.9U	6.9U
Trichloroethene	µg/kg	5.9U	2.5J
Trichlorofluoromethane	µg/kg	5.9U	6.9U
Vinyl Chloride	µg/kg	12U	14U

ubsurface Soil Explosives and Propellants Analytical Resu mmary Table
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Station ID		FBQ 048	FBQ 051	FBQ 054	FBQ 056	FBQ 057
Sample ID		FBQSO-048-0096-SO	FBQSO-051-0102-SO	FBQSO-054-0108-SO	FBQSO-056-0112-SO	FBQSO-057-0114-SO
Date Collected		10/2/2003	10/6/2003	10/2/2003	10/2/2003	10/1/2003
Depth (ft)		1-3'	1-3'	1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
1,3,5-Trinitrobenzene	µg/kg	100U	100U	100U	100U	100U
1,3-Dinitrobenzene	µg/kg	100U	100U	100U	100U	100U
2,4,6-Trinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	N/A	100U	N/A	N/A	N/A
2,6-Dinitrotoluene	µg/kg	100U	390U	100U	100U	100U
2,6-Dinitrotoluene	µg/kg	N/A	100U	N/A	N/A	N/A
2-Amino-4,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Amino-2,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Nitroaniline	µg/kg	N/A	390U	N/A	N/A	N/A
HMX	µg/kg	200U	200U	200U	200U	200U
m-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
Nitrobenzene	µg/kg	100U	390U	100U	100U	100U
Nitrobenzene	µg/kg	N/A	100U	N/A	N/A	N/A
Nitrocellulose	µg/kg	N/A	17U	N/A	N/A	N/A
Nitroglycerine	µg/kg	N/A	10000U	N/A	N/A	N/A
Nitroguanidine	µg/kg	N/A	130U	N/A	N/A	N/A
o-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
p-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
RDX	µg/kg	200U	200U	200U	200U	200U
Tetryl	µg/kg	200U	200U	200U	200U	200U

Subsurface Soil Explosives and Propellants Analytical Results Summary Table
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Station ID		FBQ 059	FBQ 060	FBQ 061	FBQ 062	FBQ 063
Sample ID		FBQSO-059-0118-SO	FBQSO-060-0120-SO	FBQSO-061-0122-SO	FBQSO-062-0124-SO	FBQSO-063-0126-SO
Date Collected		10/6/2003	10/13/2003	11/14/2003	11/17/2003	11/16/2003
Depth (ft)		1-3'	1-3'	1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
1,3,5-Trinitrobenzene	µg/kg	100U	100U	100U	100U	100U
1,3-Dinitrobenzene	µg/kg	100U	100U	100U	100U	100U
2,4,6-Trinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	N/A	100U	N/A	N/A	N/A
2,6-Dinitrotoluene	µg/kg	100U	390U	100U	100U	100U
2,6-Dinitrotoluene	µg/kg	N/A	100U	N/A	N/A	N/A
2-Amino-4,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Amino-2,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Nitroaniline	µg/kg	N/A	390U	N/A	N/A	N/A
HMX	µg/kg	200U	200U	200U	200U	200U
m-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
Nitrobenzene	µg/kg	100U	390U	100U	100U	100U
Nitrobenzene	µg/kg	N/A	100U	N/A	N/A	N/A
Nitrocellulose	µg/kg	N/A	26	N/A	N/A	N/A
Nitroglycerine	µg/kg	N/A	10000U	N/A	N/A	N/A
Nitroguanidine	µg/kg	N/A	130U	N/A	N/A	N/A
o-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
p-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
RDX	µg/kg	200U	200U	200U	200U	200U
Tetryl	µg/kg	200U	200U	200U	200U	200U

ubsurface Soil Explosives and Propellants Analytical Resu mmary Table
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Station ID		FBQ 064	FBQ 065	FBQ 066	FBQ 067	FBQ 068
Sample ID		FBQSO-064-0128-SO	FBQSO-065-0130-SO	FBQSO-066-0132-SO	FBQSO-067-0134-SO	FBQSO-068-0136-SO
Date Collected		11/14/2003	11/17/2003	11/17/2003	11/14/2003	11/14/2003
Depth (ft)		1-3'	1-3'	1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
1,3,5-Trinitrobenzene	µg/kg	100U	100U	100U	100U	100U
1,3-Dinitrobenzene	µg/kg	100U	100U	100U	100U	100U
2,4,6-Trinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene	µg/kg	100U	100U	100U	100U	390U
2,6-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2-Amino-4,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Amino-2,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Nitroaniline	µg/kg	N/A	N/A	N/A	N/A	N/A
HMX	µg/kg	200U	200U	200U	200U	200U
m-Nitrotoluene	µg/kg	200U	200U	200U	98J	200U
Nitrobenzene	µg/kg	100U	100U	100U	42J	390U
Nitrobenzene	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitrocellulose	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroglycerine	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroguanidine	µg/kg	N/A	N/A	N/A	N/A	N/A
o-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
p-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
RDX	µg/kg	200U	200U	200U	200U	200U
Tetryl	µg/kg	200U	200U	200U	200U	200U

Subsurface Soil Explosives and Propellants Analytical Results Summary Table

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Station ID		FBQ 071	FBQ 073	FBQ 074	FBQ 075	FBQ 077
Sample ID		FBQSO-071-0142-SO	FBQSO-073-0146-SO	FBQSO-074-0148-SO	FBQSO-075-0150-SO	FBQSO-077-0154-SO
Date Collected		11/17/2003	11/17/2003	11/11/2003	11/13/2003	11/17/2003
Depth (ft)		1-3'	1-3'	1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
1,3,5-Trinitrobenzene	µg/kg	100U	100U	100U	100U	100U
1,3-Dinitrobenzene	µg/kg	100U	100U	100U	100U	100U
2,4,6-Trinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,6-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2-Amino-4,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Amino-2,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Nitroaniline	µg/kg	N/A	N/A	N/A	N/A	N/A
HMX	µg/kg	200U	200U	200U	200U	200U
m-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
Nitrobenzene	µg/kg	100U	100U	100U	100U	70J
Nitrobenzene	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitrocellulose	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroglycerine	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroguanidine	µg/kg	N/A	N/A	N/A	N/A	N/A
o-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
p-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
RDX	µg/kg	200U	200U	200U	200U	200U
Tetryl	µg/kg	200U	200U	200U	200U	200U

ubsurface Soil Explosives and Propellants Analytical Resu ummary Table
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Station ID		FBQ 079	FBQ 082	FBQ 083	FBQ 085	FBQ 086
Sample ID		FBQSO-079-0158-SO	FBQSO-082-0164-SO	FBQSO-083-0166-SO	FBQSO-085-0170-SO	FBQSO-086-0172-SO
Date Collected		11/12/2003	11/11/2003	11/13/2003	11/13/2003	11/17/2003
Depth (ft)		1-3'	1-3'	1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
1,3,5-Trinitrobenzene	µg/kg	100U	100U	100U	100U	100U
1,3-Dinitrobenzene	µg/kg	100U	100U	100U	100U	100U
2,4,6-Trinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	420U	100U	390U	100U	400U
2,4-Dinitrotoluene	µg/kg	100U	N/A	100U	N/A	100U
2,6-Dinitrotoluene	µg/kg	420U	100U	390U	100U	400U
2,6-Dinitrotoluene	µg/kg	100U	N/A	100U	N/A	100U
2-Amino-4,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Amino-2,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Nitroaniline	µg/kg	420U	N/A	390U	N/A	400U
HMX	µg/kg	200U	200U	200U	200U	200U
m-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
Nitrobenzene	µg/kg	420U	52JB	390U	47J	400U
Nitrobenzene	µg/kg	35JB	N/A	100U	N/A	100U
Nitrocellulose	µg/kg	59	N/A	24	N/A	46
Nitroglycerine	µg/kg	10000U	N/A	10000U	N/A	10000U
Nitroguanidine	µg/kg	130U	N/A	130U	N/A	130U
o-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
p-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
RDX	µg/kg	200U	200U	200U	200U	200U
Tetryl	µg/kg	200U	200	200U	200U	200U

Subsurface Soil Explosives and Propellants Analytical Results Summary Table

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Station ID		FBQ 087	FBQ 088	FBQ 094	FBQ 095	FBQ 096
Sample ID		FBQSO-087-0174-SO	FBQSO-088-0176-SO	FBQSO-094-0188-SO	FBQSO-095-0190-SO	FBQSO-096-0192-SO
Date Collected		11/11/2003	11/11/2003	11/12/2003	11/12/2003	11/12/2003
Depth (ft)		1-3'	1-3'	1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
1,3,5-Trinitrobenzene	µg/kg	100U	100U	100U	100U	100U
1,3-Dinitrobenzene	µg/kg	100U	100U	100U	100U	100U
2,4,6-Trinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2,6-Dinitrotoluene	µg/kg	100U	100U	100U	100U	100U
2,6-Dinitrotoluene	µg/kg	N/A	N/A	N/A	N/A	N/A
2-Amino-4,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Amino-2,6-Dinitrotolue	µg/kg	100U	100U	100U	100U	100U
4-Nitroaniline	µg/kg	N/A	N/A	N/A	N/A	N/A
HMX	µg/kg	200U	200U	200U	200U	200U
m-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
Nitrobenzene	µg/kg	100U	100U	100U	100U	100U
Nitrobenzene	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitrocellulose	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroglycerine	µg/kg	N/A	N/A	N/A	N/A	N/A
Nitroguanidine	µg/kg	N/A	N/A	N/A	N/A	N/A
o-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
p-Nitrotoluene	µg/kg	200U	200U	200U	200U	200U
RDX	µg/kg	200U	200U	200U	200U	200U
Tetryl	µg/kg	200U	200U	200U	200U	200U

ubsurface Soil Explosives and Propellants Analytical Resu ummary Table
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Station ID		FBQ 097	FBQ 098	FBQ 100
Sample ID		FBQSO-097-0194-SO	FBQSO-098-0196-SO	FBQSO-100-0200-SO
Date Collected		11/12/2003	FBQSO-098-0196-SO	11/11/2003
Depth (ft)		1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite
Analyte	Units			
1,3,5-Trinitrobenzene	µg/kg	100U	100U	100U
1,3-Dinitrobenzene	µg/kg	100U	100U	100U
2,4,6-Trinitrotoluene	µg/kg	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	100U	100U	100U
2,4-Dinitrotoluene	µg/kg	N/A	N/A	N/A
2,6-Dinitrotoluene	µg/kg	100U	100U	100U
2,6-Dinitrotoluene	µg/kg	N/A	N/A	N/A
2-Amino-4,6-Dinitrotolue	µg/kg	100U	100U	100U
4-Amino-2,6-Dinitrotolue	µg/kg	100U	100U	100U
4-Nitroaniline	µg/kg	N/A	N/A	N/A
HMX	µg/kg	200U	200U	200U
m-Nitrotoluene	µg/kg	200U	200U	200U
Nitrobenzene	µg/kg	100U	52JB	100U
Nitrobenzene	µg/kg	N/A	N/A	N/A
Nitrocellulose	µg/kg	N/A	N/A	N/A
Nitroglycerine	µg/kg	N/A	N/A	N/A
Nitroguanidine	µg/kg	N/A	N/A	N/A
o-Nitrotoluene	µg/kg	200U	200U	200U
p-Nitrotoluene	µg/kg	200U	200U	200U
RDX	µg/kg	200U	200U	200U
Tetryl	µg/kg	200U	200U	200U

Sub-surface Soil Inorganics Analytical Results Summary Table
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Station ID		FBQ 001	FBQ 002	FBQ 003	FBQ 004	FBQ 005
Sample ID		FBQSO-001-0002-SO	FBQSO-002-0004-SO	FBQSO-003-0006-SO	FBQSO-004-0008-SO	FBQSO-005-0010-SO
Date Collected		10/14/2003	10/14/2003	10/20/2003	10/20/2003	10/20/2003
Depth (ft)		1-3'	1-3'	1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
Aluminum	mg/kg	10800	16700	16500	14200	15300
Antimony	mg/kg	0.46BN	0.27UN	0.35BN	0.29	0.31UN
Arsenic	mg/kg	19.7	12.6	12.3NE*	13.2	12.8NE*
Barium	mg/kg	61.1	90.1	88N	78.6	85.6N
Beryllium	mg/kg	0.68	0.78	0.92	0.82	0.87
Cadmium	mg/kg	0.01U	0.01U	0.01U	0.019	0.02U
Calcium	mg/kg	1490	1840	34500*	33300	32700*
Chromium	mg/kg	15.8	21.9	23.9*E	21	22.2*E
Chromium, Hexavalent	mg/kg	N/A	N/A	3.7	N/A	N/A
Cobalt	mg/kg	10.6	12.1	12.9*	14.1	13*
Copper	mg/kg	24.4	14.5	22.7	22.6	22.6
Iron	mg/kg	29400	32800	30300	28400	29500
Lead	mg/kg	15.4	13.2	12.4E	13.2	12.5E
Magnesium	mg/kg	2850N	3200N	9080N*	8180	8220N*
Manganese	mg/kg	402	918	369*	475	413*
Mercury	mg/kg	0.01B	0.02B	0.01U	32.6	0.01U
Nickel	mg/kg	24.1	17.5	31.7	2690	31.3
Potassium	mg/kg	1100N	1480N	3120N	1.2	2710N
Selenium	mg/kg	1.4	1.7	1.1	0.066	1.1B
Silver	mg/kg	0.05U	0.08B	0.06U	171	0.06U
Sodium	mg/kg	88	104	176	0.49	142
Thallium	mg/kg	0.44U	0.46U	0.81B	23.6	0.51U
Vanadium	mg/kg	20.9N	31.4N	27.5N	65.7	24.9N
Zinc	mg/kg	59.7	47.2	65.5E	0.016	61.9E

ub-surface Soil Inorganics Analytical Results Summary Tab
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Station ID		FBQ 059	FBQ 060	FBQ 061	FBQ 062	FBQ 063
Sample ID		FBQSO-059-0118-SO	FBQSO-060-0120-SO	FBQSO-061-0122-SO	FBQSO-062-0124-SO	FBQSO-063-0126-SO
Date Collected		10/6/2003	10/13/2003	11/14/2003	11/17/2003	11/16/2003
Depth (ft)		1-3'	1-3'	1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
Aluminum	mg/kg	12100	12300	15200	17100	19600
Antimony	mg/kg	1.9N	0.27UN	0.37BN	0.52BN	0.37BN
Arsenic	mg/kg	11.1	13.6	17.8	17.5N	17.4
Barium	mg/kg	79N	44.5N	94.3N	116	116N
Beryllium	mg/kg	0.73	0.55	0.93E	1.1	1.2E
Cadmium	mg/kg	0.72	0.01U	0.02U*	0.06B	0.02U*
Calcium	mg/kg	3280	300	1570	1480	1370
Chromium	mg/kg	19.6E	15.5	23.1N	24.2	27.7N
Chromium, Hexavalent	mg/kg	N/A	2.9U	N/A	N/A	N/A
Cobalt	mg/kg	10	11.6	23.8	14	20.7
Copper	mg/kg	28.2	14.2	24.3	25.7	25.8
Iron	mg/kg	23100	23200	32900	31400	36900
Lead	mg/kg	116	13.6	14.9	15.2	15.9
Magnesium	mg/kg	2430N	1830	4190N	4660N	4470N
Manganese	mg/kg	781	392	472	384	418
Mercury	mg/kg	0.76	0.01U	0.02B	0.01U	0.01B
Nickel	mg/kg	15.2	13.3	33.1	37.3	35.1
Potassium	mg/kg	1060N	841N	1890N	2350N	2200N
Selenium	mg/kg	1.3	2	0.26U	0.31U	0.38B
Silver	mg/kg	0.17B	0.06B	0.04U	0.06U	0.04U
Sodium	mg/kg	119	109	104	90.8	91.1
Thallium	mg/kg	0.49U	0.45UN	0.66B	2.8	0.54B
Vanadium	mg/kg	23.4N	24.7N	26.6	28.9	34
Zinc	mg/kg	156	46.1	69.9	72.3	76.1

Sub-surface Soil Inorganics Analytical Results Summary Table
Fuze and Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 064	FBQ 065	FBQ 066	FBQ 067	FBQ 068
Sample ID		FBQSO-064-0128-SO	FBQSO-065-0130-SO	FBQSO-066-0132-SO	FBQSO-067-0134-SO	FBQSO-068-0136-SO
Date Collected		11/14/2003	11/17/2003	11/17/2003	11/14/2003	11/14/2003
Depth (ft)		1-3'	1-3'	1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
Aluminum	mg/kg	14100	7580	12600	10800	13400
Antimony	mg/kg	0.41BN	0.25UN	0.26UN	0.45BN	0.45BN
Arsenic	mg/kg	13.1	9.6N	19.4N	21	13.5
Barium	mg/kg	62.1N	30.5	47	45.4N	52.2N
Beryllium	mg/kg	0.6E	0.32	0.64	0.57E	0.53E
Cadmium	mg/kg	0.02U*	0.01B	0.02B	0.02U*	0.02U*
Calcium	mg/kg	342	144	491	227	400
Chromium	mg/kg	19.3N	10.5	17.6	16.5N	18.1N
Chromium, Hexavalent	mg/kg	N/A	N/A	N/A	N/A	N/A
Cobalt	mg/kg	10.3	4.7	8.6	8.3	6.5
Copper	mg/kg	17.7	9.4	22.7	22.1	16.4
Iron	mg/kg	25200	13300	27000	26800	25500
Lead	mg/kg	16.4	8.7	13.2	14.2	12.3
Magnesium	mg/kg	2660N	1430N	3030N	2410N	2350N
Manganese	mg/kg	406	152	256	275	200
Mercury	mg/kg	0.02B	0.01B	0.01B	0.01U	0.01B
Nickel	mg/kg	20.1	10.2	21.4	20.4	16
Potassium	mg/kg	1280N	769N	1200N	1170N	1060N
Selenium	mg/kg	0.49B	0.27U	0.28U	0.4B	0.59B
Silver	mg/kg	0.04U	0.05U	0.05U	0.04U	0.04U
Sodium	mg/kg	75.2	53.2	60.4	288	71.4
Thallium	mg/kg	0.4U	0.9B	1.9	0.36U	0.38U
Vanadium	mg/kg	26.8	13.1	20.4	19.3	26.3
Zinc	mg/kg	55.6	29.2	57.4	61.8	44.1

ıb-surface Soil Inorganics Analytical Results Summary Tab
Fuze and Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 071	FBQ 073	FBQ 074	FBQ 075	FBQ 077
Sample ID		FBQSO-071-0142-SO	FBQSO-073-0146-SO	FBQSO-074-0148-SO	FBQSO-075-0150-SO	FBQSO-077-0154-SO
Date Collected		11/17/2003	11/17/2003	11/11/2003	11/13/2003	11/17/2003
Depth (ft)		1-3'	1-3'	1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
Aluminum	mg/kg	10500	15300	10100	9710	14600
Antimony	mg/kg	0.27UN	0.29UN	0.43BN	0.24BN	0.28UN
Arsenic	mg/kg	19N	18.4N	18.7	8.1	30.3N
Barium	mg/kg	38.3	79.2	44.2N	103N	68.7
Beryllium	mg/kg	0.65	1	0.66	0.56E	0.88
Cadmium	mg/kg	0.02B	0.04B	0.01U	0.22*	0.05B
Calcium	mg/kg	349	889	254	290	905
Chromium	mg/kg	15.2	20.3	15.1N	16.2N	19.6
Chromium, Hexavalent	mg/kg	N/A	N/A	N/A	N/A	N/A
Cobalt	mg/kg	10.3	20.8	9.9	7.7	15.3
Copper	mg/kg	21.5	24.5	22	36.5	22
Iron	mg/kg	24300	28400	26000	15700	27500
Lead	mg/kg	13.9	14	14.4	11.7	36.1
Magnesium	mg/kg	2320N	3640N	2440N	1470N	3350N
Manganese	mg/kg	260	328	280	840	272
Mercury	mg/kg	0.01U	0.01B	0.01U	0.01B	0.02B
Nickel	mg/kg	21.2	26.9	20.6	14.3	25.4
Potassium	mg/kg	1110N	1660N	1110N	769N	1630N
Selenium	mg/kg	0.28U	0.3U	0.3U	0.34B	0.3U
Silver	mg/kg	0.06U	0.06U	0.06U	0.03U	0.06U
Sodium	mg/kg	59.9	75.1	76.7	56.9	68.7
Thallium	mg/kg	2.2	2.7	0.47U	0.31U	2.4
Vanadium	mg/kg	17.7	24.5	17.4N	16.5	23.3
Zinc	mg/kg	62.2	67.2	62.2	49.4	60.8

Sub-surface Soil Inorganics Analytical Results Summary Table
Fuze and Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 079	FBQ 082	FBQ 083	FBQ 085	FBQ 086
Sample ID		FBQSO-079-0158-SO	FBQSO-082-0164-SO	FBQSO-083-0166-SO	FBQSO-085-0170-SO	FBQSO-086-0172-SO
Date Collected		11/12/2003	11/11/2003	11/13/2003	11/13/2003	11/17/2003
Depth (ft)		1-3'	1-3'	1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
Aluminum	mg/kg	11100	10000	12600	12300	14800
Antimony	mg/kg	0.36B	0.3BN	0.22B	0.18UN	0.28UN
Arsenic	mg/kg	23.1	20.7	19.2	19.7	20.1N
Barium	mg/kg	50.1N	49.7	45.8N	52.3N	59.3
Beryllium	mg/kg	0.6	0.62	0.55	0.69E	0.76
Cadmium	mg/kg	0.02U	0.01U	0.02U	0.02U*	0.02B
Calcium	mg/kg	418	1240	283	459	389
Chromium	mg/kg	17.2	14.8	18.3	18.5N	20
Chromium, Hexavalent	mg/kg	6.3U	N/A	2.7U	N/A	2.9U
Cobalt	mg/kg	9.8	9.5	7.8	11.4	10
Copper	mg/kg	23.1N	19.4	22.1N	23.4	24.2
Iron	mg/kg	28800	25000	30400	29600	29300
Lead	mg/kg	17.7N	13.8	13N	14.4	14.1
Magnesium	mg/kg	2510	2590N	2380	3000N	3260N
Manganese	mg/kg	313	373	200	285	240
Mercury	mg/kg	0.01B	0.01U	0.01U	0.01B	0.01U
Nickel	mg/kg	22	23.6	19.1	23.3	23.6
Potassium	mg/kg	1260N	1290N	1170N	1320N	1440N
Selenium	mg/kg	0.38B	0.32B	0.68B	0.22B	0.3U
Silver	mg/kg	0.03U	0.05U	0.04U	0.03U	0.06U
Sodium	mg/kg	47.9	68.4	53.1	71	65.9
Thallium	mg/kg	0.78B	0.43U	0.72B	0.4B	2.7
Vanadium	mg/kg	19.7	17.6	22.3	21.3	24.2
Zinc	mg/kg	66.8N	67.6	57.2N	64.6	77.4

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Fuze and Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 087	FBQ 088	FBQ 094	FBQ 095	FBQ 096
Sample ID		FBQSO-087-0174-SO	FBQSO-088-0176-SO	FBQSO-094-0188-SO	FBQSO-095-0190-SO	FBQSO-096-0192-SO
Date Collected		11/11/2003	11/11/2003	11/12/2003	11/12/2003	11/12/2003
Depth (ft)		1-3'	1-3'	1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
Aluminum	mg/kg	11800	11300	13900	14000	16200
Antimony	mg/kg	0.27UN	0.24UN	0.35BN	0.32BN	0.3UN
Arsenic	mg/kg	20.6	17.5	14.5	20.6	13.2
Barium	mg/kg	60.3	60.2N	51.4N	67.4N	85.7N
Beryllium	mg/kg	0.75	0.66	0.6	0.91	0.66
Cadmium	mg/kg	0.02B	0.07	0.08	0.02B	0.03B
Calcium	mg/kg	313	506	241	816	739
Chromium	mg/kg	16.7	15.6N	17.7N	18.6N	20.7N
Chromium, Hexavalent	mg/kg	N/A	N/A	N/A	N/A	N/A
Cobalt	mg/kg	11.4	9.9	8	12.3	8.4
Copper	mg/kg	23.3	23.1	17.2	23	19.4
Iron	mg/kg	28100	26400	28900	30400	29600
Lead	mg/kg	15.1	14.3	14.7	14.1	13.1
Magnesium	mg/kg	2840N	2510N	2370N	3230N	3160N
Manganese	mg/kg	352	328	369	302	331
Mercury	mg/kg	0.01U	0.01U	0.02B	0.01U	0.01B
Nickel	mg/kg	26.3	22	16.1	26.7	20.6
Potassium	mg/kg	1150N	1110N	1150N	1320N	1470N
Selenium	mg/kg	0.31B	0.29B	0.69B	0.34B	0.49B
Silver	mg/kg	0.06U	0.05U	0.07B	0.06U	0.07B
Sodium	mg/kg	62.5	72.1	100	88.3	117
Thallium	mg/kg	0.45U	0.39U	0.47U	0.49U	0.51U
Vanadium	mg/kg	19.6	20.3N	25N	22.8N	28N
Zinc	mg/kg	68	64	51.2	69	52.7

Sub-surface Soil Inorganics Analytical Results Summary Table
Fuze and Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 097	FBQ 098	FBQ 100
Sample ID		FBQSO-097-0194-SO	FBQSO-098-0196-SO	FBQSO-100-0200-SO
Date Collected		11/12/2003	11/12/2003	11/11/2003
Depth (ft)		1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite
Analyte	Units			
Aluminum	mg/kg	11800	11300	6850
Antimony	mg/kg	0.26UN	0.34B	0.23UN
Arsenic	mg/kg	12.5	15.9	13
Barium	mg/kg	44.4N	52.9N	31.8
Beryllium	mg/kg	0.51	0.56	0.51
Cadmium	mg/kg	0.01B	0.02U	0.05B
Calcium	mg/kg	293	322	490
Chromium	mg/kg	14.7N	15.9	12.9
Chromium, Hexavalent	mg/kg	N/A	N/A	N/A
Cobalt	mg/kg	7.6	8.6	7.2
Copper	mg/kg	14.6	20.9N	16.6
Iron	mg/kg	22600	25800	20700
Lead	mg/kg	10.2	15.1N	12.8
Magnesium	mg/kg	2000N	2280	1470N
Manganese	mg/kg	307	281	347
Mercury	mg/kg	0.01U	0.01B	0.02B
Nickel	mg/kg	15	20.2	16
Potassium	mg/kg	1050N	1120N	956N
Selenium	mg/kg	0.61B	0.38B	0.25U
Silver	mg/kg	0.07B	0.04U	0.05U
Sodium	mg/kg	90.5	50.5	46.3
Thallium	mg/kg	0.44U	0.57B	0.39U
Vanadium	mg/kg	23.6N	21	13.2
Zinc	mg/kg	45.6	60.1N	59.8

Subsurface Soil Pesticides and PCBs Analytical Results S[illegible]ry Table

Fuze[illegible]Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 003	FBQ 009	FBQ 019	FBQ 051	FBQ 060
Sample ID		FBQSO-003-0006-SO	FBQSO-009-0018-SO	FBQSO-019-0038-SO	FBQSO-051-0102-SO	FBQSO-060-0120-SO
Date Collected		10/20/2003	10/20/2003	10/13/2003	10/6/2003	10/13/2003
Depth (ft)		1-3'	1-3'	1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite	Composite	Composite
Analyte	Units					
4,4-DDD	µg/kg	2U	2.1U	2U	1.9U	2U
4,4-DDE	µg/kg	2U	2.1U	2U	1.9U	2U
4,4-DDT	µg/kg	2U	2.1U	2U	1.9U	2U
Aldrin	µg/kg	2U	2.1U	2U	1.9U	2U
Alpha-BHC	µg/kg	2U	2.1U	2U	1.9U	2U
Alpha-Chlordane	µg/kg	2U	2.1U	2U	1.9U	2U
Beta-BHC	µg/kg	2U	2.1U	2U	1.9U	2U
Chlordane	µg/kg	39U	42U	40U	1.9U	2U
Delta-BHC	µg/kg	2U	2.1U	2U	39U	39U
Dieldrin	µg/kg	2U	2.1U	2U	1.9U	2U
Endosulfan I	µg/kg	2U	2.1U	2U	1.9U	2U
Endosulfan II	µg/kg	2U	2.1U	2U	1.9U	2U
Endosulfan Sulfate	µg/kg	2U	2.1U	2U	1.9U	2U
Endrin	µg/kg	2U	2.1U	2U	1.9U	2U
Endrin Aldehyde	µg/kg	2U	2.1U	2U	1.9U	2U
Endrin Ketone	µg/kg	2U	2.1U	2U	1.9U	2U
Gamma-BHC (Lindane)	µg/kg	2U	2.1U	2U	1.9U	2U
Gamma-Chlordane	µg/kg	2U	2.1U	2U	1.9U	2U
Heptachlor	µg/kg	2U	2.1U	2U	1.9U	2U
Heptachlor Epoxide	µg/kg	2U	2.1U	2U	1.9U	2U
Methoxychlor	µg/kg	2U	2.1U	2U	1.9U	2U
PCB-1016	µg/kg	39U	42U	40U	39U	39U
PCB-1221	µg/kg	39U	42U	40U	39U	39U
PCB-1242	µg/kg	39U	42U	40U	39U	39U
PCB-1248	µg/kg	39U	42U	40U	39U	39U
PCB-1254	µg/kg	39U	42U	40U	39U	39U
PCB-1260	µg/kg	39U	42U	40U	39U	39U
Toxaphene	µg/kg	39U	42U	40U	39U	39U

Subsurface Soil Pesticides and PCBs Analytical Results Summary Table
Fuze and Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 079	FBQ 083	FBQ 086
Sample ID		FBQSO-079-0158-SO	FBQSO-083-0166-SO	FBQSO-086-0172-SO
Date Collected		11/12/2003	11/13/2003	11/17/2003
Depth (ft)		1-3'	1-3'	1-3'
Sample Type		Composite	Composite	Composite
Analyte	Units			
4,4-DDD	µg/kg	2.1U	1.9U	2U
4,4-DDE	µg/kg	2.1U	1.9U	2U
4,4-DDT	µg/kg	2.1U	1.9U	2U
Aldrin	µg/kg	2.1U	1.9U	2U
Alpha-BHC	µg/kg	2.1U	1.9U	2U
Alpha-Chlordane	µg/kg	2.1U	1.9U	2U
Beta-BHC	µg/kg	2.1U	1.9U	2U
Chlordane	µg/kg	42U	39U	40U
Delta-BHC	µg/kg	2.1U	1.9U	2U
Dieldrin	µg/kg	2.1U	1.9U	2U
Endosulfan I	µg/kg	2.1U	1.9U	2U
Endosulfan II	µg/kg	2.1U	1.9U	2U
Endosulfan Sulfate	µg/kg	2.1U	1.9U	2U
Endrin	µg/kg	2.1U	1.9U	2U
Endrin Aldehyde	µg/kg	2.1U	1.9U	2U
Endrin Ketone	µg/kg	2.1U	1.9U	2U
Gamma-BHC (Lindane)	µg/kg	2.1U	1.9U	2U
Gamma-Chlordane	µg/kg	2.1U	1.9U	2U
Heptachlor	µg/kg	2.1U	1.9U	2U
Heptachlor Epoxide	µg/kg	2.1U	1.9U	2U
Methoxychlor	µg/kg	2.1U	1.9U	2U
PCB-1016	µg/kg	42U	39U	40U
PCB-1221	µg/kg	42U	39U	40U
PCB-1242	µg/kg	42U	39U	40U
PCB-1248	µg/kg	42U	39U	40U
PCB-1254	µg/kg	42U	39U	40U
PCB-1260	µg/kg	42U	39U	40U
Toxaphene	µg/kg	42U	39U	40U

Subsurface Soil SVOCs Analytical Results Summary Table
Fuze and Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 003	FBQ 009	FBQ 019	FBQ 051	FBQ 060
Sample ID		FBQSO-003-0006-SO	FBQSO-009-0018-SO	FBQSO-019-0038-SO	FBQSO-051-0102-SO	FBQSO-060-0120-SO
Date Collected		10/20/2003	10/20/2003	10/13/2003	10/6/2003	10/13/2003
Depth (ft)		1-3'	1-3'	1-3'	1-3'	1-3'
Sample Type		Grab	Grab	Grab	Grab	Grab
Analyte	Units					
di-n-Octyl Phthalate	µg/kg	390U	420U	400U	390U	390U
Fluoranthene	µg/kg	390U	420U	400U	390U	390U
Fluorene	µg/kg	390U	420U	400U	390U	390U
Hexachlorobenzene	µg/kg	390U	420U	400U	390U	390U
Hexachlorobutadiene	µg/kg	390U	420U	400U	390U	390U
Hexachlorocyclopentadie	µg/kg	390U	420U	400U	390U	390U
Hexachloroethane	µg/kg	390U	420U	400U	390U	390U
Indeno(1,2,3-c,d)Pyrene	µg/kg	390U	420U	400U	390U	390U
Isophorone	µg/kg	390U	420U	400U	390U	390U
Naphthalene	µg/kg	390U	420U	400U	390U	390U
Nitrobenzene	µg/kg	390U	420U	400U	390U	390U
Nitrobenzene	µg/kg	100	100J	81J	100U	100U
n-Nitrosodi-n-Propylamir	µg/kg	390U	420U	400U	390U	390U
n-Nitrosodiphenylamine	µg/kg	390U	420U	400U	390U	390U
Pentachlorophenol	µg/kg	780U	830U	800U	780U	790U
Phenanthrene	µg/kg	390U	420U	400U	390U	390U
Phenol	µg/kg	390U	420U	400U	390U	390U
Pyrene	µg/kg	390U	420U	400U	390U	390U

Subsurface Soil SVOCs Analytical Results Summary Table
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Station ID		FBQ 079	FBQ 083	FBQ 086
Sample ID		FBQSO-079-0158-SO	FBQSO-083-0166-SO	FBQSO-086-0172-SO
Date Collected		11/12/2003	11/13/2003	11/17/2003
Depth (ft)		1-3'	1-3'	1-3'
Sample Type		Grab	Grab	Grab
Analyte	Units			
1,1- Biphenyl	µg/kg	420U	390U	400U
2,2-Oxybis(1-Chloroprop	µg/kg	420U	390U	400U
2,4,5-Trichlorophenol	µg/kg	420U	390U	400U
2,4,6-Trichlorophenol	µg/kg	420U	390U	400U
2,4-Dichlorophenol	µg/kg	420U	390U	400U
2,4-Dimethylphenol	µg/kg	420U	390U	400U
2,4-Dinitrophenol	µg/kg	850U	780U	800U
2,4-Dinitrotoluene	µg/kg	420U	390U	400U
2,4-Dinitrotoluene	µg/kg	100U	100U	100U
2,6-Dinitrotoluene	µg/kg	420U	390U	400U
2,6-Dinitrotoluene	µg/kg	100U	100U	100U
2-Chloronaphthalene	µg/kg	420U	390U	400U
2-Chlorophenol	µg/kg	420U	390U	400U
2-Methylnaphthalene	µg/kg	420U	390U	400U
2-methylphenol	µg/kg	420U	390U	400U
2-Nitroaniline	µg/kg	420U	390U	400U
2-Nitrophenol	µg/kg	420U	390U	400U
3,3-Dichlorobenzidine	µg/kg	850U	780U	800U
3-Nitroaniline	µg/kg	420U	390U	400U
4,6-dinitro-2-methyl pher	µg/kg	850U	780U	800U
4-Bromophenyl-phenylet	µg/kg	420U	390U	400U
4-chloro-3-methylphenol	µg/kg	420U	390U	400U
4-Chloroaniline	µg/kg	420U	390U	400U
4-Chlorophenyl Phenyl E	µg/kg	420U	390U	400U
4-methylphenol	µg/kg	420U	390U	400U

Station ID		FBQ 079	FBQ 083	FBQ 086
Sample ID		FBQSO-079-0158-SO	FBQSO-083-0166-SO	FBQSO-086-0172-SO
Date Collected		11/12/2003	11/13/2003	11/17/2003
Depth (ft)		1-3'	1-3'	1-3'
Sample Type		Grab	Grab	Grab
Analyte	Units			
4-Nitroaniline	µg/kg	420U	390U	400U
4-Nitrophenol	µg/kg	850U	780U	800U
Acenaphthene	µg/kg	420U	390U	400U
Acenaphthylene	µg/kg	420U	390U	400U
Acetophenone	µg/kg	420U	390U	400U
Anthracene	µg/kg	420U	390U	400U
Atrazine	µg/kg	420U	390U	400U
Benzaldehyde	µg/kg	420U	390U	400U
Benzo(a)anthracene	µg/kg	420U	390U	400U
Benzo(a)pyrene	µg/kg	420U	390U	400U
Benzo(b)fluoranthene	µg/kg	420U	390U	400U
Benzo(g,h,i)perylene	µg/kg	420U	390U	400U
Benzo(k)fluoranthene	µg/kg	420U	390U	400U
Benzyl Butyl Phthalate	µg/kg	420U	390U	400U
bis(2-chloroethoxy) meth	µg/kg	420U	390U	400U
bis(2-chloroethyl) ether	µg/kg	420U	390U	400U
bis(2-ethylhexyl) phthala	µg/kg	420U	390U	400U
Caprolactam	µg/kg	420U	390U	400U
Carbazole	µg/kg	420U	390U	400U
Chrysene	µg/kg	420U	390U	400U
Dibenz(a,h)Anthracene	µg/kg	420U	390U	400U
Dibenzofuran	µg/kg	420U	390U	400U
Diethyl Phthalate	µg/kg	420U	390U	400U
Dimethyl Phthalate	µg/kg	420U	390U	400U
di-n-Butyl Phthalate	µg/kg	420U	390U	400U

Subsurface Soil SVOCs Analytical Results Summary Table
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Station ID		FBQ 079	FBQ 083	FBQ 086
Sample ID		FBQSO-079-0158-SO	FBQSO-083-0166-SO	FBQSO-086-0172-SO
Date Collected		11/12/2003	11/13/2003	11/17/2003
Depth (ft)		1-3'	1-3'	1-3'
Sample Type		Grab	Grab	Grab
Analyte	Units			
di-n-Octyl Phthalate	µg/kg	420U	390U	400U
Fluoranthene	µg/kg	420U	390U	400U
Fluorene	µg/kg	420U	390U	400U
Hexachlorobenzene	µg/kg	420U	390U	400U
Hexachlorobutadiene	µg/kg	420U	390U	400U
Hexachlorocyclopentadie	µg/kg	420U	390U	400U
Hexachloroethane	µg/kg	420U	390U	400U
Indeno(1,2,3-c,d)Pyrene	µg/kg	420U	390U	400U
Isophorone	µg/kg	420U	390U	400U
Naphthalene	µg/kg	420U	390U	400U
Nitrobenzene	µg/kg	420U	390U	400U
Nitrobenzene	µg/kg	35JB	100U	100U
n-Nitrosodi-n-Propylamir	µg/kg	420U	390U	400U
n-Nitrosodiphenylamine	µg/kg	420U	390U	400U
Pentachlorophenol	µg/kg	850U	780U	800U
Phenanthrene	µg/kg	420U	390U	400U
Phenol	µg/kg	420U	390U	400U
Pyrene	µg/kg	420U	390U	400U

Station ID		FBQ 079	FBQ 083	FBQ 086
Sample ID		FBQSO-079-0158-SO	FBQSO-083-0166-SO	FBQSO-086-0172-SO
Date Collected		11/12/2003	11/13/2003	11/17/2003
Depth (ft)		1-3'	1-3'	1-3'
Sample Type		Grab	Grab	Grab
Analyte	Units			
1,1,1-Trichloroethane	µg/kg	6.5U	5.8U	6.2U
1,1,2,2-Tetrachloroethane	µg/kg	6.5U	5.8U	6.2U
1,1,2-Trichloroethane	µg/kg	6.5U	5.8U	6.2U
1,1-Dichloroethane	µg/kg	6.5U	5.8U	6.2U
1,1-Dichloroethene	µg/kg	6.5U	5.8U	6.2U
1,2,4-Trichlorobenzene	µg/kg	6.5U	5.8U	6.2U
1,2-Dibromo-3-Chloropropan	µg/kg	6.5U	5.8U	6.2U
1,2-Dichlorobenzene	µg/kg	6.5U	5.8U	6.2U
1,2-Dichloroethane	µg/kg	6.5U	5.8U	6.2U
1,2-Dichloropropane	µg/kg	6.5U	5.8U	6.2U
1,3-Dichlorobenzene	µg/kg	6.5U	5.8U	6.2U
1,4-Dichlorobenzene	µg/kg	6.5U	5.8U	6.2U
2-Butanone	µg/kg	13U	12U	5.4J
2-Hexanone	µg/kg	13U	12U	12U
4-Methyl-2-Pentanone	µg/kg	13U	12U	12U
Acetone	µg/kg	13U	13B	12JB
Benzene	µg/kg	6.5U	5.8U	6.2U
Bromochloromethane	µg/kg	N/A	N/A	N/A
Bromoform	µg/kg	6.5U	5.8U	6.2U
Bromomethane	µg/kg	13U	12U	12U
Carbon Disulfide	µg/kg	6.5U	16	3.1J
Carbon Tetrachloride	µg/kg	6.5U	5.8U	6.2U
Chlorobenzene	µg/kg	6.5U	5.8U	6.2U
Chloroethane	µg/kg	13U	12U	12U
Chloroform	µg/kg	6.5U	5.8U	6.2U

Subsurface Soil VOCs Analytical REsults Summary Table
Fuze and Booster Quarry Ponds Draft Remedial Investigation Report

Station ID		FBQ 079	FBQ 083	FBQ 086
Sample ID		FBQSO-079-0158-SO	FBQSO-083-0166-SO	FBQSO-086-0172-SO
Date Collected		11/12/2003	11/13/2003	11/17/2003
Depth (ft)		1-3'	1-3'	1-3'
Sample Type		Grab	Grab	Grab
Analyte	Units			
Chloromethane	µg/kg	13U	12U	12U
cis-1,2-Dichloroethene	µg/kg	6.5U	5.8U	6.2U
cis-1,3-Dichloropropene	µg/kg	6.5U	5.8U	6.2U
Cyclohexane	µg/kg	6.5U	5.8U	6.2U
Dibromochloromethane	µg/kg	6.5U	5.8U	6.2U
Dichlorodifluoromethane	µg/kg	6.5U	5.8U	6.2U
Ethylbenzene	µg/kg	6.5U	5.8U	6.2U
Ethylene Dibromide	µg/kg	6.5U	5.8U	6.2U
Freon 113	µg/kg	6.5U	5.8U	6.2U
Isopropylbenzene	µg/kg	6.5U	5.8U	6.2U
m,p-Xylenes	µg/kg	6.5U	5.1J	6.2U
Methyl Acetate	µg/kg	6.5U	5.8U	6.2U
Methylcyclohexane	µg/kg	6.5U	5.8U	6.2U
Methylene Chloride	µg/kg	14B	7JB	9.2JB
o-Xylene	µg/kg	6.5U	2J	6.2U
Styrene	µg/kg	6.5U	5.8U	6.2U
tert-butyl methyl ether	µg/kg	6.5U	5.8U	6.2U
Tetrachloroethylene	µg/kg	6.5U	5.8U	6.2U
Toluene	µg/kg	6.5U	3.6J	6.2U
trans-1,2-dichloroethene	µg/kg	6.5U	5.8U	6.2U
trans-1,3-dichloropropene	µg/kg	6.5U	5.8U	6.2U
Trichloroethene	µg/kg	6.5U	5.8U	6.2U
Trichlorofluoromethane	µg/kg	6.5U	5.8U	6.2U
Vinyl Chloride	µg/kg	13U	12U	12U

APPENDIX A4
QUALITY CONTROL SUMMARY REPORT

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QUALITY CONTROL SUMMARY REPORT

TABLE OF CONTENTS

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LIST OF TABLES

LIST OF ATTACHMENT

ACRONYMS

EDD	electronic data deliverable
IS	internal standard
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
PCB	polychlorinated biphenyl
PQL	project quantitation level
QAPP	Quality Assurance Project Plan
QC	quality control
QCSR	Quality Control Summary Report
RPD	relative percent difference
RVAAP	Ravenna Army Ammunition Plant
SDG	Sample Delivery Group
SVOC	semivolatile organic compound
VOC	volatile organic compound
%R	percent recovery
%RSD	percent relative standard deviation

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1.0 INTRODUCTION

This Quality Control Summary Report (QCSR) covers the field and laboratory work performed during sampling events at the Ravenna Army Ammunition Plant (RAAP) Fuze and Booster Quarry Landfill/Ponds conducted from October through December 2003, and additional samples collected in June and July of 2004. Soil, sediment, surface water, and groundwater were sampled for volatile organic compounds (VOCs) including perchlorate, semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), explosive compounds including nitrocellulose, metals, miscellaneous chemical species such as hexavalent chromium, and total organic carbon. In addition, several samples were collected for toxicity characteristic leaching procedure and analyzed for VOCs, SVOCs, pesticides, herbicides, and hazardous characteristics including flashpoint, pH, and reactivity. Samples referenced in Tables 5-1 through 5-4 of the *Work Plan and Sampling and Analysis Plan Addenda for the Phase I/Phase II Remedial Investigation of the Fuze Booster Quarry Landfill/Ponds at the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2002) were collected by SpecPro Incorporated field personnel. GPL Laboratories, 202 Perry Parkway, Gaithersburg, MD 20877, performed all analytical work.

Data verification and review of field and laboratory results described in this QCSR were conducted under the guidance provided by the facility-wide *Quality Assurance Project Plan (QAPP) for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2001), and the *Quality Assurance Project Plan Addendum for Phase I/Phase II Remedial Investigation of the Fuze Booster Quarry Landfill/Ponds* (USACE 2003). Where required, the U. S. Army Corps of Engineers' *Shell Document for Analytical Chemistry Requirements* (USACE 1998) was used as a secondary reference. The topics covered include:

- the conformance of the participating laboratory to quality control (QC) procedures described in the referenced Quality Assurance Project Plans (QAPPs),
- an evaluation of the quality of the data, and
- all rejected data.

2.0 FIELD DATA VERIFICATION

Chain of custody records and sampling records were reviewed to ensure that the correct bottles and preservatives were utilized throughout sampling. Samples were preserved and held at the correct temperature from the time of collection through sample shipment, receipt in the laboratory, and until point of analysis. Appropriate field duplicates were collected on each matrix type and at the appropriate frequency to meet project requirements. Field QC samples were collected including trip blanks, field blanks, and equipment rinsate blanks. Unless addressed specifically in the summaries for each analytical method reviewed below, all field QC measures were within acceptance criteria and met project and method requirements.

3.0 LABORATORY DATA VERIFICATION

Twenty-six sample delivery groups (SDGs) were submitted to the laboratory. A complete data package consisting of analytical, calibration, and QC information for each method within an SDG was supplied by the laboratory. All data packages were reviewed for each method for adherence to QAPP requirements as stated above. Completeness, correctness, consistency, and compliance were evaluated for all samples, which include all sample duplicate analysis and conformance to project reporting limits. In addition, 15% of the data was validated. During the validation process, calibration, calibration verification, blank contamination, recoveries of laboratory control samples (LCS), and matrix spike/matrix spike duplicate (MS/MSD) were evaluated. For organic analyses, instrument tuning, internal standard (IS) performance, and surrogate recoveries were also evaluated. For metals, interference checks, dilution tests, and post-digestion recoveries were also evaluated.

3.1 GENERAL FINDINGS

Unless addressed specifically in the summaries for each analytical method reviewed below, preservation, sample custody logs, preparation, extraction and cleanup logs, analysis logs, sample identification, and holding times were within acceptance criteria and met method requirements. Calibration and QC parameters for all methods were found acceptable. All exceptions are discussed in the sections below.

High concentrations of metal analytes, hexavalent chromium, and mercury required occasional sample dilutions prior to analysis to maintain results within calibration range. Project quantitation levels (PQLs) were not adversely impacted by sample dilution.

Manual integration was performed for some analytes for VOCs, SVOCs, pesticides, and explosive compounds. The rationale provided in the case narratives based the need for manual integration on improper integration performed by the software. In most cases, the adjustments were made on low-concentration standards and QC samples where concentrations were near the limit of sensitivity. The laboratory submitted software-produced EICP chromatograms and corresponding manually integrated chromatograms. The adjustments were properly executed and consistent with the intent of the LCG guidance on manual integration.

3.2 PROJECT QUANTITATION LEVELS

In general, the laboratory was able to achieve the PQLs specified in the QAPP. VOC analysis was typically performed using a 5-mL purging volume to obtain reporting limits of approximately 5 µg/L for water. These levels met most LCG requirements; however, they did not achieve the PQL goals of the QAPP.

Method reporting limit (MRL) check standards were typically analyzed at the beginning of a sequence, but not consistently repeated either at the end of the sequence or every 12 hrs as required by the LCG for most analytical methods.

Prior to the beginning of the project, the laboratory was granted some PQL variances because of their inability to achieve QAPP-specified limits. In most cases, the laboratory reporting limits generally met LCG requirements. A comparison of the laboratory PQLs and the project-specific PQLs for performing baseline risk assessment for primary chemicals of potential concern at RVAAP is presented in Table 3-1. A comparison of the laboratory PQLs and the project-specific PQLs is presented in Appendix A.

Table 3-1. Non-Conforming Primary Chemicals of Potential Concern at RVAAP

Element	Soil (mg/kg) GPL MRL	Soil (mg/kg) Baseline RA DL Requirements	Water (µg/L) GPL MRL	Water (µg/L) Baseline RA DL Requirements
	mg/kg		µg/L	
2,4-DNT	NA	0.9	0.26	0.1
2,6-DNT	NA	0.9	0.26	0.1
TNT	NA	21	NA	3
RDX	NA	5.8	NA	0.8
HMX	NA	3900	NA	2,000
Nitrocellulose	NA	Best available	NA	Best available
Nitroglycerine	NA	Best available	NA	Best available
Nitroguanidine	NA	7,800	NA	4,000
Aluminum	NA	Best available	NA	Best available
Arsenic	2.0	0.4	20	0.1
Barium	NA	5,500	NA	2,000
Cadmium	NA	78	6.0	5.0
Chromium	NA	230	NA	100
Lead	NA	400	NA	15
Mercury	NA	23	NA	2.0
Selenium	NA	390	NA	50
Silver	NA	390	NA	200
Zinc	NA	24,000	NA	11,000
1,3,5-TNB	NA	2,300	NA	1,000
1,3-DNB	NA	7.8	NA	4.0
Nitrobenzene	NA	39	NA	20
o-nitrotoluene	NA	780	NA	400
n-nitrotoluene	NA	780	NA	400
p-nitrotoluene	NA	780	NA	400
Manganese	NA	3,600	NA	2,000
PCBs	NA	0.3	1.1	0.04

DL = Detection limit.
GPL = GPL Laboratories, Inc.
MRL = Method reporting limit.
NA = GPL MRL met QAPP requirements.
RA = Remedial action.
RVAAP = Ravenna Army Ammunition Plant.

Overall, the laboratory met PQL requirements. The exceptions noted above are discussed under the respective method evaluations.

3.3 FIELD DUPLICATES

Field duplicate samples were collected for each matrix under investigation and analyzed for all target analytes. Relative percent differences (RPDs) were calculated where applicable and the results are presented for each method. The RPDs are not applicable where one of the analytical results was nondetect or is estimated below the level of quantitation. This event is indicated by an asterisk (*) in the table. Where the RPD exceeded QAPP-acceptance criteria, 30% for waters or 50% for soils and sediments, the word "Fail" qualifies the listed RPD. Positive results in the primary and field duplicate have been qualified estimated (J). This estimated value implies that more variability than acceptable may occur in subsequent re-sampling events.

3.4 SPLIT SAMPLES

Field samples were divided between GPL and another laboratory to evaluate analytical quality. No evaluation of inter-laboratory precision was made because analytical data from the second laboratory was not provided.

4.0 VOLATILE ORGANIC COMPOUNDS

Nine samples were submitted as field duplicates for volatile analysis and represented all matrix types sampled for this project. All compounds detected in one or both aliquots of the field duplicate have been summarized below. Most RPD values have been qualified with an (*) representing undetectable or estimated below the quantitation limit in the other aliquot. All RPD values calculated for volatile organics meet the QAPP criteria.

FBQMW-167			
Chemical	**-0308-GW**	**-0407-GW**	**RPD**
1,1,1-Trichloroethane	5.80	5.00 U	14.8 *
1,1-Dichloroethene	4.20 J	5.00 U	17.4 *
Acetone	5.60 JB	4.80 JB	15.4 *
Methylene Chloride	6.60 JB	6.10 JB	7.87 *

FBQSD-130-			
Chemical	**-0255-SD**	**-0389-SD**	**RPD**
Acetone	16.00 JB	17.00 JB	6.1 *
Methylene Chloride	18.00 JB	16.00 JB	11.7 *

FBQSD-133			
Chemical	**-0258-SD**	**-0394-SD**	**RPD**
2-Butanone	17.00 U	15.00 J	12.5 *
Acetone	8.50 JB	40.00 B	129 *
Methylene Chloride	11.00 JB	14.00 JB	24 *
Toluene	7.30 J	79.00	166 *

FBQSD-138			
Chemical	**-0263-SD**	**-0393-SD**	**RPD**
Acetone	9.60 JB	17.0 U	55.6 *
Methylene Chloride	11.00 JB	17.00 JB	42.8 *

FBQSD-140			
Chemical	**-0265-SD**	**-0395-SD**	**RPD**
2-Butanone	13.00 JB	9.80 JB	28.1 *
Acetone	36.00	32.00	11.8
Methylene Chloride	18.00 JB	14.00 U	25.0 *

FBQSO-086			
Chemical	**-0172-SO**	**-0406-SO**	**RPD**
2-Butanone	5.40 J	12.00 U	75.9 *
Acetone	12.00 JB	10.00 JB	18.2 *
Carbon Disulfide	3.10 J	6.10 U	65.2 *
Methylene Chloride	9.20 JB	16.00 JB	54.0 *

FBQSS-084			
Chemical	**-0167-SO**	**-0404-SO**	**RPD**
Acetone	10.00 JB	7.30 JB	31.2 *
Methylene Chloride	6.50 JB	11.00 JB	51.4 *
Toluene	3.90 J	5.8 U	39.2 *

FBQSW-134			
Chemical	**-0300-SW**	**-0391-SW**	**RPD**
2-Butanone	3.40 J	2.50 J	30.5 *
Acetone	14.00 B	14.00 B	0 *
Carbon Disulfide	1.70 J	5.0 U	98.5 *
Methylene Chloride	6.20 JB	6.70 JB	7.7 *
Toluene	16.00	17.00	6.1

FBQSW-135			
Chemical	**-0301-SW**	**-0392-SW**	**RPD**
Acetone	7.10 JB	4.90 JB	36.6 *
Methylene Chloride	7.60 JB	5.70 JB	28.6 *
Toluene	3.60 J	3.90 J	8.0 *

In the review of laboratory QC criteria, calibrations were generally acceptable and followed method requirements. Instrument tuning met requirements. Where the percent relative standard deviation (%RSD) failed to meet the required 15% limit for an analyte, undetectable levels of these compounds were rejected (R) and positive results were qualified estimated (J). Table 4-1, Rejected Results for Volatile Compounds, lists specific sample numbers and analytes that were rejected.

Calibration verification was performed using a second source standard. When compounds had %RSD values that were greater than 20%, further evaluation of the data was performed. When positive bias existed in the %RSD, associated samples with undetectable levels of the compounds were not qualified. However, a positive bias associated with a positive result was qualified estimated (J). When a negative bias was present in the %RSD, positive values were qualified estimated (J) and nondetected values were estimated at the reporting limit (UJ). No %RSD values were seen in excess of 40%.

Table 4-1. Rejected Results for Volatile Organic Compounds

SDG	Sample IDs	Compound	% RSD	Type	Date
311136	FBQ-MW-168-0310-GW	Bromomethane	17	ICAL	11/10/03
	FBQ-MW-172-0318-GW	Methylene Chloride	23.6		
	FBQ-MW-172-0408-GW	Acetone	32.7		
	FBQ-MW-175-0324-GW	2-Butanone	16		
	Trip Blank	*trans*-1,3-Dichloropropene	21.8		
311076	FBQ-MW-171-0316-GW	2-Hexanone	15.4		
	FBQ-MW-170-0314-GW	Bromoform	20.8		
	Trip Blank	1,2-Dibromo-3-chloropropane	21.8		
	FBQ-SO-079-0158-SO	1,2,4-Trichlorobenzene	23.6		
	FBQ-SS-079-0157-SO	Freon-113	19.8		
	FBQ-SS-098-0195-SO	Cyclohexane	19.7		
311113	FBQ-MW-167-0308-GW	Methyl Acetate	21.2		
	FBQ-MW-167-0407-GW				
	FBQ-MW-169-0312-GW				
	FBQ-MW-174-0322-GW				
	FBQ-SO-086-0172-SO				
	FBQ-SO-086-0406-SO				
	Trip Blank				
310082	FBQ-SS-019-0037-SO	Chloromethane	17	ICAL	10/7/03
	FBQ-SS-019-0038-SO	Bromomethane	17.2		
	FBQ-SS-060-0119-SO	Methylene Chloride	15.2		
	FBQ-SS-060-0120-SO				
	FBQ-SS-017-0033-SO				
	FBQ-SS-045-0089-SO				
	FBQTB-0379				
	FBQ-SS-017-0033-SO-RE	Methylene Chloride	17.2	ICAL	10/21/03
	FBQ-SS-045-0089-SO-RE	Acetone	27.7		
		2-Hexanone	23.3		
311095	FBQ-SS-083-0165-SO	1,1-Dichloroethene	23.6	ICAL	11/10/03
	FBQ-SS-083-0166-SO	Acetone	32.7		
	FBQ-SS-084-0404-SO	*trans*-1,3-Dichloropropene	21.8		
	FBQ-SS-084-0167-SO	Bromoform	20.8		
	FBQ-TB-0405	Methyl Acetate	21.2		

%RSD = Percent relative standard deviation.
SDG = Sample Delivery Group.

Surrogate recovery exceeded acceptable limits of 50 to 150% for the analysis of several samples in various SDGs. In most cases, samples were reanalyzed within the holding time with similar results. Since all recoveries were between 10 and 50%, positive values for all volatiles in these samples have been qualified estimated (J) and all nondetect values have been qualified estimated at the reporting limit (UJ). Samples affected by low surrogate recovery include: FBQSS-019-0037-SO, FBQSS-019-0038-SO, FBQSS-017-0033-SO, FBQSS-045-0089-SO, FBQ-SO-098-0195-SO, FBQ-SO-079-0158-SO, FBQ-SO-079-0157-SO, FBQ-SO-086-0172-SO, and FBQ-SO-086-0406-SO.

IS area counts were acceptable for all samples evaluated during validation.

Method blanks were contaminated above one-half the MRL with acetone, methylene chloride, and/or 2-butanone. Trip blanks contained acetone and methylene chloride also. Equipment rinse blanks also contained carbon disulfide in addition to methylene chloride and acetone. Sample results have been qualified "B" for common laboratory contaminants less than ten times the amount in the blank and less than five times the amount in the blank for other contaminants according to the LCG criterion.

LCS recoveries were generally acceptable. Elevated LCS/LCS duplicate (LCSD) recoveries were seen in several SDGs. Positive values for toluene were qualified estimated (J) in SDG 311095; in all other cases, elevated LCS/LCSD percent recoveries were associated with undetectable compounds in the associated samples. Low recovery of methyl acetate was reported in SDG 311136. All samples in this analytical batch had undetectable levels of this compound, and have been previously qualified (R) due to calibration issues.

MS/MSD analysis was performed at an appropriate frequency by the laboratory. In general, MS/MSD percent recoveries for samples associated with this project were acceptable. When batch QC was utilized by the laboratory, more compounds were reported out of control for MS/MSD criteria. Project samples were not qualified based on batch QC samples not collected from this project. For soil and sediment samples, MS/MSD recoveries for chloromethane, methylene chloride, carbon disulfide, 4-methyl-2-pentanone, and 2-hexanone were slightly out of control limits. For aqueous samples, MS/MSD recoveries for acetone and methyl acetate were slightly outside of control limits. There was no significant impact on data usability.

5.0 SEMIVOLATILE ORGANIC COMPOUNDS

Nine samples were submitted as field duplicates for semivolatile analysis and represented all matrix types sampled for this project. All compounds detected in one or both aliquots of the field duplicate have been summarized below. Three field duplicates had undetectable levels of all SVOC compounds in both aliquots. Most RPD values have been qualified with an (*) representing undetectable or estimated below the quantitation limit in the other aliquot. All RPD values calculated for semivolatile organics meet the QAPP criteria.

FBQMW-167			
Chemical	**-0308-GW**	**-0407-GW**	**RPD**
bis(2-Ethylhexyl) phthalate	2.30 JB	2.60 J	12.2 *
Caprolactam	46.00	36.00	24.4

FBQSD-130			
Chemical	**-0255-SD**	**-0389-SD**	**RPD**
Benzo(*a*)pyrene	100.00 J	82.00 J	19.8 *
Benzo(*b*)fluoranthene	160.00 J	120.00 J	28.6 *
bis(2-Ethylhexyl) phthalate	880.00 U	93.00 J	162 *
Chrysene	110.00 J	89.00 J	21.1 *
Fluoranthene	170.00 J	160.00 J	6.06 *
Pyrene	200.00 J	800.00 U	120 *

FBQSD-133			
Chemical	**-0258-SD**	**-0394-SD**	**RPD**
4-Methylphenol	510.00 J	440.00 J	14.7 *
bis(2-Ethylhexyl) phthalate	110.00 JB	72.00 JB	41.7 *

FBQSD-138			
Chemical	**-0263-SD**	**-0393-SD**	**RPD**
Benzo(*a*)anthracene	74.00 J	560.00 U	153 *
Benzo(*a*)pyrene	72.00 J	60.00 J	18.2 *
Benzo(*b*)fluoranthene	120.00 J	96.00 J	22.2 *
Chrysene	81.00 J	67.00 J	18.9 *
Fluoranthene	180.00 J	140.00 J	25.0 *
Phenanthrene	97.00 J	95.00 J	2.1 *
Pyrene	130.00 J	560.00 U	124 *

FBQSW-134			
Chemical	**-0300-SW**	**-0391-SW**	**RPD**
4-Methylphenol	170.00	22.00 J	154 *
bis(2-Ethylhexyl) phthalate	2.80 JB	2.50 JB	11.3 *
Phenol	120.00	110.00	8.7

FBQSW-135			
Chemical	**-0301-SW**	**-0392-SW**	**RPD**
bis(2-Ethylhexyl) phthalate	1.40 J	2.00JB	35.3 *

Calibration and calibration verifications were generally acceptable and followed method requirements. Instrument tuning and IS performance met requirements except where noted below.

In the review of laboratory QC criteria, calibrations and calibration verifications were generally acceptable and followed method requirements. Instrument tuning and IS performance met requirements. Where the %RSD failed to meet the required 15% limit for an analyte, undetectable levels of these compounds were rejected (R) and positive results were qualified estimated (J). Table 5-1, Rejected Results for semivolatile Compounds, lists specific sample numbers and analytes that were rejected.

The laboratory has recently started running a low level MRL standard at least at the beginning of each analytical sequence. Recovery is expected between 70 and 130%. For recoveries between 50 and 70%, all positive values have been qualified (J) and all nondetected compounds (UJ). Rejected data for semivolatile compounds are listed in Table 5-1 where %RSD was less than 50%. Continuing calibration verification was also used to qualify data with %RSD values greater than 20%. Compounds with a negative bias were qualified (J) to positive values and (R) to undetected compounds.

ISs were acceptable for all samples validated.

Method blanks were contaminated above one-half the MRL with bis(2-ethyl hexyl)phthalate. Sample results have been qualified (B) for this common laboratory contaminant less than ten times the amount in the blank according to the LCG criterion.

Table 5-1. Rejected Results for Semivolatile Organic Compounds

SDG	Sample IDs	Compound	% RSD	Type	Date
311136	FBQ-MW-168-0310-GW	Benzadehyde	74.5	ICAL	12/22/03
	FBQ-MW-172-0318-GW	Phenol	16.3		
	FBQ-MW-172-0408-GW	n-Nitroso-di-n-propylamine	15.7		
	FBQ-MW-175-0324-GW	Naphthalene	16.9		
	FBQ-MW-175-0324-GW-DL	4-Chloroaniline	18.4		
311113	FBQ-MW-167-0308-GW	Hexachlorocyclopentadiene	19.6		
	FBQ-MW-167-0407-GW	1,1-Biphenyl	15.9		
	FBQ-MW-169-0312-GW	Acenaphthene	23.1		
	FBQ-MW-174-0322-GW	2,4-Dinitrophenol	18.6		
	FBQ-SO-086-0172-SO	Dibenzofuran	15.2		
	FBQ-SO-086-0406-SO	Fluorene	16		
	Trip Blank	4,6-Dinitro-2-methylphenol	15.8		
		n-Nitrosodiphenylamine	19.4		
		Atrazine	76.8		
		Phenanthrene	22.5		
		Anthracene	23.5		
		Carbazole	23.6		
		di-n-Butylphthalate	25		
		Fluoranthene	21.8		
		Pyrene	19.2		
		3,3-Dichlorobenzidine	34.4		
3100082	FBQ-SS-019-0038-SO	Benzadehyde	67.7	ICAL	10/17/03
	FBQ-SS-060-0119-SO	2,4-Dinitrophenol	26.8		
	FBQ-SS-060-0120-SO	4,6-Dinitro-2-methylphenol	15.6		
	FBQ-SS-017-0033-SO	3,3-Dichlorobenzidine	15.4		
	FBQ-SS-045-0089-SO				
		Hexachlorocyclopentadiene	31.7	MRL	
		4-Nitrophenol	32.2		
		n-Nitrosodimethylamine	48.2		
		di-n-Octylphthalate	-30.8		
		Caprolactam	-37.2	CCV	
		3-Nitroaniline	-24.5		
		2,4-Dinitrotoluene	-20.5		
		4-Nitroaniline	-31.5		
		di-n-Butylphthalate	-24.0		
311076	FBQ-MW-171-0316-GW	Benzaldehyde	57.6	ICAL	12/3/03
	FBQ-MW-170-0314-GW	Acenaphthylene	18.5		
		2,4-dinitrophenol	20.5		
		Atrazine	42		
		Phenanthrene	18.9		
		Carbazole	17.7		
		di-n-Butylphthalate	18.3		
		Fluoranthene	18.6		
		3,3-Dichlorobenzidine	23.3		
		4-Chloroaniline	-26.1	CCV	
		4-Nitroaniline	-34.7		
		4-Nitrophenol	0%		
		Pentachlorophenol	6%		

Table 5-1. Rejected Results for Semivolatile Organic Compounds (continued)

SDG	Sample IDs	Compound	% RSD	Type	Date
311095	FBQ-SS-083-0165-SO FBQ-SS-083-0166-SO FBQ-SS-084-0404-SO FBQ-SS-084-0167-SO FBQ-SO-079-0158-SO FBQ-SO-079-0157-SO FBQ-SS-098-0195-SO	Benzadehyde Bis(2-chloroethyl)ether Acenaphthylene 2,4-Dinitrophenol	72.5 21.8 16.7 19.3	ICAL	12/23/03
		Hexachlorobutadiene din-n-Octylphthalate	-23.3 -24.4	CCV	
311103	FBQ-SS-TCLP	Pyridine Hexachlorobutadiene	22.2 17	ICAL	12/1/03

%RSD = Percent relative standard deviation.
SDG = Sample Delivery Group.

Low LCS/LCSD percent recoveries were reported in SDG 311076 for 2-chlorophenol, 4-nitrophenol, pentachlorophenol, and phenol. Results for 4-nitrophenol and pentachlorophenol have been rejected (R) due to recovery less than 30%. All other compounds with low LCS percent recoveries have been qualified estimated (J/UJ). Low LCS recovery was reported in SDG 311095 for 2-chlorophenol, 4-nitrophenol, 4-chloro-3-methylphenol, pentachlorophenol, phenol, and n-nitrosodi-n-propylamine. All values of these compounds have been qualified estimated (J/UJ) due to these slight exceedances.

MS/MSD recoveries were within acceptance criteria.

6.0 PESTICIDES/POLYCHLORINATED BIPHENYLS

Nine samples were submitted as field duplicates for pesticide and PCB analysis and represented all matrix types sampled for this project. All compounds detected in one or both aliquots of the field duplicate have been summarized below. Six field duplicates had undetectable levels of all pesticide/PCB compounds in both aliquots. Most RPD values have been qualified with an (*) representing undetectable or estimated below the quantitation limit in the other aliquot. All RPD values calculated for pesticides and PCBs met the QAPP criteria.

FBQSD-133			
Chemical	**-0394-SD**	**-0258-SD**	**RPD**
Methoxychlor	1.10 J	2.80 U	87.2 *

FBQSD-138			
Chemical	**-0393-SD**	**-0263-SD**	**RPD**
Methoxychlor	0.94 J	2.5 U	90.7 *

FBQSD-140			
Chemical	**-0265-SD**	**-0395-SD**	**RPD**
4,4-DDE	0.79 J	0.57 J	32.3 *

Calibration and calibration verifications were acceptable and followed method requirements.

Low LCS percent recovery (%R) was reported for delta-BHC in SDGs 311136, 311076, and 311113. The laboratory attributed this problem to a standard problem. However, because of the recovery less than 30%, all sample data in this analytical batch have been rejected (R) for delta-BHC in these associated SDGs. Table 6-1, Rejected Results for Pesticide/PCB Compounds, lists specific sample numbers and analytes that were rejected.

Table 6-1. Rejected Results for Pesticide/PCB Compounds

SDG	Sample Number	Analyte	Analysis
311136	FBQ-MW-168-0310-GW FBQ-MW-172-0318-GW FBQ-MW-172-0408-GW FBQ-MW-175-0324-GW	Delta-BHC	LCS
311076	FBQ-MW-171-0316-GW FBQ-MW-170-0314-GW	Delta-BHC	LCS
311113	FBQ-MW-167-0308-GW FBQ-MW-167-0407-GW FBQ-MW-169-0312-GW FBQ-MW-174-0322-GW	Delta-BHC	LCS

PCB = Polychlorinated biphenyl.
SDG = Sample Delivery Group.

The method blank in SDG 311095 had low level contamination of 4,4-DDT; aldrin; dieldrin; endrin; endrin ketone; gamma-BHC; and heptachlor. The laboratory isolated this contamination to syringe contamination. Only one sample showed low level contamination of similar compounds at levels within five times the value found in the blank. These compounds have been qualified found in blank (B) in this sample.

MS/MSD recoveries were acceptable. Surrogate recoveries were generally acceptable.

With the exceptions noted above, the data are considered to be technically sound and usable.

7.0 EXPLOSIVES AND PROPELLANTS SW8330

Twenty-six samples were submitted as field duplicates for explosive analysis and represented all matrix types sampled for this project. All compounds detected in one or both aliquots of the field duplicate have been summarized below. Twenty-one field duplicates had undetectable levels of all explosive compounds in both aliquots. Most RPD values have been qualified with an (*) representing undetectable or estimated below the quantitation limit in the other aliquot. All RPD values calculated for explosives met the QAPP criteria.

FBQSS-049			
Chemical	**-0097-SO**	**-0378-SO**	**RPD**
2,4,6-Trinitrotoluene	82.00 J	120.00	37.6 *
2-Amino-4,6-Dinitrotoluene	140.00	190.00	30.3
4-Amino-2,6-Dinitrotoluene	110.00	140.00	24

FBQSS-075			
Chemical	**-0149-SO**	**-0403-SO**	**RPD**
Tetryl	170.00 J	200.00 U	16.2 *

FBQSD-133			
Chemical	**-0394-SD**	**-0258-SD**	**RPD**
m-Nitrotoluene	81.00 J	200.00 U	84.7 *

FBQSD-138			
Chemical	**-0263-SD**	**-0393-SD**	**RPD**
m-Nitrotoluene	78.00 J	200.00 U	85.6 *

FBQSW-134			
Chemical	**-0300-SW**	**-0391-SW**	**RPD**
2-Amino-4,6-Dinitrotoluene	0.68 J	0.53 J	24.8 *
4-Amino-2,6-Dinitrotoluene	20.00 J	18.00 J	10.5 *

Calibration and calibration verifications were acceptable and followed method requirements. Associated calibration and method blanks were free of contamination.

Most LCS results met acceptable percent recoveries. In SDG 311082, low LCS %R was reported for tetryl. All samples had undetectable levels of tetryl and have been qualified rejected (R) due to recovery less than 30%. Also in SDG 311076, LCS/LCSD percent recoveries were outside of laboratory QC limits in the water analysis for 1,3,5-trinitrobenzene and tetryl. All associated samples had undetectable levels of these compounds, and results for these compounds were rejected (R) due to percent recoveries less than 30%. In the same SDG, LCS/LCSD percent recoveries were outside of laboratory QC limits in the soil analysis for 1,3,5-trinitrobenzene and tetryl and were rejected (R) due to percent recoveries less than 30%.

No surrogate results were reported for nitroguanidine. The laboratory stated that nitroguanidine was directly injected and there is typically no surrogate added when the direct injection method is used.

MS/MSD and LCS recoveries met the QAPP requirements.

With the exceptions noted above, the data are considered to be technically sound and usable.

8.0 METALS AND MERCURY

Twenty-six samples were submitted as field duplicates for metals analysis and represented all matrix types sampled for this project. All compounds detected in one or both aliquots of the field duplicate have been summarized below. Most RPD values have been qualified with an (*) representing undetectable or estimated below quantitation limit in the other aliquot. Most compounds where high RPD values have been calculated between duplicates are with sample concentrations within five times the standard reporting limit. No data were qualified with this low level variability. Most RPD values calculated for metals met the QAPP criteria.

Calibration and calibration verification performance were within acceptance criteria. Interference checks, dilution tests, and post-digestion recoveries were within acceptance criteria except where noted.

The preparation blank frequently contained calcium, chromium, copper, sodium, and occasionally other target analytes above the MRL. The initial calibration blank was free of contamination, while continuing calibration blanks contained aluminum, iron, lead, sodium, thallium, magnesium, and occasionally other target analytes. Results for these analytes should be qualified (B) where positive values are less than five times the blank value in accordance with the LCG.

LCS recoveries of all analytes were within the specified control limits.

MS/MSD recoveries frequently were outside of control limits for antimony, arsenic, copper, magnesium, and potassium. However, post-digestion spike recoveries were with acceptance limits.

With the exceptions noted above, the data are considered to be technically sound and usable.

9.0 GENERAL CHEMISTRY (IAAP NITROCELLULOSE, CYANIDE, SULFIDE, FLASHPOINT, TOTAL ORGANIC CARBON, AND HEXAVALENT CHROMIUM)

Calibrations for general chemistry methods were acceptable. Sulfide is a titrimetric method and data for the standardization of the titrant were provided. Subsequent continuing calibration verification standards confirmed that the analyses remained in control. Associated calibration and method blanks were free of contamination.

LCS recoveries for analytes were within the specified control limits. MS/MSD recoveries were within acceptance criteria.

Several sample dilutions were required due to the limited range of the analytical method performed for hexavalent chromium. Dilutions were required to bring hexavalent chromium levels to within the linear range of the instrument. Reported values accurately reflected target analyte concentrations in project samples.

The data are considered to be technically sound and usable.

10.0 QUALITY CONTROL PARAMETERS

10.1 ACCURACY

Accuracy is defined as the agreement of a measurement with an accepted reference or true value and was measured by the %R of each analyte in the LCSs analyzed with each sample batch. Any rejection of analytical results based on non-conformant LCS recoveries is discussed under each method in previous sections of this report. The overall level of accuracy is considered to be acceptable.

10.2 PRECISION

Precision is defined as the agreement between a set of replicate measurements without consideration or knowledge of the true value. Precision was evaluated based on MS/MSD and field duplicate results where available. Any rejection of analytical results based on non-conformant MS/MSD RPDs are discussed under each method in previous sections of this report. Field duplicate samples were also analyzed and RPDs were calculated where applicable. The overall level of precision is considered to be acceptable.

10.3 COMPLETENESS

Completeness is the quantitative measure of the amount of data obtained from a measurement process compared with the amount expected to be obtained under the conditions of measurement. Unusable analytical data are those results reported by the laboratory but rejected during the data validation process. Completeness for all analytical fractions is outlined below. Table 10-1 summarizes the overall rejected results for all methods. Soil VOCs had higher than 10% rejections. The overall percentage of acceptable results was 96.8%, meeting the project completeness goal of 90%.

Table 10-1. Summary of Rejected Results for All Methods

Media	Analysis Group	Rejected Results	Total Results	Percent Rejected
Sediment	Metals	0	1,012	0%
	Volatile Organics	0	2,156	0%
	Semivolatile Organics	0	2,860	0%
	Pesticides/PCBs	0	1,276	0%
	Explosives	0	748	0%
	General Chemistry	0	99	0%
	Subtotal	0	8,151	0%
Soil	Metals	8	3,933	0.20%
	Volatile Organics	279	1,066	26.2%
	Semivolatile Organics	114	1,495	7.62%
	Pesticides/PCBs	0	645	0%
	Explosives	44	2,606	1.69%
	General Chemistry	0	22	0%
	Subtotal	445	9,767	4.56%
Surface Water, Groundwater, and Quality Control	Metals	0	805	0%
	Volatile Organics	157	2,548	6.16%
	Semivolatile Organics	203	2,275	8.92%
	Pesticides/PCBs	10	1,015	0.98%
	Explosives	4	595	0.67%
	General Chemistry	0	46	0%
	Subtotal	374	7,284	5.13%
Project Totals		**818**	**25,202**	**3.24%**

PCB = Polychlorinated biphenyl.

10.4 REPRESENTATIVENESS

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness was evaluated by comparing the results of the field duplicate pairs and conducting sampling in accordance with the work plan, QAPP, and relevant standard operating procedures. Results for all analytes satisfied the field duplicate evaluation criteria and all sampling/analysis protocols were followed.

10.5 COMPARABILITY

Comparability expresses the confidence with which one data set can be compared to another. Comparability for this project could not be evaluated because of the absence of any previous data.

10.6 REJECTED DATA

Rejected data eliminate the actual result or data points for these compounds in the affected samples. Therefore, the data cannot be used to definitively state that these compounds are not present in these samples. If these compounds were suspected to be present in the samples, or were considered a critical contaminant of concern, re-sampling and re-analysis may be necessary to validate the concentration reported to the standards required by the data quality guidelines.

11.0 ELECTRONIC DATA DELIVERABLES

The electronic data deliverables (EDDs) were reviewed for completeness and the following observations were made. Overall the EDDs were acceptable with the following exceptions.

- Calibration data are not included in the EDDs. However, all the data packages are presented in electronic format (PDF) as well as hard copies. Calibration and QC data are available in both CD-ROM and hard copy formats.
- The VOC and SVOC LCS analyzed with SDG 208002 contained only a short analyte list reported in the EDD, well under the target analyte list as required by the QAPP Addendum. However, the results for the whole target analyte list were reported in the hardcopy data package and CD-ROM.
- Inconsistent reporting of compound names has been corrected to reflect consistent reporting requirements in the EDD.

12.0 REFERENCES

This report was written by Valerie Mariola.

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USACE 2001. *Quality Assurance Project Plan (QAPP) for Environmental Investigations at the Ravenna Army Ammunition Plant, Ravenna, Ohio*, March.

USACE 2002. *Work Plan and Sampling and Analysis Plan Addenda for the Phase I/Phase II RI at the Fuze and Booster Quarry Landfill/Ponds at the Ravenna Army Ammunition Plant, Ravenna, Ohio* (SAP Addendum).

USACE 2003. *Quality Assurance Project Plan Addendum for Phase I/Phase II Remedial Investigation of the Fuze Booster Quarry Landfill/Ponds*, October.

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ATTACHMENT A
PROJECT QUANTITATION LIMIT GOALS AND ACHIEVED METHOD REPORTING LIMITS

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Table A-1. Project Quantitation Limit Goals and Achieved Method Reporting Limits

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal (µg/L)	Achieved Method Detection Level (µg/L)	Project Quantitation Goal (µg/kg)	Achieved Method Detection Level (µg/kg)
VOCs SW 846-8260B				
1,1,1-Trichloroethane	1	5.0	5	5
1,1,2,2-Tetrachloroethane	1	5.0	5	5
1,1,2-Trichloroethane	1	5.0	5	5
1,1-Dichloroethane	1	5.0	5	5
1,1-Dichloroethene	1	5.0	5	5
1,2-Dibromomethane	1	5.0	5	5
1,2-Dichloroethane	1	5.0	5	5
1,2-Dichloroethene (total)	1	5.0	5	5
1,2-Dichloropropane	1	5.0	5	5
2-Butanone	10	10	20	10
2-Hexanone	10	10	20	10
4-Methyl-2-pentanone	10	10	20	10
Acetone	10	10	20	10
Benzene	1	5.0	5	5
Bromochloromethane	1	5.0	5	5
Bromodichloromethane	1	5.0	5	5
Bromoform	1	5.0	5	5
Bromomethane	1	5.0	5	10
Carbon Disulfide	1	5.0	5	5
Carbon Tetrachloride	1	5.0	5	5
Chlorobenzene	1	5.0	5	5
Chloroethane	1	5.0	5	10
Chloroform	1	5.0	5	5
Chloromethane	1	5.0	5	10
cis-1,3-Dichloropropene	1	5.0	5	5
Dibromochloromethane	1	5.0	5	5
Ethylbenzene	1	5.0	5	5
Methylene Chloride	1	5.0	5	10
Styrene	1	5.0	5	5
Tetrachloroethene	1	5.0	5	5
Toluene	1	5.0	5	5
trans-1,3-Dichloropropene	1	5.0	5	5
VOCs SW 846-8260B				
Trichloroethene	1	5.0	5	5
Vinyl Chloride	1	5.0	5	10
Xylenes (total)	2	15	10	15
SVOCs SW 846-8270C				
1,2,4-Trichlorobenzene	10	11	330	330
1,2-Dichlorobenzene	10	11	330	330
1,3-Dichlorobenzene	10	11	330	330
1,4-Dichlorobenzene	10	11	330	330
2,4,5-Trichlorophenol	25	22	330	330
2,4,6-Trichlorophenol	10	11	330	330
2,4-Dichlorophenol	10	11	330	330
2,4-Dimethylphenol	10	11	330	330

Table A-1. Project Quantitation Limit Goals and Achieved Method Reporting Limits (continued)

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal (µg/L)	Achieved Method Detection Level (µg/L)	Project Quantitation Goal (µg/kg)	Achieved Method Detection Level (µg/kg)
2,4-Dinitrophenol	25	22	800	660
2,4-Dinitrotoluene	10	11	330	330
2,6-Dinitrotoluene	10	11	330	330
2-Chloronaphthalene	10	11	330	330
2-Chlorophenol	10	11	330	330
2-Methylnaphthalene	10	11	330	330
2-Methylphenol	10	11	330	330
2-Nitroaniline	25	11	800	330
2-Nitrophenol	10	11	330	330
3,3'-Dichlorobenzidine	25	22	330	660
3-Nitroaniline	25	11	800	330
4,6-Dinitro-2-methylphenol	25	22	800	660
4-Bromophenylphenylether	10	11	330	330
4-Chloro-3-methylphenol	10	11	330	330
4-Chloroaniline	10	11	330	330
4-Chlorophenyl-phenyl ether	10	11	330	330
3 & 4-Methylphenol	10	11	330	660
4-Nitroaniline	25	11	800	330
4-Nitrophenol	25	22	800	660
Acenaphthene	10	11	50	330
SVOCs SW 846-8270C				
Acenaphthylene	10	11	50	330
Anthracene	10	11	50	330
Benzo(*a*)anthracene	10	11	50	330
Benzo(*a*)pyrene	10	11	50	330
Benzo(*b*)fluoranthene	10	11	50	330
Benzo(*ghi*)perylene	10	11	50	330
Benzo(*k*)fluoranthene	10	11	50	330
Benzoic Acid	25	22	800	660
Benzyl alcohol	10	11	330	330
2,2'-oxybis(1-Chloropropane)	10	11	330	330
bis(2-Chloroethoxy) methane	10	11	330	330
bis(2-Chloroethyl) ether	10	11	330	330
bis(2-Ethylhexyl)phthalate	10	11	330	330
Butylbenzylphthalate	10	11	330	330
Carbazole	10	11	50	330
Chrysene	10	11	50	330
Di-n-butylphthalate	10	11	330	330
Di-n-octylphthalate	10	11	330	330
Dibenzo(*a,h*)anthracene	10	11	50	330
Dibenzofuran	10	11	330	330
Diethylphthalate	10	11	330	330
Dimethylphthalate	10	11	330	330
Fluoranthene	10	11	50	330
Fluorene	10	11	50	330

Table A-1. Project Quantitation Limit Goals and Achieved Method Reporting Limits (continued)

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal (µg/L)	Achieved Method Detection Level (µg/L)	Project Quantitation Goal (µg/kg)	Achieved Method Detection Level (µg/kg)
Hexachlorobenzene	10	11	330	330
Hexachlorobutadiene	10	11	330	330
Hexachloroethane	10	11	330	330
Hexacholorocyclopentadiene	10	11	330	330
Indeno(1,2,3-*cd*)pyrene	10	11	50	330
Isophorone	10	11	330	330
N-Nitroso-di-n-dipropylamine	10	11	330	330
N-Nitrosodiphenylamine	10	11	330	330
SVOCs SW 846-8270C				
Naphthalene	10	11	50	330
Nitrobenzene	10	11	330	330
Pentachlorophenol	25	22	330	660
Phenanthrene	10	11	50	330
Phenol	10	11	330	330
Pyrene	10	11	50	330
Pesticides SW 846-8081				
4,4-DDD	0.05	0.05	1.7	1.7
4,4-DDE	0.05	0.05	1.7	1.7
4,4-DDT	0.05	0.05	1.7	1.7
Aldrin	0.05	0.05	1.7	1.7
alpha-BHC	0.05	0.05	1.7	1.7
alpha-Chlordane	0.05	0.05	1.7	1.7
beta-BHC	0.05	0.05	1.7	1.7
Chlordane	0.05	1.0	1.7	33
delta-BHC	0.05	0.05	1.7	1.7
Dieldrin	0.05	0.05	1.7	1.7
Endosulfan I	0.05	0.05	1.7	1.7
Endosulfan II	0.05	0.05	1.7	1.7
Endosulfan Sulfate	0.05	0.05	1.7	1.7
Endrin	0.05	0.05	1.7	1.7
Endrin aldehyde	0.05	0.05	1.7	1.7
Endrin Ketone	0.05	0.05	1.7	1.7
gamma-BHC (Lindane)	0.05	0.05	1.7	1.7
gamma-Chlordane	0.05	0.05	1.7	1.7
Heptachlor	0.05	0.05	1.7	1.7
Heptachlor Epoxide	0.05	0.05	1.7	1.7
Methoxychlor	0.1	0.05	1.7	1.7
Toxaphene	2.0	1.0	170	33
PCB SW 846-8082				
Arochlor-1016	0.5	1.0	33	33
Arochlor-1221	0.5	1.0	33	33
PCB SW 846-8082				
Aroclor-1232	0.5	1.0	33	33
Aroclor-1242	0.5	1.0	33	33
Aroclor-1248	0.5	1.0	33	33
Aroclor-1254	0.5	1.0	33	33

Table A-1. Project Quantitation Limit Goals and Achieved Method Reporting Limits (continued)

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal (µg/L)	Achieved Method Detection Level (µg/L)	Project Quantitation Goal (µg/kg)	Achieved Method Detection Level (µg/kg)
Aroclor-1260	0.5	1.0	33	33
Explosive Compounds SW 846-8330				
HMX (Octahydro-1,3,5,7-Tetranitro-1,3,5,7-tetrazocine)	0.5	0.52	1.0	0.2
RDX (cyclonite) Hexahydro-1,3,5-trinitro-1,3,5-triazine	0.5	0.52	1.0	0.2
1,3,5-Trinitrobenzene	0.2	0.26	0.25	0.1
1,3-Dinitrobenzene	0.2	0.26	0.25	0.1
Tetryl	0.2	0.52	1.0	0.2
Nitrobenzene	0.2	0.26	0.25	0.1
2,4,6-Trinitrotoluene	0.2	0.26	0.25	0.1
2,4-Dinitrotoluene	0.1	0.26	0.25	0.1
2,6-Dinitrotoluene	0.1	0.26	0.25	0.1
2-Amino-4,6-dinitrotoluene	0.2	0.26	0.25	0.1
4-Amino-2,6-dinitrotoluene	0.2	0.26	0.25	0.1
o-Nitrotoluene	0.2	0.52	0.25	0.2
m-Nitrotoluene	0.2	0.52	0.25	0.2
p-Nitrotoluene	0.2	0.52	0.25	0.2
Additional Explosive Compounds				
Nitroglycerin	3.0	26	3	10
Nitroquanidine	20	10	0.25	0.13
Nitrocellulose	500	700	5	39
Metals SW 846-6010B/6020 or 7000				
Aluminum	100	200	10	20
Antimony	5	20	.05	2.0
Arsenic	5	20	0.5	2.0
Barium	10	5.0	1	0.5
Beryllium	1	2.0	0.1	0.2
Metals SW 846-6010B/6020				
Cadmium	1	6.0	0.1	0.6
Calcium	100	1000	10	100
Chromium	5	5.0	0.5	0.5
Cobalt	5	5.0	0.5	0.5
Copper	5	10	0.5	1.0
Iron	100	150	10	15
Lead	3	10	0.3	1.0
Magnesium	100	250	10	25
Manganese	10	5.0	1	0.5
Mercury (CVAA) SW846-7470A/7471A	0.2	0.2	0.1	0.03
Nickel	10	10	1	1.0
Potassium	200	250	20	25
Selenium	5	20	0.5	2.0
Silver	5	3.0	0.5	0.3

Table A-1. Project Quantitation Limit Goals and Achieved Method Reporting Limits (continued)

Parameters/Methods	Water		Soil/Sediment	
	Project Quantitation Goal (µg/L)	Achieved Method Detection Level (µg/L)	Project Quantitation Goal (µg/kg)	Achieved Method Detection Level (µg/kg)
Sodium	200	2500	20	250
Thallium	2	30	0.2	3.0
Vanadium	10	10	1	1.0
Zinc	10	20	1	2.0
General Chemistry				
Nitrate/Nitrite Nitrogen E353.2	0.1	0.02	NL	NA
Sulfide E376.2	1.0	2.5	NL	80
Total Cyanide SW846 9014T	0.01	0.005	0.5	0.25
Hexavalent Chromium SW846 7196A	NL	0.05	NL	0.4
Total Organic Carbon SW846 9060A	1.0	1.0	10.0	100

PCB = Polychlorinated biphenyl.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.
NL = Project quantitation level not listed for this analyte in the Facility-wide Quality Assurance Project Plan.
NA = No analysis for this compound.

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APPENDIX B

HUMAN HEALTH RISK CHARACTERIZATION

APPENDIX B

COMPUTATIONS FOR
HUMAN HEALTH RISK ASSESSMENT

Appendix Table B-1. COPC Screening for Shallow Surface Soil (0-1 ft bgs) at 40mm Firing Range
(All units are mg/kg)

Analyte	CAS Number	Frequency of Detection	Nondetect Results[a]		Detect Results[b]		Avg Result	95% UCL of Mean	EPC[c]	Bkgd Criteria[d]	MDC exceeds Bkgd?	Region 9 Residential PRG[e]	MDC Exceeds PRG?	COPC?	Justification
			Min DL	Max DL	Min	Max									
Metals															
Aluminum	7429905	40/40 (100%)	AD	AD	3470	21000	11100	12400	12400 (X)	17700	Yes	7600 (nc)	Yes	Yes	MDC > Bkgd & PRG
Antimony	7440360	0/40 (0%)	0.18	0.52	ND	ND	0.157	0.167	0.167 (O)	0.96	ND	3.1 (nc)	No	No	Not detected
Arsenic	7440382	40/40 (100%)	AD	AD	5.7	20.5	11.4	12.5	12.5 (L)	15.4	Yes	0.39 (ca)	Yes	Yes	MDC > Bkgd & PRG
Barium	7440393	40/40 (100%)	AD	AD	21.9	144	65.8	76.8	76.8 (L)	88.4	Yes	540 (nc)	No	No	MDC < PRG
Beryllium	7440417	36/36 (100%)	AD	AD	0.42	1	0.66	0.704	0.704 (L)	0.88	Yes	15 (nc)	No	No	MDC < PRG
Cadmium	7440439	20/40 (50%)	0.018	0.074	0.057	0.87	0.129	0.178	0.178 (X)	0	Yes	3.7 (nc)	No	No	MDC < PRG
Calcium	7440702	40/40 (100%)	AD	AD	153	9250	1150	1620	1620 (X)	15800	No	None	None	No	Essential Nutrient[f]
Chromium	7440473	40/40 (100%)	AD	AD	7.5	429	26.5	43.9	43.9 (X)	17.4	Yes	22 (nc)	Yes	Yes	MDC > Bkgd & PRG
Chromium, hexavalent	18540299	0/4 (0%)	2.9	5.9	ND	ND	1.9	2.73	2.73 (O)	NA	NA	22 (nc)	No	No	Not detected
Cobalt	7440484	40/40 (100%)	AD	AD	4.4	13	8.83	9.46	9.46 (N)	10.4	Yes	140 (nc)	No	No	MDC < PRG
Copper	7440508	40/40 (100%)	AD	AD	6	68.6	17.3	20.2	20.2 (L)	17.7	Yes	310 (nc)	No	No	MDC < PRG
Iron	7439896	40/40 (100%)	AD	AD	15200	34700	23400	24600	24600 (L)	23100	Yes	2300 (nc)	Yes	No	Essential Nutrient[f]
Lead	7439921	40/40 (100%)	AD	AD	11.6	49.5	16.9	18.5	18.5 (X)	26.1	Yes	400 (nc)	No	No	MDC < PRG
Magnesium	7439954	40/40 (100%)	AD	AD	575	4290	2160	2390	2390 (N)	3030	Yes	None	None	No	Essential Nutrient[f]
Manganese	7439965	40/40 (100%)	AD	AD	204	1300	546	632	632 (L)	1450	No	180 (nc)	Yes	No	MDC < Bkgd
Mercury	7439976	0/40 (0%)	0.014	0.061	ND	ND	0.0123	0.0136	0.0136 (O)	0.036	ND	2.3 (nc)	No	No	Not detected
Nickel	7440020	40/40 (100%)	AD	AD	9.2	28.2	16.5	17.7	17.7 (N)	21.1	Yes	160 (nc)	No	No	MDC < PRG
Potassium	7440097	40/40 (100%)	AD	AD	578	2010	1080	1170	1170 (L)	927	Yes	None	None	No	Essential Nutrient[f]
Selenium	7782492	0/40 (0%)	0.27	0.93	ND	ND	0.246	0.27	0.27 (O)	1.4	ND	39 (nc)	No	No	Not detected
Silver	7440224	0/40 (0%)	0.039	0.17	ND	ND	0.0329	0.0367	0.0367 (O)	0	ND	39 (nc)	No	No	Not detected
Sodium	7440235	36/40 (90%)	47.7	52.3	30.4	118	66	72.1	72.1 (N)	123	No	None	None	No	Essential Nutrient[f]
Thallium	7440280	6/40 (15%)	0.36	1.8	2	2.6	0.611	0.804	0.804 (D)	0	Yes	0.52 (nc)	Yes	Yes	MDC > Bkgd & PRG
Vanadium	7440622	40/40 (100%)	AD	AD	9.2	34.1	20.7	22.7	22.7 (X)	31.1	Yes	7.8 (nc)	Yes	Yes	MDC > Bkgd & PRG
Zinc	7440666	40/40 (100%)	AD	AD	44.2	114	60.6	63.9	63.9 (X)	61.8	Yes	2300 (nc)	No	No	MDC < PRG
Organics-Explosives															
1,3,5-Trinitrobenzene	99354	0/30 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	180 (nc)	No	No	Not detected
1,3-Dinitrobenzene	99650	0/40 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	0.61 (nc)	No	No	Not detected
2,4,6-Trinitrotoluene	118967	1/40 (2.5%)	0.1	0.1	0.11	0.11	0.0515	0.054	0.054 (D)	NA	NA	3.1 (nc)	No	No	MDC < PRG
2,4-Dinitrotoluene	121142	1/40 (2.5%)	0.1	0.1	0.096	0.096	0.0512	0.0531	0.0531 (D)	NA	NA	0.72 (ca)	No	No	MDC < PRG
2,6-Dinitrotoluene	606202	0/40 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	0.72 (ca)	No	No	Not detected
2-Amino-4,6-dinitrotoluene	35572782	0/40 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	None	None	No	Not detected
2-Nitrotoluene	88722	0/40 (0%)	0.2	0.2	ND	ND	0.1	0.1	0.1 (O)	NA	NA	0.88 (ca)	No	No	Not detected
3-Nitrotoluene	99081	1/40 (2.5%)	0.2	0.2	0.1	0.1	0.1	0.1	0.1 (D)	NA	NA	73 (nc)	No	No	MDC < PRG
4-Amino-2,6-dinitrotoluene	19406510	0/40 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	None	None	No	Not detected
4-Nitrotoluene	99990	0/40 (0%)	0.2	0.2	ND	ND	0.1	0.1	0.1 (O)	NA	NA	12 (ca)	No	No	Not detected
HMX	2691410	1/40 (2.5%)	0.2	0.2	0.28	0.28	0.105	0.112	0.112 (D)	NA	NA	310 (nc)	No	No	MDC < PRG
Nitrobenzene	98953	4/40 (10%)	0.037	0.1	0.033	0.066	0.0483	0.0506	0.0506 (D)	NA	NA	2.0 (nc)	No	No	MDC < PRG
Nitrocellulose	9004700	4/4 (100%)	AD	AD	20	64	43	65	64 (N)	NA	NA	None	None	Yes	No bkgd or PRG
Nitroglycerin	55630	0/4 (0%)	10	10	ND	ND	5	5	5 (O)	NA	NA	35 (ca)	No	No	Not detected

Appendix Table B-1. COPC Screening for Shallow Surface Soil (0-1 ft bgs) at 40mm Firing Range
(All units are mg/kg)

Analyte	CAS Number	Frequency of Detection	Nondetect Results[a] Min DL	Max DL	Detect Results[b] Min	Max	Avg Result	95% UCL of Mean	EPC[c]	Bkgd Criteria[d]	MDC exceeds Bkgd?	Region 9 Residential PRG[e]	MDC Exceeds PRG?	COPC?	Justification
Nitroguanidine	556887	0/4 (0%)	0.13	0.13	ND	ND	0.065	0.065	0.065 (O)	NA	NA	610 (nc)	No	No	Not detected
RDX	121824	0/40 (0%)	0.2	0.2	ND	ND	0.1	0.1	0.1 (O)	NA	NA	4.4 (ca)	No	No	Not detected
Tetryl	479458	1/30 (3.3%)	0.2	0.2	0.17	0.17	0.102	0.106	0.106 (D)	NA	NA	61 (nc)	No	No	MDC < PRG
Organics-Pesticide/PCB															
4,4'-DDD	72548	0/4 (0%)	0.002	0.0024	ND	ND	0.00105	0.00117	0.00117 (O)	NA	NA	2.4 (ca)	No	No	Not detected
4,4'-DDE	72559	1/4 (25%)	0.002	0.0024	0.00033	0.00033	0.000883	0.00133	0.00033 (D)	NA	NA	1.7 (ca)	No	No	MDC < PRG
4,4'-DDT	50293	0/4 (0%)	0.002	0.0024	ND	ND	0.0011	0.00124	0.0012 (O)	NA	NA	1.7 (ca)	No	No	Not detected
Aldrin	309002	1/4 (25%)	0.002	0.0024	0.0012	0.0012	0.0011	0.00124	0.0012 (D)	NA	NA	0.03 (ca)	No	No	MDC < PRG
Chlordane	57749	0/4 (0%)	0.039	0.047	ND	ND	0.021	0.023	0.023 (O)	NA	NA	1.6 (ca)	No	No	Not detected
Dieldrin	60571	0/4 (0%)	0.002	0.0024	ND	ND	0.00106	0.00117	0.00117 (O)	NA	NA	0.03 (ca)	No	No	Not detected
Endosulfan I	959988	0/4 (0%)	0.002	0.0024	ND	ND	0.00105	0.00117	0.00117 (O)	NA	NA	37 (nc)	No	No	Not detected
Endosulfan II	33213659	0/4 (0%)	0.002	0.0024	ND	ND	0.00105	0.00117	0.00117 (O)	NA	NA	37 (nc)	No	No	Not detected
Endosulfan sulfate	1031078	0/4 (0%)	0.002	0.0024	ND	ND	0.00105	0.00117	0.00117 (O)	NA	NA	37 (nc)	No	No	Not detected
Endrin	72208	0/4 (0%)	0.002	0.0026	ND	ND	0.00113	0.0013	0.0013 (O)	NA	NA	1.8 (nc)	No	No	Not detected
Endrin aldehyde	7421934	1/4 (25%)	0.002	0.0024	0.00085	0.00085	0.00101	0.00118	0.00085 (D)	NA	NA	1.8 (nc)	No	No	MDC < PRG
Endrin ketone	53494705	1/4 (25%)	0.002	0.0024	0.00034	0.00034	0.000885	0.00133	0.00034 (D)	NA	NA	1.8 (nc)	No	No	MDC < PRG
Heptachlor	76448	1/4 (25%)	0.002	0.0024	0.00079	0.00079	0.000998	0.00119	0.00079 (D)	NA	NA	0.11 (ca)	No	No	MDC < PRG
Heptachlor epoxide	1024573	0/4 (0%)	0.002	0.0024	ND	ND	0.00105	0.00117	0.00117 (O)	NA	NA	0.05 (ca)	No	No	Not detected
Lindane	58899	1/4 (25%)	0.002	0.0024	0.00093	0.00093	0.00103	0.00117	0.00093 (D)	NA	NA	0.44 (ca)	No	No	MDC < PRG
Methoxychlor	72435	0/4 (0%)	0.002	0.0024	ND	ND	0.00105	0.00117	0.00117 (O)	NA	NA	31 (nc)	No	No	Not detected
PCB-1016	12674112	0/4 (0%)	0.039	0.047	ND	ND	0.021	0.023	0.023 (O)	NA	NA	0.39 (nc)	No	No	Not detected
PCB-1221	11104282	0/4 (0%)	0.039	0.047	ND	ND	0.021	0.023	0.023 (O)	NA	NA	0.11 (nc)	No	No	Not detected
PCB-1232	11141165	0/4 (0%)	0.039	0.047	ND	ND	0.021	0.023	0.023 (O)	NA	NA	0.11 (nc)	No	No	Not detected
PCB-1242	53469219	0/4 (0%)	0.039	0.047	ND	ND	0.021	0.023	0.023 (O)	NA	NA	0.11 (nc)	No	No	Not detected
PCB-1248	12672296	0/4 (0%)	0.039	0.047	ND	ND	0.021	0.023	0.023 (O)	NA	NA	0.11 (nc)	No	No	Not detected
PCB-1254	11097691	0/4 (0%)	0.039	0.047	ND	ND	0.021	0.023	0.023 (O)	NA	NA	0.11 (nc)	No	No	Not detected
PCB-1260	11096825	0/4 (0%)	0.039	0.047	ND	ND	0.021	0.023	0.023 (O)	NA	NA	0.11 (nc)	No	No	Not detected
Toxaphene	8001352	0/4 (0%)	0.039	0.047	ND	ND	0.021	0.023	0.023 (O)	NA	NA	0.44 (ca)	No	No	Not detected
alpha-BHC	319846	0/4 (0%)	0.002	0.0024	ND	ND	0.00105	0.00117	0.00117 (O)	NA	NA	0.09 (ca)	No	No	Not detected
alpha-Chlordane	5103719	0/4 (0%)	0.002	0.0024	ND	ND	0.00105	0.00117	0.00117 (O)	NA	NA	1.6 (ca)	No	No	Not detected
beta-BHC	319857	0/4 (0%)	0.002	0.0024	ND	ND	0.00105	0.00117	0.00117 (O)	NA	NA	0.32 (ca)	No	No	Not detected
delta-BHC	319868	0/4 (0%)	0.002	0.0024	ND	ND	0.00105	0.00117	0.00117 (O)	NA	NA	None	None	No	Not detected
gamma-Chlordane	5103742	0/4 (0%)	0.002	0.0024	ND	ND	0.00105	0.00117	0.00117 (O)	NA	NA	1.6 (ca)	No	No	Not detected
Organics-Semivolatile															
1,1-Biphenyl	92524	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	300 (nc)	No	No	Not detected
2,4,5-Trichlorophenol	95954	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	610 (nc)	No	No	Not detected
2,4,6-Trichlorophenol	88062	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	0.61 (nc)	No	No	Not detected
2,4-Dichlorophenol	120832	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	18 (nc)	No	No	Not detected
2,4-Dimethylphenol	105679	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	120 (nc)	No	No	Not detected
2-Chloronaphthalene	91587	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	490 (nc)	No	No	Not detected
2-Chlorophenol	95578	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	6.3 (nc)	No	No	Not detected

Appendix Table B-1. COPC Screening for Shallow Surface Soil (0-1 ft bgs) at 40mm Firing Range
(All units are mg/kg)

Analyte	CAS Number	Frequency of Detection	Nondetect Results[a]		Detect Results[b]		Avg Result	95% UCL of Mean	EPC[c]	Bkgd Criteria[d]	MDC exceeds Bkgd?	Region 9 Residential PRG[e]	MDC Exceeds PRG?	COPC?	Justification
			Min DL	Max DL	Min	Max									
2-Methyl-4,6-dinitrophenol	534521	0/4 (0%)	0.78	0.94	ND	ND	0.419	0.46	0.46 (O)	NA	NA	0.61 (nc)	No	No[g]	Not detected
2-Methylnaphthalene	91576	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	5.6 (nc)	No	No	Not detected
2-Methylphenol	95487	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	310 (nc)	No	No	Not detected
2-Nitrobenzenamine	88744	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	18 (nc)	No	No	Not detected
2-Nitrophenol	88755	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	None	None	No	Not detected
3-Nitrobenzenamine	99092	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	1.8 (nc)	No	No	Not detected
4-Bromophenyl phenyl ether	101553	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	None	None	No	Not detected
4-Chloro-3-methylphenol	59507	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	None	None	No	Not detected
4-Chlorobenzenamine	106478	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	24 (nc)	No	No	Not detected
4-Chlorophenyl phenyl ether	7005723	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	None	None	No	Not detected
4-Methylphenol	106445	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	31 (nc)	No	No	Not detected
4-Nitrobenzenamine	100016	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	18 (nc)	No	No	Not detected
4-Nitrophenol	100027	0/4 (0%)	0.78	0.94	ND	ND	0.419	0.46	0.46 (O)	NA	NA	None	None	No	Not detected
Acenaphthene	83329	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	370 (nc)	No	No	Not detected
Acetophenone	98862	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	None	None	No	Not detected
Anthracene	120127	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	2200 (nc)	No	No	Not detected
Atrazine	1912249	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	2.2 (ca)	No	No	Not detected
Benz(a)anthracene	56553	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	0.62 (ca)	No	No	Not detected
Benzo(a)pyrene	50328	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	0.06 (ca)	No	No[g]	Not detected
Benzo(b)fluoranthene	205992	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	0.62 (ca)	No	No	Not detected
Benzo(ghi)perylene	191242	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	None	None	No	Not detected
Benzo(k)fluoranthene	207089	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	6.2 (ca)	No	No	Not detected
Bis(2-chloroethoxy)methane	111911	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	None	None	No	Not detected
Bis(2-chloroisopropyl) ether	108601	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	2.9 (ca)	No	No	Not detected
Bis(2-ethylhexyl)phthalate	117817	1/4 (25%)	0.39	0.47	0.15	0.15	0.196	0.238	0.15 (D)	NA	NA	35 (ca)	No	No	MDC < PRG
Butyl benzyl phthalate	85687	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	1200 (nc)	No	No	Not detected
Caprolactam	105602	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	3100 (nc)	No	No	Not detected
Carbazole	86748	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	24 (ca)	No	No	Not detected
Chrysene	218019	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	62 (ca)	No	No	Not detected
Di-n-butyl phthalate	84742	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	610 (nc)	No	No	Not detected
Dibenz(a,h)anthracene	53703	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	0.06 (ca)	No	No[g]	Not detected
Dibenzofuran	132649	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	15 (nc)	No	No	Not detected
Diethyl phthalate	84662	1/4 (25%)	0.39	0.47	5.6	5.6	1.56	4.73	4.73 (D)	NA	NA	4900 (nc)	No	No	MDC < PRG
Dimethyl phthalate	131113	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	61000 (nc)	No	No	Not detected
Fluoranthene	206440	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	230 (nc)	No	No	Not detected
Fluorene	86737	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	270 (nc)	No	No	Not detected
Hexachlorobenzene	118741	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	0.30 (ca)	No	No[g]	Not detected
Hexachlorocyclopentadiene	77474	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	37 (nc)	No	No	Not detected
Hexachloroethane	67721	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	6.1 (nc)	No	No	Not detected
Indeno(1,2,3-cd)pyrene	193395	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	0.62 (ca)	No	No	Not detected

Appendix Table B-1. COPC Screening for Shallow Surface Soil (0-1 ft bgs) at 40mm Firing Range
(All units are mg/kg)

Analyte	CAS Number	Frequency of Detection	Nondetect Results[a] Min DL	Nondetect Results[a] Max DL	Detect Results[b] Min	Detect Results[b] Max	Avg Result	95% UCL of Mean	EPC[c]	Bkgd Criteria[d]	MDC exceeds Bkgd?	Region 9 Residential PRG[e]	MDC Exceeds PRG?	COPC?	Justification
Isophorone	78591	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	510 (ca)	No	No	Not detected
N-Nitroso-di-n-propylamine	621647	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	0.07 (ca)	No	No[g]	Not detected
N-Nitrosodiphenylamine	86306	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	99 (ca)	No	No	Not detected
Naphthalene	91203	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	5.6 (nc)	No	No	Not detected
Pentachlorophenol	87865	0/4 (0%)	0.78	0.94	ND	ND	0.419	0.46	0.46 (O)	NA	NA	3.0 (ca)	No	No	Not detected
Phenanthrene	85018	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	None	None	No	Not detected
Phenol	108952	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	1800 (nc)	No	No	Not detected
Pyrene	129000	0/4 (0%)	0.39	0.47	ND	ND	0.21	0.23	0.23 (O)	NA	NA	230 (nc)	No	No	Not detected
Organics-Volatile															
1,1,1-Trichloroethane	71556	1/4 (25%)	0.0059	0.0069	0.013	0.013	0.00561	0.0114	0.0114 (D)	NA	NA	200 (nc)	No	No	MDC < PRG
1,1,2,2-Tetrachloroethane	79345	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	0.41 (ca)	No	No	Not detected
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	0/2 (0%)	0.0059	0.0069	ND	ND	0.003	0.00332	0.00305 (O)	NA	NA	2100 (nc)	No	No	Not detected
1,1,2-Trichloroethane	79005	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	0.73 (ca)	No	No	Not detected
1,1-Dichloroethane	75343	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	51 (nc)	No	No	Not detected
1,1-Dichloroethene	75354	1/3 (33%)	0.0059	0.0069	0.0074	0.0074	0.00463	0.00869	0.0074 (D)	NA	NA	12 (nc)	No	No	MDC < PRG
1,2,4-Trichlorobenzene	120821	0/2 (0%)	0.0059	0.0069	ND	ND	0.003	0.00332	0.00305 (O)	NA	NA	6.2 (nc)	No	No	Not detected
1,2-Dibromo-3-chloropropane	96128	0/2 (0%)	0.0059	0.0069	ND	ND	0.003	0.00332	0.00305 (O)	NA	NA	0.21 (nc)	No	No	Not detected
1,2-Dibromoethane	106934	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	0.03 (ca)	No	No	Not detected
1,2-Dichlorobenzene	95501	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	110 (nc)	No	No	Not detected
1,2-Dichloroethane	107062	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	0.28 (ca)	No	No	Not detected
1,2-Dichloropropane	78875	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	0.34 (ca)	No	No	Not detected
1,2-Dimethylbenzene	95476	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	None	None	No	Not detected
1,3-Dichlorobenzene	541731	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	53 (nc)	No	No	Not detected
1,4-Dichlorobenzene	106467	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	3.4 (ca)	No	No	Not detected
2-Butanone	78933	0/2 (0%)	0.012	0.014	ND	ND	0.006	0.006	0.006 (O)	NA	NA	2200 (nc)	No	No	Not detected
2-Hexanone	591786	0/2 (0%)	0.012	0.014	ND	ND	0.006	0.006	0.006 (O)	NA	NA	None	None	No	Not detected
2-Methoxy-2-methylpropane	1634044	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	17 (ca)	No	No	Not detected
4-Methyl-2-pentanone	108101	0/4 (0%)	0.012	0.014	ND	ND	0.00625	0.00684	0.00684 (O)	NA	NA	530 (nc)	No	No	Not detected
Acetone	67641	0/2 (0%)	0.0066	0.015	ND	ND	0.00445	0.00698	0.00485 (O)	NA	NA	1400 (nc)	No	No	Not detected
Benzene	71432	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	0.64 (ca)	No	No	Not detected
Bromodichloromethane	75274	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	0.82 (ca)	No	No	Not detected
Bromomethane	74839	0/2 (0%)	0.012	0.014	ND	ND	0.006	0.006	0.006 (O)	NA	NA	0.39 (nc)	No	No	Not detected
Carbon disulfide	75150	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	36 (nc)	No	No	Not detected
Carbon tetrachloride	56235	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	0.22 (nc)	No	No	Not detected
Chlorobenzene	108907	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	15 (nc)	No	No	Not detected
Chloroethane	75003	0/4 (0%)	0.012	0.014	ND	ND	0.00625	0.00684	0.00684 (O)	NA	NA	3.0 (ca)	No	No	Not detected
Chloroform	67663	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	0.22 (ca)	No	No	Not detected
Chloromethane	74873	0/4 (0%)	0.012	0.014	ND	ND	0.00625	0.00684	0.00684 (O)	NA	NA	4.7 (nc)	No	No	Not detected
Cumene	98828	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	16 (nc)	No	No	Not detected
Cyclohexane	110827	0/2 (0%)	0.0059	0.0069	ND	ND	0.003	0.00332	0.00305 (O)	NA	NA	140 sat	No	No	Not detected

Appendix Table B-1. COPC Screening for Shallow Surface Soil (0-1 ft bgs) at 40mm Firing Range
(All units are mg/kg)

Analyte	CAS Number	Frequency of Detection	Nondetect Results[a] Min DL	Nondetect Results[a] Max DL	Detect Results[b] Min	Detect Results[b] Max	Avg Result	95% UCL of Mean	EPC[c]	Bkgd Criteria[d]	MDC exceeds Bkgd?	Region 9 Residential PRG[e]	MDC Exceeds PRG?	COPC?	Justification
Dibromochloromethane	124481	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	1.1 (ca)	No	No	Not detected
Dichlorodifluoromethane	75718	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	9.4 (nc)	No	No	Not detected
Ethylbenzene	100414	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	190 (nc)	No	No	Not detected
M + P Xylene	136777612	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	27 (nc)	No	No	Not detected
Methylcyclohexane	108872	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	260 (nc)	No	No	Not detected
Methylene chloride	75092	0/2 (0%)	0.0085	0.012	ND	ND	0.006	0.006	0.006 (O)	NA	NA	9.1 (ca)	No	No	Not detected
Styrene	100425	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	440 (nc)	No	No	Not detected
Tetrachloroethene	127184	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	0.48 (ca)	No	No	Not detected
Toluene	108883	1/4 (25%)	0.0059	0.0069	0.002	0.002	0.00286	0.00359	0.002 (D)	NA	NA	66 (nc)	No	No	Not detected
Trichloroethene	79016	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	0.05 (ca)	No	No	MDC < PRG
Trichlorofluoromethane	75694	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	39 (nc)	No	No	Not detected
Vinyl chloride	75014	0/4 (0%)	0.012	0.014	ND	ND	0.00625	0.00684	0.00684 (O)	NA	NA	0.08 (ca)	No	No	Not detected
cis-1,2-Dichloroethene	156592	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	4.3 (nc)	No	No	Not detected
cis-1,3-Dichloropropene	10061015	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	0.78 (ca)	No	No	Not detected
trans-1,2-Dichloroethene	156605	0/4 (0%)	0.0059	0.0069	ND	ND	0.00313	0.00339	0.00339 (O)	NA	NA	6.9 (nc)	No	No	Not detected

[a]Minimum and maximum detection limit (DL) shown for nondetect results.
[b]Minimum and maximum detected concentration shown for detect results.
[c]Exposure point concentration (EPC) is lesser of 95% upper conficence level (UCL) or maxaximum detected concentration (MDC) as appropriate based on data distribution (shown in parentheses). Data distribution codes:
D - Distribution not determined due to less than 50% frequency of detection. 95% UCL calculated using Student's t-statistic.
L - Distribution is lognormal. 95% UCL calculated using Land's H method.
N - Distribution is normal. 95% UCL calculated using Student's t-statistic.
O - The analyte was not detected. 95% UCL calculated using Student's t-statistic.
X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.
[d]Background criteria for RVAAP from USACE 2001. *Final Phase II Remedial Investigation Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio*.
[e]Residential soil preliminary remediation goal (PRG) from Region 9 corresponding to risk of 1.0E-06 for carcinogenic endpoint (ca) or hazard index of 0.1 for noncarcinogenic endpoint (nc).
[f]Essential nutrients are not retained as COPCs because the MDC would result in an intake less than the recommended daily intake (RDI).
[g]Analyte is not a COPC because it was not detected in soil at the 40mm Range; however, because the maximum detection limit exceeds the Region 9 PRG this chemical is included in the risk characterization.

AD - All results are detects.
CAS - chemical abstract service.
COPC - chemical of potential concern.
DL - detection limit.
EPC - exposure point concentration.
MDC - maximum detected concentration.
NA - not applicable, background criteria are only used to screen naturally occuring inorganics.
ND - All results are nondetect.
None - no PRG available.
PRG - preliminary remediation goal.
UCL - upper confidence limit.

Appendix Table B-2. COPC Screening for Deep Surface Soil (0-3 ft bgs) at 40mm Firing Range
(All units are mg/kg)

Analyte	CAS Number	Frequency of Detection	Nondetect Results[a] Min DL	Nondetect Results[a] Max DL	Detect Results[b] Min	Detect Results[b] Max	Avg Result	95% UCL of Mean	EPC[c]	Bkgd Criteria[d]	MDC Exceeds Bkgd?	Region 9 Residential PRG[e]	MDC Exceeds PRG?	COPC?	Justification
Metals															
Aluminum	7429905	66/66 (100%)	AD	AD	3470	21000	11700	12600	12600 (X)	17700	Yes	7600 (nc)	Yes	Yes	MDC > Bkgd & PRG
Antimony	7440360	0/66 (0%)	0.18	0.52	ND	ND	0.156	0.164	0.164 (O)	0.96	ND	3.1 (nc)	ND	No	Not detected
Arsenic	7440382	66/66 (100%)	AD	AD	5.7	30.3	13.8	15	15 (L)	15.4	Yes	0.39 (ca)	Yes	Yes	MDC > Bkgd & PRG
Barium	7440393	66/66 (100%)	AD	AD	21.9	144	64.3	71.3	71.3 (L)	88.4	Yes	540 (nc)	No	No	MDC < PRG
Beryllium	7440417	59/59 (100%)	AD	AD	0.32	1.2	0.679	0.719	0.719 (L)	0.88	Yes	15 (nc)	No	No	MDC < PRG
Cadmium	7440439	23/66 (35%)	0.016	0.074	0.057	0.87	0.0889	0.121	0.121 (D)	0	Yes	3.7 (nc)	No	No	MDC < PRG
Calcium	7440702	66/66 (100%)	AD	AD	144	9250	931	1220	1220 (X)	15800	No	None	None	No	Essential Nutrient[f]
Chromium, total	7440473	66/66 (100%)	AD	AD	7.5	429	23.1	33.6	33.6 (X)	17.4	Yes	22 (nc)	Yes	Yes	MDC > Bkgd & PRG
Chromium, hexavalent	18540299	0/7 (0%)	2.7	6.3	ND	ND	1.94	2.5	2.5 (O)	0	ND	22 (nc)	ND	No	Not detected
Cobalt	7440484	66/66 (100%)	AD	AD	4.4	23.8	9.65	10.4	10.4 (X)	10.4	Yes	140 (nc)	No	No	MDC < PRG
Copper	7440508	66/66 (100%)	AD	AD	6	68.6	19	21	21 (X)	17.7	Yes	310 (nc)	No	No	MDC < PRG
Iron	7439896	66/66 (100%)	AD	AD	13300	36900	24700	25700	25700 (N)	23100	Yes	2300 (nc)	Yes	No	Essential Nutrient[f]
Lead	7439921	66/66 (100%)	AD	AD	8.7	49.5	16	17.2	17.2 (X)	26.1	Yes	400 (nc)	No	No	MDC < PRG
Magnesium	7439954	66/66 (100%)	AD	AD	575	4700	2400	2590	2590 (N)	3030	Yes	None	None	No	Essential Nutrient[f]
Manganese	7439965	66/66 (100%)	AD	AD	152	1300	462	512	512 (L)	1450	No	180 (nc)	Yes	No	MDC < Bkgrd
Mercury	7439976	0/66 (0%)	0.013	0.061	ND	ND	0.011	0.0119	0.0119 (O)	0.036	ND	2.3 (nc)	ND	No	Not detected
Nickel	7440020	66/66 (100%)	AD	AD	9.2	38.5	18.8	20.1	20.1 (L)	21.1	Yes	160 (nc)	No	No	MDC < PRG
Potassium	7440097	66/66 (100%)	AD	AD	578	2400	1170	1250	1250 (L)	927	Yes	None	None	No	Essential Nutrient[f]
Selenium	7782492	0/66 (0%)	0.22	0.93	ND	ND	0.223	0.24	0.24 (O)	1.4	ND	39 (nc)	ND	No	Not detected
Silver	7440224	0/66 (0%)	0.037	0.17	ND	ND	0.0309	0.0333	0.0333 (O)	0	ND	39 (nc)	ND	No	Not detected
Sodium	7440235	62/66 (94%)	47.7	52.3	30.4	288	71.9	79	79 (X)	123	Yes	None	None	No	Essential Nutrient[f]
Thallium	7440280	12/66 (18%)	0.31	1.8	1.9	2.8	0.669	0.838	0.838 (D)	0	Yes	0.52 (nc)	Yes	Yes	MDC > Bkgd & PRG
Vanadium	7440622	66/66 (100%)	AD	AD	9.2	34.1	21.2	22.5	22.5 (N)	31.1	Yes	7.8 (nc)	Yes	Yes	MDC > Bkgd & PRG
Zinc	7440666	66/66 (100%)	AD	AD	29.2	114	60.5	62.9	62.9 (X)	61.8	Yes	2300 (nc)	No	No	MDC < PRG
Organics-Explosives															
1,3,5-Trinitrobenzene	99354	0/53 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	180 (nc)	ND	No	Not detected
1,3-Dinitrobenzene	99650	0/66 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	0.61 (nc)	ND	No	Not detected
2,4,6-Trinitrotoluene	118967	1/66 (1.5%)	0.1	0.1	0.11	0.11	0.0509	0.0524	0.0524 (D)	NA	NA	3.1 (nc)	No	No	MDC < PRG
2,4-Dinitrotoluene	121142	1/66 (1.5%)	0.1	0.1	0.096	0.096	0.0507	0.0519	0.0519 (D)	NA	NA	0.72 (ca)	No	No	MDC < PRG
2,6-Dinitrotoluene	606202	0/66 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	0.72 (ca)	ND	No	Not detected
2-Amino-4,6-dinitrotoluene	35572782	0/66 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	None	ND	No	Not detected
2-Nitrotoluene	88722	0/66 (0%)	0.2	0.2	ND	ND	0.1	0.1	0.1 (O)	NA	NA	0.88 (ca)	ND	No	Not detected
3-Nitrotoluene	99081	2/66 (3.0%)	0.2	0.2	0.098	0.1	0.1	0.1	0.1 (D)	NA	NA	73 (nc)	No	No	MDC < PRG
4-Amino-2,6-dinitrotoluene	19406510	0/66 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	None	ND	No	Not detected
4-Nitrotoluene	99990	0/66 (0%)	0.2	0.2	ND	ND	0.1	0.1	0.1 (O)	NA	NA	12 (ca)	ND	No	Not detected
HMX	2691410	1/66 (1.5%)	0.2	0.2	0.28	0.28	0.103	0.107	0.107 (D)	NA	NA	310 (nc)	No	No	MDC < PRG
Nitrobenzene	98953	7/66 (11%)	0.035	0.1	0.033	0.07	0.0479	0.0498	0.0498 (D)	NA	NA	2 (nc)	No	No	MDC < PRG
Nitrocellulose	9004700	7/7 (100%)	AD	AD	20	64	43	55.3	55.3 (N)	NA	NA	None	None	Yes	No bkgd or PRG
Nitroglycerin	55630	0/7 (0%)	10	10	ND	ND	5	5	5 (O)	NA	NA	35 (ca)	ND	No	Not detected
Nitroguanidine	556887	0/7 (0%)	0.13	0.13	ND	ND	0.065	0.065	0.065 (O)	NA	NA	610 (nc)	ND	No	Not detected
RDX	121824	0/66 (0%)	0.2	0.2	ND	ND	0.1	0.1	0.1 (O)	NA	NA	4.4 (ca)	ND	No	Not detected
Tetryl	479458	1/53 (1.9%)	0.2	0.2	0.17	0.17	0.101	0.104	0.104 (D)	NA	NA	61 (nc)	No	No	MDC < PRG
Organics-Pesticide/PCB															

Appendix Table B-2. COPC Screening for Deep Surface Soil (0-3 ft bgs) at 40mm Firing Range
(All units are mg/kg)

Analyte	CAS Number	Frequency of Detection	Nondetect Results[a] Min DL	Nondetect Results[a] Max DL	Detect Results[b] Min	Detect Results[b] Max	Avg Result	95% UCL of Mean	EPC[c]	Bkgd Criteria[d]	MDC Exceeds Bkgd?	Region 9 Residential PRG[e]	MDC Exceeds PRG?	COPC?	Justification
4,4'-DDD	72548	0/7 (0%)	0.0019	0.0024	ND	ND	0.00103	0.00109	0.0011 (O)	NA	NA	2.4 (ca)	ND	No	Not detected
4,4'-DDE	72559	1/ 7 (14%)	0.0019	0.0024	0.00033	0.00033	0.000933	0.00114	0.0003 (D)	NA	NA	1.7 (ca)	No	No	MDC < PRG
4,4'-DDT	50293	0/7 (0%)	0.0019	0.0024	ND	ND	0.00106	0.00113	0.0011 (O)	NA	NA	1.7 (ca)	ND	No	Not detected
Aldrin	309002	1/7 (14%)	0.0019	0.0024	0.0012	0.0012	0.00106	0.00113	0.0011 (D)	NA	NA	0.029 (ca)	No	No	MDC < PRG
Chlordane	57749	0/7 (0%)	0.039	0.047	ND	ND	0.0206	0.0217	0.0217 (O)	NA	NA	1.6 (ca)	ND	No	Not detected
Dieldrin	60571	0/7 (0%)	0.0019	0.0024	ND	ND	0.00104	0.00109	0.0011 (O)	NA	NA	0.03 (ca)	ND	No	Not detected
Endosulfan I	959988	0/7 (0%)	0.0019	0.0024	ND	ND	0.00103	0.00109	0.0011 (O)	NA	NA	37 (nc)	ND	No	Not detected
Endosulfan II	33213659	0/7 (0%)	0.0019	0.0024	ND	ND	0.00103	0.00109	0.0011 (O)	NA	NA	37 (nc)	ND	No	Not detected
Endosulfan sulfate	1031078	0/7 (0%)	0.0019	0.0024	ND	ND	0.00103	0.00109	0.0011 (O)	NA	NA	37 (nc)	ND	No	Not detected
Endrin	72208	0/7 (0%)	0.0019	0.0026	ND	ND	0.00107	0.00117	0.0012 (O)	NA	NA	1.8 (nc)	ND	No	Not detected
Endrin aldehyde	7421934	1/7 (14%)	0.0019	0.0024	0.00085	0.00085	0.00101	0.00108	0.0009 (D)	NA	NA	1.8 (nc)	No	No	MDC < PRG
Endrin ketone	53494705	1/7 (14%)	0.0019	0.0024	0.00034	0.00034	0.000934	0.00114	0.0003 (D)	NA	NA	1.8 (nc)	No	No	MDC < PRG
Heptachlor	76448	1/7 (14%)	0.0019	0.0024	0.00079	0.00079	0.000999	0.00109	0.0008 (D)	NA	NA	0.11 (ca)	No	No	MDC < PRG
Heptachlor epoxide	1024573	0/7 (0%)	0.0019	0.0024	ND	ND	0.00103	0.00109	0.0011 (O)	NA	NA	0.053 (ca)	ND	No	Not detected
Lindane	58899	1/7 (14%)	0.0019	0.0024	0.00093	0.00093	0.00102	0.00108	0.0009 (D)	NA	NA	0.44 (ca)	No	No	MDC < PRG
Methoxychlor	72435	0/7 (0%)	0.0019	0.0024	ND	ND	0.00103	0.00109	0.0011 (O)	NA	NA	31 (nc)	ND	No	Not detected
PCB-1016	12674112	0/7 (0%)	0.039	0.047	ND	ND	0.0206	0.0217	0.0217 (O)	NA	NA	0.39 (nc)	ND	No	Not detected
PCB-1221	11104282	0/7 (0%)	0.039	0.047	ND	ND	0.0206	0.0217	0.0217 (O)	NA	NA	0.11 (nc)	ND	No	Not detected
PCB-1232	11141165	0/7 (0%)	0.039	0.047	ND	ND	0.0206	0.0217	0.0217 (O)	NA	NA	0.11 (nc)	ND	No	Not detected
PCB-1242	53469219	0/7 (0%)	0.039	0.047	ND	ND	0.0206	0.0217	0.0217 (O)	NA	NA	0.11 (nc)	ND	No	Not detected
PCB-1248	12672296	0/7 (0%)	0.039	0.047	ND	ND	0.0206	0.0217	0.0217 (O)	NA	NA	0.11 (nc)	ND	No	Not detected
PCB-1254	11097691	0/7 (0%)	0.039	0.047	ND	ND	0.0206	0.0217	0.0217 (O)	NA	NA	0.11 (nc)	ND	No	Not detected
PCB-1260	11096825	0/7 (0%)	0.039	0.047	ND	ND	0.0206	0.0217	0.0217 (O)	NA	NA	0.11 (nc)	ND	No	Not detected
Toxaphene	8001352	0/7 (0%)	0.039	0.047	ND	ND	0.0206	0.0217	0.0217 (O)	NA	NA	0.44 (ca)	ND	No	Not detected
alpha-BHC	319846	0/7 (0%)	0.0019	0.0024	ND	ND	0.00103	0.00109	0.0011 (O)	NA	NA	0.09 (ca)	ND	No	Not detected
alpha-Chlordane	5103719	0/7 (0%)	0.0019	0.0024	ND	ND	0.00103	0.00109	0.0011 (O)	NA	NA	1.6 (ca)	ND	No	Not detected
beta-BHC	319857	0/7 (0%)	0.0019	0.0024	ND	ND	0.00103	0.00109	0.0011 (O)	NA	NA	0.32 (ca)	ND	No	Not detected
delta-BHC	319868	0/7 (0%)	0.0019	0.0024	ND	ND	0.00103	0.00109	0.0011 (O)	NA	NA	None	ND	No	Not detected
gamma-Chlordane	5103742	0/7 (0%)	0.0019	0.0024	ND	ND	0.00103	0.00109	0.0011 (O)	NA	NA	1.6 (ca)	ND	No	Not detected
Organics-Semivolatile															
1,1-Biphenyl	92524	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	300 (nc)	ND	No	Not detected
2,4,5-Trichlorophenol	95954	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	610 (nc)	ND	No	Not detected
2,4,6-Trichlorophenol	88062	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	0.61 (nc)	ND	No	Not detected
2,4-Dichlorophenol	120832	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	18 (nc)	ND	No	Not detected
2,4-Dimethylphenol	105679	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	120 (nc)	ND	No	Not detected
2,4-Dinitrophenol	51285	0/1 (0%)	0.78	0.94	ND	ND	0.4		0.4 (O)	NA	NA	12 (nc)	ND	No	Not detected
2-Chloronaphthalene	91587	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	490 (nc)	ND	No	Not detected
2-Chlorophenol	95578	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	6.3 (nc)	ND	No	Not detected
2-Methyl-4,6-dinitrophenol	534521	0/7 (0%)	0.78	0.94	ND	ND	0.413	0.433	0.433 (O)	NA	NA	0.61 (nc)	ND	No[g]	Not detected
2-Methylnaphthalene	91576	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	5.6 (nc)	ND	No	Not detected
2-Methylphenol	95487	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	310 (nc)	ND	No	Not detected
2-Nitrobenzenamine	88744	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	18 (nc)	ND	No	Not detected
2-Nitrophenol	88755	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	None	ND	No	Not detected
3,3'-Dichlorobenzidine	91941	0/1 (0%)	0.78	0.94	ND	ND	0.4		0.4 (O)	NA	NA	1.1 (ca)	ND	No	Not detected
3-Nitrobenzenamine	99092	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	1.8 (nc)	ND	No	Not detected

Appendix Table B-2. COPC Screening for Deep Surface Soil (0-3 ft bgs) at 40mm Firing Range
(All units are mg/kg)

Analyte	CAS Number	Frequency of Detection	Nondetect Results[a] Min DL	Nondetect Results[a] Max DL	Detect Results[b] Min	Detect Results[b] Max	Avg Result	95% UCL of Mean	EPC[c]	Bkgd Criteria[d]	MDC Exceeds Bkgd?	Region 9 Residential PRG[e]	MDC Exceeds PRG?	COPC?	Justification
4-Bromophenyl phenyl ether	101553	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	None	ND	No	Not detected
4-Chloro-3-methylphenol	59507	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	None	ND	No	Not detected
4-Chlorobenzenamine	106478	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	24 (nc)	ND	No	Not detected
4-Chlorophenyl phenyl ether	7005723	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	None	ND	No	Not detected
4-Methylphenol	106445	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	31 (nc)	ND	No	Not detected
4-Nitrobenzenamine	100016	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	18 (nc)	ND	No	Not detected
4-Nitrophenol	100027	0/7 (0%)	0.78	0.94	ND	ND	0.413	0.433	0.433 (O)	NA	NA	None	ND	No	Not detected
Acenaphthene	83329	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	370 (nc)	ND	No	Not detected
Acenaphthylene	208968	0/1 (0%)	0.39	0.47	ND	ND	0.2		0.2 (O)	NA	NA	None	ND	No	Not detected
Acetophenone	98862	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	None	ND	No	Not detected
Anthracene	120127	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	2200 (nc)	ND	No	Not detected
Atrazine	1912249	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	2.2 (ca)	ND	No	Not detected
Benz(a)anthracene	56553	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	0.62 (ca)	ND	No	Not detected
Benzaldehyde	100527	0/1 (0%)	0.39	0.47	ND	ND	0.2		0.2 (O)	NA	NA	610 (nc)	ND	No	Not detected
Benzo(a)pyrene	50328	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	0.062 (ca)	ND	No[g]	Not detected
Benzo(b)fluoranthene	205992	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	0.62 (ca)	ND	No	Not detected
Benzo(ghi)perylene	191242	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	None	ND	No	Not detected
Benzo(k)fluoranthene	207089	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	6.2 (ca)	ND	No	Not detected
Bis(2-chloroethoxy)methane	111911	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	None	ND	No	Not detected
Bis(2-chloroethyl) ether	111444	0/1 (0%)	0.39	0.47	ND	ND	0.2		0.2 (O)	NA	NA	0.22 (ca)	ND	No[g]	Not detected
Bis(2-chloroisopropyl) ether	108601	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	2.9 (ca)	ND	No	Not detected
Bis(2-ethylhexyl)phthalate	117817	1/7 (14%)	0.39	0.47	0.15	0.15	0.199	0.217	0.15 (D)	NA	NA	35 (ca)	No	No	MDC < PRG
Butyl benzyl phthalate	85687	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	1200 (nc)	ND	No	Not detected
Caprolactam	105602	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	3100 (nc)	ND	No	Not detected
Carbazole	86748	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	24 (ca)	ND	No	Not detected
Chrysene	218019	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	62 (ca)	ND	No	Not detected
Di-n-butyl phthalate	84742	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	610 (nc)	ND	No	Not detected
Di-n-octylphthalate	117840	0/1 (0%)	0.39	0.47	ND	ND	0.2		0.2 (O)	NA	NA	240 (nc)	ND	No	Not detected
Dibenz(a,h)anthracene	53703	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	0.062 (ca)	ND	No[g]	Not detected
Dibenzofuran	132649	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	15 (nc)	ND	No	Not detected
Diethyl phthalate	84662	1/7 (14%)	0.39	0.47	5.6	5.6	0.977	2.47	2.47 (D)	NA	NA	4900 (nc)	No	No	MDC < PRG
Dimethyl phthalate	131113	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	61000 (nc)	ND	No	Not detected
Fluoranthene	206440	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	230 (nc)	ND	No	Not detected
Fluorene	86737	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	270 (nc)	ND	No	Not detected
Hexachlorobenzene	118741	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	0.3 (ca)	ND	No[g]	Not detected
Hexachlorobutadiene	87683	0/1 (0%)	0.39	0.47	ND	ND	0.2		0.2 (O)	NA	NA	1.8 (nc)	ND	No	Not detected
Hexachlorocyclopentadiene	77474	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	37 (nc)	ND	No	Not detected
Hexachloroethane	67721	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	6.1 (nc)	ND	No	Not detected
Indeno(1,2,3-cd)pyrene	193395	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	0.62 (ca)	ND	No	Not detected
Isophorone	78591	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	510 (ca)	ND	No	Not detected
N-Nitroso-di-n-propylamine	621647	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	0.069 (ca)	ND	No[g]	Not detected
N-Nitrosodiphenylamine	86306	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	99 (ca)	ND	No	Not detected
Naphthalene	91203	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	5.6 (nc)	ND	No	Not detected
Pentachlorophenol	87865	0/7 (0%)	0.78	0.94	ND	ND	0.413	0.433	0.433 (O)	NA	NA	3 (ca)	ND	No	Not detected

Appendix Table B-2. COPC Screening for Deep Surface Soil (0-3 ft bgs) at 40mm Firing Range
(All units are mg/kg)

Analyte	CAS Number	Frequency of Detection	Nondetect Results[a] Min DL	Nondetect Results[a] Max DL	Detect Results[b] Min	Detect Results[b] Max	Avg Result	95% UCL of Mean	EPC[c]	Bkgd Criteria[d]	MDC Exceeds Bkgd?	Region 9 Residential PRG[e]	MDC Exceeds PRG?	COPC?	Justification
Phenanthrene	85018	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	None	ND	No	Not detected
Phenol	108952	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	1800 (nc)	ND	No	Not detected
Pyrene	129000	0/7 (0%)	0.39	0.47	ND	ND	0.206	0.217	0.217 (O)	NA	NA	230 (nc)	ND	No	Not detected
Organics-Volatile															
1,1,1-Trichloroethane	71556	1/7 (14%)	0.0058	0.0069	0.013	0.013	0.00453	0.00728	0.0073 (D)	NA	NA	200 (nc)	No	No	MDC < PRG
1,1,2,2-Tetrachloroethane	79345	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	0.41 (ca)	ND	No	Not detected
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	0/3 (0%)	0.0058	0.0069	ND	ND	0.00297	0.0031	0.0031 (O)	NA	NA	2100 (nc)	ND	No	Not detected
1,1,2-Trichloroethane	79005	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	0.73 (ca)	ND	No	Not detected
1,1-Dichloroethane	75343	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	51 (nc)	ND	No	Not detected
1,1-Dichloroethene	75354	1/5 (20%)	0.0058	0.0069	0.0074	0.0074	0.00405	0.00584	0.0058 (D)	NA	NA	12 (nc)	No	No	MDC < PRG
1,2,4-Trichlorobenzene	120821	0/3 (0%)	0.0058	0.0069	ND	ND	0.00297	0.0031	0.0031 (O)	NA	NA	6.2 (nc)	ND	No	Not detected
1,2-Dibromo-3-chloropropane	96128	0/3 (0%)	0.0058	0.0069	ND	ND	0.00297	0.0031	0.0031 (O)	NA	NA	0.21 (nc)	ND	No	Not detected
1,2-Dibromoethane	106934	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	0.032 (ca)	ND	No	Not detected
1,2-Dichlorobenzene	95501	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	110 (nc)	ND	No	Not detected
1,2-Dichloroethane	107062	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	0.28 (ca)	ND	No	Not detected
1,2-Dichloropropane	78875	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	0.34 (ca)	ND	No	Not detected
1,2-Dimethylbenzene	95476	1/7 (14%)	0.0059	0.0069	0.002	0.002	0.00298	0.00332	0.002 (D)	NA	NA	27 (nc)	No	No	MDC < PRG
1,3-Dichlorobenzene	541731	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	53 (nc)	ND	No	Not detected
1,4-Dichlorobenzene	106467	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	3.4 (ca)	ND	No	Not detected
2-Butanone	78933	0/3 (0%)	0.012	0.014	ND	ND	0.006	0.006	0.006 (O)	NA	NA	2200 (nc)	ND	No	Not detected
2-Hexanone	591786	0/3 (0%)	0.012	0.014	ND	ND	0.006	0.006	0.006 (O)	NA	NA	None	ND	No	Not detected
2-Methoxy-2-methylpropane	1634044	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	17 (ca)	ND	No	Not detected
4-Methyl-2-pentanone	108101	0/7 (0%)	0.012	0.014	ND	ND	0.00621	0.0065	0.0065 (O)	NA	NA	530 (nc)	ND	No	Not detected
Acetone	67641	0/3 (0%)	0.0066	0.015	ND	ND	0.00513	0.00724	0.0065 (O)	NA	NA	1400 (nc)	ND	No	Not detected
Benzene	71432	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	0.64 (ca)	ND	No	Not detected
Bromodichloromethane	75274	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	0.82 (ca)	ND	No	Not detected
Bromomethane	74839	0/3 (0%)	0.012	0.014	ND	ND	0.006	0.006	0.006 (O)	NA	NA	0.39 (nc)	ND	No	Not detected
Carbon disulfide	75150	2/7 (29%)	0.0059	0.0069	0.0031	0.016	0.00498	0.00855	0.0086 (D)	NA	NA	36 (nc)	No	No	MDC < PRG
Carbon tetrachloride	56235	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	0.22 (nc)	ND	No	Not detected
Chlorobenzene	108907	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	15 (nc)	ND	No	Not detected
Chloroethane	75003	0/7 (0%)	0.012	0.014	ND	ND	0.00621	0.0065	0.0065 (O)	NA	NA	3 (ca)	ND	No	Not detected
Chloroform	67663	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	0.22 (ca)	ND	No	Not detected
Chloromethane	74873	0/7 (0%)	0.012	0.014	ND	ND	0.00621	0.0065	0.0065 (O)	NA	NA	4.7 (nc)	ND	No	Not detected
Cumene	98828	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	16 (nc)	ND	No	Not detected
Cyclohexane	110827	0/3 (0%)	0.0058	0.0069	ND	ND	0.00297	0.0031	0.0031 (O)	NA	NA	140 sat	ND	No	Not detected
Dibromochloromethane	124481	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	1.1 (ca)	ND	No	Not detected
Dichlorodifluoromethane	75718	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	9.4 (nc)	ND	No	Not detected
Ethylbenzene	100414	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	190 (nc)	ND	No	Not detected
M + P Xylene	136777612	1/7 (14%)	0.0059	0.0069	0.0051	0.0051	0.00342	0.00398	0.004 (D)	NA	NA	27 (nc)	No	No	MDC < PRG
Methylcyclohexane	108872	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	260 (nc)	ND	No	Not detected
Methylene chloride	75092	0/3 (0%)	0.007	0.014	ND	ND	0.00517	0.0076	0.006 (O)	NA	NA	9.1 (ca)	ND	No	Not detected
Styrene	100425	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	440 (nc)	ND	No	Not detected
Tetrachloroethene	127184	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	0.48 (ca)	ND	No	Not detected
Toluene	108883	2/7 (29%)	0.0059	0.0069	0.002	0.0036	0.00306	0.00344	0.0034 (D)	NA	NA	66 (nc)	No	No	MDC < PRG

Appendix Table B-2. COPC Screening for Deep Surface Soil (0-3 ft bgs) at 40mm Firing Range
(All units are mg/kg)

Analyte	CAS Number	Frequency of Detection	Nondetect Results[a]		Detect Results[b]		Avg Result	95% UCL of Mean	EPC[c]	Bkgd Criteria[d]	MDC Exceeds Bkgd?	Region 9 Residential PRG[e]	MDC Exceeds PRG?	COPC?	Justification
			Min DL	Max DL	Min	Max									
Trichloroethene	79016	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	0.053 (ca)	ND	No	Not detected
Trichlorofluoromethane	75694	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	39 (nc)	ND	No	Not detected
Vinyl chloride	75014	0/7 (0%)	0.012	0.014	ND	ND	0.00621	0.0065	0.0065 (O)	NA	NA	0.079 (ca)	ND	No	Not detected
cis-1,2-Dichloroethene	156592	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	4.3 (nc)	ND	No	Not detected
cis-1,3-Dichloropropene	10061015	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	0.78 (ca)	ND	No	Not detected
trans-1,2-Dichloroethene	156605	0/7 (0%)	0.0058	0.0069	ND	ND	0.00311	0.00325	0.0033 (O)	NA	NA	6.9 (nc)	ND	No	Not detected

[a]Minimum and maximum detection limit (DL) shown for nondetect results.

[b]Minimum and maximum detected concentration shown for detect results.

[c]Exposure point concentration (EPC) is lesser of 95% upper conficence level (UCL) or maxaximum detected concentration (MDC) as appropriate based on data distribution (shown in parentheses). Data distribution codes:

D - Distribution not determined due to less than 50% frequency of detection. 95% UCL calculated using Student's t-statistic.
L - Distribution is lognormal. 95% UCL calculated using Land's H method.
N - Distribution is normal. 95% UCL calculated using Student's t-statistic.
O - The analyte was not detected. 95% UCL calculated using Student's t-statistic.
X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

[d]Background criteria for RVAAP from USACE 2001. *Final Phase II Remedial Investigation Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio*.

[e]Residential soil preliminary remediation goal (PRG) from Region 9 corresponding to risk of 1.0E-06 for carcinogenic endpoint (ca) or hazard index of 0.1 for noncarcinogenic endpoint (nc).

[f]Essential nutrients are not retained as COPCs because the MDC would result in an intake less than the recommended daily intake (RDI).

[g]Analyte is not a COPC because it was not detected in soil at the 40mm Range; however, because the maximum detection limit exceeds the Region 9 PRG this chemical is included in the risk characterization.

AD - All results are detects.
CAS - chemical abstract service.
COPC - chemical of potential concern.
DL - detection limit.
EPC - exposure point concentration.
MDC - maximum detected concentration.
NA - not applicable, background criteria are only used to screen naturally occuring inorganics.
ND - All results are nondetect.
None - no PRG available.
PRG - preliminary remediation goal.
UCL - upper confidence limit.

Appendix Table B-3. COPC Screening for Subsurface Soil (1-3 ft bgs) at 40mm Firing Range
(All units are mg/kg)

Analyte	CAS Number	Frequency of Detection	Nondetect Results[a] Min DL	Nondetect Results[a] Max DL	Detect Results[b] Min	Detect Results[b] Max	Avg Result	95% UCL of Mean	EPC[c]	Bkgd Criteria[d]	MDC exceeds Bkgd?	Region 9 Residential PRG[e]	MDC Exceeds PRG?	COPC?	Justification
Metals															
Aluminum	7429905	26/26 (100%)	AD	AD	19600	6850	12600	13600	13600 (N)	19500	Yes	7600 (nc)	Yes	Yes	MDC > Bkgd & PRG
Antimony	7440360	0/26 (0%)	0.18	0.45	ND	ND	0.154	0.166	0.166 (O)	0.96	No	3.1 (nc)	No	No	Not detected
Arsenic	7440382	26/26 (100%)	AD	AD	30.3	8.1	17.5	19	19 (N)	19.8	Yes	0.39 (ca)	Yes	Yes	MDC > Bkgd & PRG
Barium	7440393	26/26 (100%)	AD	AD	121	30.5	62	71	71 (L)	124	No	540 (nc)	No	No	MDC < Bkgd
Beryllium	7440417	23/23 (100%)	AD	AD	1.2	0.32	0.709	0.796	0.796 (L)	0.88	Yes	15 (nc)	No	No	MDC < PRG
Cadmium	7440439	3/26 (12%)	0.016	0.061	0.22	0.077	0.0279	0.0424	0.0424 (D)	0	Yes	3.7 (nc)	No	No	MDC < PRG
Calcium	7440702	26/26 (100%)	AD	AD	1570	144	589	774	774 (L)	35500	No	None	None	No	Essential Nutrient[f]
Chromium	7440473	26/26 (100%)	AD	AD	27.7	10.5	17.9	19.2	19.2 (L)	27.2	Yes	22 (nc)	Yes	Yes	MDC > Bkgd & PRG
Chromium, hexavalent	18540299	0/3 (0%)	2.7	6.3	ND	ND	1.98	3.69	3.15 (O)	0	ND	22 (nc)	No	No	Not detected
Cobalt	7440484	26/26 (100%)	AD	AD	23.8	4.7	10.9	12.5	12.5 (L)	23.2	Yes	140 (nc)	No	No	MDC < PRG
Copper	7440508	26/26 (100%)	AD	AD	36.5	9.4	21.6	23.2	23.2 (X)	32.3	Yes	310 (nc)	No	No	MDC < PRG
Iron	7439896	26/26 (100%)	AD	AD	36900	13300	26800	28400	28400 (X)	35200	Yes	2300 (nc)	Yes	No	Essential Nutrient[f]
Lead	7439921	26/26 (100%)	AD	AD	36.1	8.7	14.7	16.3	16.3 (X)	19.1	Yes	400 (nc)	No	No	MDC < PRG
Magnesium	7439954	26/26 (100%)	AD	AD	4700	1430	2770	3120	3120 (L)	8790	No	None	None	No	Essential Nutrient[f]
Manganese	7439965	26/26 (100%)	AD	AD	840	152	333	375	375 (L)	3030	No	180 (nc)	Yes	No	MDC < Bkgd
Mercury	7439976	0/26 (0%)	0.013	0.023	ND	ND	0.00906	0.00948	0.00948 (O)	0.044	No	2.3 (nc)	No	No	Not detected
Nickel	7440020	26/26 (100%)	AD	AD	38.5	10.2	22.2	24.7	24.7 (L)	60.7	No	160 (nc)	No	No	MDC < Bkgd
Potassium	7440097	26/26 (100%)	AD	AD	2400	769	1310	1440	1440 (L)	3350	No	None	None	No	Essential Nutrient[f]
Selenium	7782492	0/26 (0%)	0.22	0.69	ND	ND	0.188	0.21	0.21 (O)	1.5	No	39 (nc)	No	No	Not detected
Silver	7440224	0/26 (0%)	0.037	0.079	ND	ND	0.0277	0.0297	0.0297 (O)	0	ND	39 (nc)	No	No	Not detected
Sodium	7440235	26/26 (100%)	AD	AD	288	46.3	81	96.4	96.4 (X)	145	Yes	None	None	No	Essential Nutrient[f]
Thallium	7440280	6/26 (23%)	0.31	0.9	2.8	1.9	0.759	1.08	1.08 (D)	0.91	Yes	0.52 (nc)	Yes	Yes	MDC > Bkgd & PRG
Vanadium	7440622	26/26 (100%)	AD	AD	34	13.1	22	23.6	23.6 (N)	37.6	No	7.8 (nc)	Yes	No	MDC < Bkgd
Zinc	7440666	26/26 (100%)	AD	AD	77.4	29.2	60.5	64.1	64.1 (N)	93.3	No	2300 (nc)	No	No	MDC < Bkgd
Organics-Explosives															
1,3,5-Trinitrobenzene	99354	0/23 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	180 (nc)	No	No	Not detected
1,3-Dinitrobenzene	99650	0/26 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	0.61 (nc)	No	No	Not detected
2,4,6-Trinitrotoluene	118967	0/26 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	3.1 (nc)	No	No	Not detected
2,4-Dinitrotoluene	121142	0/26 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	0.72 (ca)	No	No	Not detected
2,6-Dinitrotoluene	606202	0/26 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	0.72 (ca)	No	No	Not detected
2-Amino-4,6-dinitrotoluene	35572782	0/26 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	None	None	No	Not detected
2-Nitrotoluene	88722	0/26 (0%)	0.2	0.2	ND	ND	0.1	0.1	0.1 (O)	NA	NA	0.88 (ca)	No	No	Not detected
3-Nitrotoluene	99081	1/26 (3.9)	0.2	0.2	0.098	0.098	0.0999	0.1	0.098 (D)	NA	NA	73 (nc)	No	No	MDC < PRG
4-Amino-2,6-dinitrotoluene	19406510	0/26 (0%)	0.1	0.1	ND	ND	0.05	0.05	0.05 (O)	NA	NA	None	None	No	Not detected
4-Nitrotoluene	99990	0/26 (0%)	0.2	0.2	ND	ND	0.1	0.1	0.1 (O)	NA	NA	12 (ca)	No	No	Not detected
HMX	2691410	0/26 (0%)	0.2	0.2	ND	ND	0.1	0.1	0.1 (O)	NA	NA	310 (nc)	No	No	Not detected
Nitrobenzene	98953	3/26 (12%)	0.035	0.1	0.07	0.042	0.0473	0.0506	0.0506 (D)	NA	NA	2 (nc)	No	No	MDC < PRG
Nitrocellulose	9004700	3/3 (100%)	AD	AD	59	24	43	72.8	59 (N)	NA	NA	None	None	Yes	No bkgd or PRG
Nitroglycerin	55630	0/3 (0%)	10	10	ND	ND	5	5	5 (O)	NA	NA	35 (ca)	No	No	Not detected
Nitroguanidine	556887	0/3 (0%)	0.13	0.13	ND	ND	0.065	0.065	0.065 (O)	NA	NA	610 (nc)	No	No	Not detected
RDX	121824	0/26 (0%)	0.2	0.2	ND	ND	0.1	0.1	0.1 (O)	NA	NA	4.4 (ca)	No	No	Not detected
Tetryl	479458	0/23 (0%)	0.2	0.2	ND	ND	0.1	0.1	0.1 (O)	NA	NA	61 (nc)	No	No	Not detected

Appendix Table B-3. COPC Screening for Subsurface Soil (1-3 ft bgs) at 40mm Firing Range
(All units are mg/kg)

Analyte	CAS Number	Frequency of Detection	Nondetect Results[a] Min DL	Nondetect Results[a] Max DL	Detect Results[b] Min	Detect Results[b] Max	Avg Result	95% UCL of Mean	EPC[c]	Bkgd Criteria[d]	MDC exceeds Bkgd?	Region 9 Residential PRG[e]	MDC Exceeds PRG?	COPC?	Justification
Organics-Pesticide/PCB															
4,4'-DDD	72548	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	2.4 (ca)	No	No	Not detected
4,4'-DDE	72559	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	1.7 (ca)	No	No	Not detected
4,4'-DDT	50293	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	1.7 (ca)	No	No	Not detected
Aldrin	309002	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	0.029 (ca)	No	No	Not detected
Chlordane	57749	0/3 (0%)	0.039	0.042	ND	ND	0.0202	0.0215	0.021 (O)	NA	NA	1.6 (ca)	No	No	Not detected
Dieldrin	60571	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	0.03 (ca)	No	No	Not detected
Endosulfan I	959988	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	37 (nc)	No	No	Not detected
Endosulfan II	33213659	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	37 (nc)	No	No	Not detected
Endosulfan sulfate	1031078	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	37 (nc)	No	No	Not detected
Endrin	72208	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	1.8 (nc)	No	No	Not detected
Endrin aldehyde	7421934	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	1.8 (nc)	No	No	Not detected
Endrin ketone	53494705	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	1.8 (nc)	No	No	Not detected
Heptachlor	76448	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	0.11 (ca)	No	No	Not detected
Heptachlor epoxide	1024573	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	0.053 (ca)	No	No	Not detected
Lindane	58899	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	0.44 (ca)	No	No	Not detected
Methoxychlor	72435	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	31 (nc)	No	No	Not detected
PCB-1016	12674112	0/3 (0%)	0.039	0.042	ND	ND	0.0202	0.0215	0.021 (O)	NA	NA	0.39 (nc)	No	No	Not detected
PCB-1221	11104282	0/3 (0%)	0.039	0.042	ND	ND	0.0202	0.0215	0.021 (O)	NA	NA	0.11 (nc)	No	No	Not detected
PCB-1232	11141165	0/3 (0%)	0.039	0.042	ND	ND	0.0202	0.0215	0.021 (O)	NA	NA	0.11 (nc)	No	No	Not detected
PCB-1242	53469219	0/3 (0%)	0.039	0.042	ND	ND	0.0202	0.0215	0.021 (O)	NA	NA	0.11 (nc)	No	No	Not detected
PCB-1248	12672296	0/3 (0%)	0.039	0.042	ND	ND	0.0202	0.0215	0.021 (O)	NA	NA	0.11 (nc)	No	No	Not detected
PCB-1254	11097691	0/3 (0%)	0.039	0.042	ND	ND	0.0202	0.0215	0.021 (O)	NA	NA	0.11 (nc)	No	No	Not detected
PCB-1260	11096825	0/3 (0%)	0.039	0.042	ND	ND	0.0202	0.0215	0.021 (O)	NA	NA	0.11 (nc)	No	No	Not detected
Toxaphene	8001352	0/3 (0%)	0.039	0.042	ND	ND	0.0202	0.0215	0.021 (O)	NA	NA	0.44 (ca)	No	No	Not detected
alpha-BHC	319846	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	0.09 (ca)	No	No	Not detected
alpha-Chlordane	5103719	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	1.6 (ca)	No	No	Not detected
beta-BHC	319857	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	0.32 (ca)	No	No	Not detected
delta-BHC	319868	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	None	None	No	Not detected
gamma-Chlordane	5103742	0/3 (0%)	0.0019	0.0021	ND	ND	0.001	0.00108	0.00105 (O)	NA	NA	1.6 (ca)	No	No	Not detected
Organics-Semivolatile															
1,1-Biphenyl	92524	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	300 (nc)	No	No	Not detected
2,4,5-Trichlorophenol	95954	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	610 (nc)	No	No	Not detected
2,4,6-Trichlorophenol	88062	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	0.61 (nc)	No	No	Not detected
2,4-Dichlorophenol	120832	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	18 (nc)	No	No	Not detected
2,4-Dimethylphenol	105679	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	120 (nc)	No	No	Not detected
2,4-Dinitrophenol	51285	0/1 (0%)	0.78	0.85	ND	ND	0.4		0.4 (O)	NA	NA	12 (nc)	No	No	Not detected
2-Chloronaphthalene	91587	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	490 (nc)	No	No	Not detected
2-Chlorophenol	95578	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	6.3 (nc)	No	No	Not detected
2-Methyl-4,6-dinitrophenol	534521	0/3 (0%)	0.78	0.85	ND	ND	0.405	0.435	0.425 (O)	NA	NA	0.61 (nc)	No	No[g]	Not detected
2-Methylnaphthalene	91576	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	5.6 (nc)	No	No	Not detected
2-Methylphenol	95487	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	310 (nc)	No	No	Not detected
2-Nitrobenzenamine	88744	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	18 (nc)	No	No	Not detected
2-Nitrophenol	88755	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	None	None	No	Not detected

Appendix Table B-3. COPC Screening for Subsurface Soil (1-3 ft bgs) at 40mm Firing Range
(All units are mg/kg)

Analyte	CAS Number	Frequency of Detection	Nondetect Results[a] Min DL	Nondetect Results[a] Max DL	Detect Results[b] Min	Detect Results[b] Max	Avg Result	95% UCL of Mean	EPC[c]	Bkgd Criteria[d]	MDC exceeds Bkgd?	Region 9 Residential PRG[e]	MDC Exceeds PRG?	COPC?	Justification
3,3'-Dichlorobenzidine	91941	0/1 (0%)	0.78	0.85	ND	ND	0.4		0.4 (O)	NA	NA	1.1 (ca)	No	No	Not detected
3-Nitrobenzenamine	99092	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	1.8 (nc)	No	No	Not detected
4-Bromophenyl phenyl ether	101553	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	None	None	No	Not detected
4-Chloro-3-methylphenol	59507	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	None	None	No	Not detected
4-Chlorobenzenamine	106478	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	24 (nc)	No	No	Not detected
4-Chlorophenyl phenyl ether	7005723	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	None	None	No	Not detected
4-Methylphenol	106445	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	31 (nc)	No	No	Not detected
4-Nitrobenzenamine	100016	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	18 (nc)	No	No	Not detected
4-Nitrophenol	100027	0/3 (0%)	0.78	0.85	ND	ND	0.405	0.435	0.425 (O)	NA	NA	None	None	No	Not detected
Acenaphthene	83329	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	370 (nc)	No	No	Not detected
Acenaphthylene	208968	0/1 (0%)	0.39	0.42	ND	ND	0.2		0.2 (O)	NA	NA	None	None	No	Not detected
Acetophenone	98862	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	None	None	No	Not detected
Anthracene	120127	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	2200 (nc)	No	No	Not detected
Atrazine	1912249	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	2.2 (ca)	No	No	Not detected
Benz(a)anthracene	56553	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	0.62 (ca)	No	No	Not detected
Benzaldehyde	100527	0/1 (0%)	0.39	0.42	ND	ND	0.2		0.2 (O)	NA	NA	610 (nc)	No	No	Not detected
Benzo(a)pyrene	50328	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	0.062 (ca)	No	No[g]	Not detected
Benzo(b)fluoranthene	205992	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	0.62 (ca)	No	No	Not detected
Benzo(ghi)perylene	191242	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	None	None	No	Not detected
Benzo(k)fluoranthene	207089	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	6.2 (ca)	No	No	Not detected
Bis(2-chloroethoxy)methane	111911	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	None	None	No	Not detected
Bis(2-chloroethyl) ether	111444	0/1 (0%)	0.39	0.42	ND	ND	0.2		0.2 (O)	NA	NA	0.22 (ca)	No	No[g]	Not detected
Bis(2-chloroisopropyl) ether	108601	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	2.9 (ca)	No	No	Not detected
Bis(2-ethylhexyl)phthalate	117817	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	35 (ca)	No	No	Not detected
Butyl benzyl phthalate	85687	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	1200 (nc)	No	No	Not detected
Caprolactam	105602	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	3100 (nc)	No	No	Not detected
Carbazole	86748	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	24 (ca)	No	No	Not detected
Chrysene	218019	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	62 (ca)	No	No	Not detected
Di-n-butyl phthalate	84742	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	610 (nc)	No	No	Not detected
Di-n-octylphthalate	117840	0/1 (0%)	0.39	0.42	ND	ND	0.2		0.2 (O)	NA	NA	240 (nc)	No	No	Not detected
Dibenz(a,h)anthracene	53703	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	0.062 (ca)	No	No[g]	Not detected
Dibenzofuran	132649	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	15 (nc)	No	No	Not detected
Diethyl phthalate	84662	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	4900 (nc)	No	No	Not detected
Dimethyl phthalate	131113	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	61000 (nc)	No	No	Not detected
Fluoranthene	206440	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	230 (nc)	No	No	Not detected
Fluorene	86737	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	270 (nc)	No	No	Not detected
Hexachlorobenzene	118741	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	0.3 (ca)	No	No[g]	Not detected
Hexachlorobutadiene	87683	0/1 (0%)	0.39	0.42	ND	ND	0.2		0.2 (O)	NA	NA	1.8 (nc)	No	No	Not detected
Hexachlorocyclopentadiene	77474	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	37 (nc)	No	No	Not detected
Hexachloroethane	67721	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	6.1 (nc)	No	No	Not detected
Indeno(1,2,3-cd)pyrene	193395	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	0.62 (ca)	No	No	Not detected
Isophorone	78591	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	510 (ca)	No	No	Not detected
N-Nitroso-di-n-propylamine	621647	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	0.069 (ca)	No	No[g]	Not detected

Appendix Table B-3. COPC Screening for Subsurface Soil (1-3 ft bgs) at 40mm Firing Range
(All units are mg/kg)

Analyte	CAS Number	Frequency of Detection	Nondetect Results[a] Min DL	Nondetect Results[a] Max DL	Detect Results[b] Min	Detect Results[b] Max	Avg Result	95% UCL of Mean	EPC[c]	Bkgd Criteria[d]	MDC exceeds Bkgd?	Region 9 Residential PRG[e]	MDC Exceeds PRG?	COPC?	Justification
N-Nitrosodiphenylamine	86306	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	99 (ca)	No	No	Not detected
Naphthalene	91203	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	5.6 (nc)	No	No	Not detected
Pentachlorophenol	87865	0/3 (0%)	0.78	0.85	ND	ND	0.405	0.435	0.425 (O)	NA	NA	3 (ca)	No	No	Not detected
Phenanthrene	85018	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	None	None	No	Not detected
Phenol	108952	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	1800 (nc)	No	No	Not detected
Pyrene	129000	0/3 (0%)	0.39	0.42	ND	ND	0.202	0.215	0.21 (O)	NA	NA	230 (nc)	No	No	Not detected
Organics-Volatile															
1,1,1-Trichloroethane	71556	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	200 (nc)	No	No	Not detected
1,1,2,2-Tetrachloroethane	79345	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	0.41 (ca)	No	No	Not detected
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	0/1 (0%)	0.0058	0.0065	ND	ND	0.0029		0.0029 (O)	NA	NA	2100 (nc)	No	No	Not detected
1,1,2-Trichloroethane	79005	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	0.73 (ca)	No	No	Not detected
1,1-Dichloroethane	75343	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	51 (nc)	No	No	Not detected
1,1-Dichloroethene	75354	0/2 (0%)	0.0058	0.0065	ND	ND	0.00318	0.00365	0.00325 (O)	NA	NA	12 (nc)	No	No	Not detected
1,2,4-Trichlorobenzene	120821	0/1 (0%)	0.0058	0.0065	ND	ND	0.0029		0.0029 (O)	NA	NA	6.2 (nc)	No	No	Not detected
1,2-Dibromo-3-chloropropane	96128	0/1 (0%)	0.0058	0.0065	ND	ND	0.0029		0.0029 (O)	NA	NA	0.21 (nc)	No	No	Not detected
1,2-Dibromoethane	106934	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	0.032 (ca)	No	No	Not detected
1,2-Dichlorobenzene	95501	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	110 (nc)	No	No	Not detected
1,2-Dichloroethane	107062	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	0.28 (ca)	No	No	Not detected
1,2-Dichloropropane	78875	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	0.34 (ca)	No	No	Not detected
1,2-Dimethylbenzene	95476	1/3 (33%)	0.0062	0.0065	0.002	0.002	0.00278	0.00393	0.002 (D)	NA	NA	27 (nc)	No	No	MDC < PRG
1,3-Dichlorobenzene	541731	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	53 (nc)	No	No	Not detected
1,4-Dichlorobenzene	106467	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	3.4 (ca)	No	No	Not detected
2-Butanone	78933	0/1 (0%)	0.012	0.013	ND	ND	0.006		0.006 (O)	NA	NA	2200 (nc)	No	No	Not detected
2-Hexanone	591786	0/1 (0%)	0.012	0.013	ND	ND	0.006		0.006 (O)	NA	NA	None	None	No	Not detected
2-Methoxy-2-methylpropane	1634044	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	17 (ca)	No	No	Not detected
4-Methyl-2-pentanone	108101	0/3 (0%)	0.012	0.013	ND	ND	0.00617	0.00665	0.0065 (O)	NA	NA	530 (nc)	No	No	Not detected
Acetone	67641	0/1 (0%)	0.012	0.013	ND	ND	0.0065		0.0065 (O)	NA	NA	1400 (nc)	No	No	Not detected
Benzene	71432	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	0.64 (ca)	No	No	Not detected
Bromodichloromethane	75274	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	0.82 (ca)	No	No	Not detected
Bromomethane	74839	0/1 (0%)	0.012	0.013	ND	ND	0.006		0.006 (O)	NA	NA	0.39 (nc)	No	No	Not detected
Carbon disulfide	75150	2/3 (67%)	0.0065	0.0065	0.016	0.0031	0.00745	0.0199	0.016 (X)	NA	NA	36 (nc)	No	No	MDC < PRG
Carbon tetrachloride	56235	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	0.22 (nc)	No	No	Not detected
Chlorobenzene	108907	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	15 (nc)	No	No	Not detected
Chloroethane	75003	0/3 (0%)	0.012	0.013	ND	ND	0.00617	0.00665	0.0065 (O)	NA	NA	3 (ca)	No	No	Not detected
Chloroform	67663	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	0.22 (ca)	No	No	Not detected
Chloromethane	74873	0/3 (0%)	0.012	0.013	ND	ND	0.00617	0.00665	0.0065 (O)	NA	NA	4.7 (nc)	No	No	Not detected
Cumene	98828	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	16 (nc)	No	No	Not detected
Cyclohexane	110827	0/1 (0%)	0.0058	0.0065	ND	ND	0.0029		0.0029 (O)	NA	NA	140 sat	No	No	Not detected
Dibromochloromethane	124481	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	1.1 (ca)	No	No	Not detected
Dichlorodifluoromethane	75718	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	9.4 (nc)	No	No	Not detected
Ethylbenzene	100414	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	190 (nc)	No	No	Not detected
M + P Xylene	136777612	1/3 (33%)	0.0062	0.0065	0.0051	0.0051	0.00382	0.00569	0.0051 (D)	NA	NA	27 (nc)	No	No	MDC < PRG
Methylcyclohexane	108872	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	260 (nc)	No	No	Not detected
Methylene chloride	75092	0/1 (0%)	0.007	0.014	ND	ND	0.0035		0.0035 (O)	NA	NA	9.1 (ca)	No	No	Not detected

Appendix Table B-3. COPC Screening for Subsurface Soil (1-3 ft bgs) at 40mm Firing Range
(All units are mg/kg)

Analyte	CAS Number	Frequency of Detection	Nondetect Results[a] Min DL	Nondetect Results[a] Max DL	Detect Results[b] Min	Detect Results[b] Max	Avg Result	95% UCL of Mean	EPC[c]	Bkgd Criteria[d]	MDC exceeds Bkgd?	Region 9 Residential PRG[e]	MDC Exceeds PRG?	COPC?	Justification
Styrene	100425	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	440 (nc)	No	No	Not detected
Tetrachloroethene	127184	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	0.48 (ca)	No	No	Not detected
Toluene	108883	1/3 (33%)	0.0062	0.0065	0.0036	0.0036	0.00332	0.00375	0.0036 (D)	NA	NA	66 (nc)	No	No	MDC < PRG
Trichloroethene	79016	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	0.053 (ca)	No	No	Not detected
Trichlorofluoromethane	75694	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	39 (nc)	No	No	Not detected
Vinyl chloride	75014	0/3 (0%)	0.012	0.013	ND	ND	0.00617	0.00665	0.0065 (O)	NA	NA	0.079 (ca)	No	No	Not detected
cis-1,2-Dichloroethene	156592	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	4.3 (nc)	No	No	Not detected
cis-1,3-Dichloropropene	10061015	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	0.78 (ca)	No	No	Not detected
trans-1,2-Dichloroethene	156605	0/3 (0%)	0.0058	0.0065	ND	ND	0.00308	0.00338	0.00325 (O)	NA	NA	6.9 (nc)	No	No	Not detected

[a]Minimum and maximum detection limit (DL) shown for nondetect results.

[b]Minimum and maximum detected concentration shown for detect results.

[c]Exposure point concentration (EPC) is lesser of 95% upper conficence level (UCL) or maxaximum detected concentration (MDC) as appropriate based on data distribution (shown in parentheses). Data distribution codes:

D - Distribution not determined due to less than 50% frequency of detection. 95% UCL calculated using Student's t-statistic.

L - Distribution is lognormal. 95% UCL calculated using Land's H method.

N - Distribution is normal. 95% UCL calculated using Student's t-statistic.

O - The analyte was not detected. 95% UCL calculated using Student's t-statistic.

X - Distribution is nonparametric. 95% UCL calculated using Student's t-statistic.

[d]Background criteria for RVAAP from USACE 2001. *Final Phase II Remedial Investigation Report for the Winklepeck Burning Grounds at the Ravenna Army Ammunition Plant, Ravenna, Ohio*.

[e]Residential soil preliminary remediation goal (PRG) from Region 9 corresponding to risk of 1.0E-06 for carcinogenic endpoint (ca) or hazard index of 0.1 for noncarcinogenic endpoint (nc).

[f]Essential nutrients are not retained as COPCs because the MDC would result in an intake less than the recommended daily intake (RDI).

[g]Analyte is not a COPC because it was not detected in soil at the 40mm Range; however, because the maximum detection limit exceeds the Region 9 PRG this chemical is included in the risk characterization.

AD - All results are detects.
CAS - chemical abstract service.
COPC - chemical of potential concern.
DL - detection limit.

EPC - exposure point concentration.
MDC - maximum detected concentration.
NA - not applicable, background criteria are only used to screen naturally occuring inorganics.
ND - All results are nondetect.

None - no PRG available.
PRG - preliminary remediation goal.
UCL - upper confidence limit.

Appendix Table B-4. Chemical-specific Exposure Parameters for 40 mm Range COPCs

COPC	Dermal Absorption Factor[a] (unitless)	Volatilization Factor[b] (m^3/kg)	Soil-to-Plant Uptake Factor[c]		Beef Transfer Coefficient[c] (kg/kg)	Milk Transfer Coefficient[c] (kg/kg)
			Dry Weight (days/kg)	Wet Weight (days/kg)		
Inorganics						
Aluminum	1.0E-03	--	4.0E-03	1.0E-03	1.5E-03	2.0E-04
Arsenic	3.0E-02	--	4.0E-02	1.0E-02	2.0E-03	6.0E-05
Chromium (as Chromium III)	1.0E-03	--	4.0E-02	1.0E-04	9.0E-03	1.0E-05
Thallium (as Thallium carbonate)	1.0E-03	--	4.0E-03	1.0E-03	4.0E-02	2.0E-03
Vanadium	1.0E-03	--	5.5E-03	1.4E-03	2.5E-03	2.0E-05
Organics						
2-Methyl-4,6-dinitrophenol	1.0E-01	--	1.0E+00	2.1E-01	1.3E-05	4.0E-06
Benzo(a)pyrene	1.3E-01	--	1.1E-02	2.2E-03	3.1E-02	9.9E-03
Bis(2-chloroethyl) ether	1.0E-01	4.0E+04	6.7E+00	1.4E+00	5.0E-07	1.6E-07
Dibenz(a,h)anthracene	1.3E-01	--	4.3E-03	8.8E-04	1.6E-01	5.0E-02
Hexachlorobenzene	1.0E-01	--	3.2E-02	6.5E-03	5.0E-03	1.6E-03
N-Nitroso-di-n-propylamine	1.0E-01	--	5.9E+00	1.2E+00	6.3E-07	2.0E-07

[a] Chemical-specific absorption factor values from EPA Region V (EPA, 2000). When chemical-specific values are not available the following default values are used for soil and sediment only:

SVOCs = 0.1, VOCs = 0.01, inorganics = 0.001 per USEPA Region 4 Supplemental Guidance to RAGS.

[b] Volatilization factors (VFs) calculated using the 1996 EPA Soil Screening Guidance Methodology, using site-specific parameter values for Cleveland, Ohio. Only used for soil and sediment VOCs.

[c] Parameter used to evaluate food pathways.

COPC = Chemical of potential concern.

RAGS = Risk Assessment Guidance for Superfund.

SVOC = Semivolatile organic compound.

VOC = Volatile organic compound.

-- = No value available.

Appendix Table B-5. Non-carcinogenic Reference Doses for 40 mm Range COPCs

COPC	Oral Chronic RFD (mg/kg-day)	Confidence Level	% GI absorption[a]	Dermal Chronic RfD (mg/kg-day)	Inhalation Chronic RfD (mg/kg-day)	RfD Basis (vehicle)	Critical Effect	Uncertainty/ Modifying Factor
Inorganics								
Aluminum	1.0E+00	NA	1	1.0E+00	1.4E-03	NA	NA	(O) UF=10
Arsenic	3.0E-04	Medium (O)	0.95	3.0E-04	--	Oral, oral-water	Hyperpigmentation and keritosis and possible vascular complication	(O) UF=3
Chromium (as Chromium III)	1.5E+00	Low (O)	0.013	2.0E-02	--	Oral (rat)	Reduced liver/spleen weight	(O) UF=100
Thallium	8.0E-05	Low (O)	1	8.0E-05	--	Oral	Nervous system, lungs, heart, liver, and kidneys	(O) MF=1 (O) UF=3000
Vanadium	7.0E-03	NA	0.026	1.8E-04	--	Inhalation	(I) respiratory system	(O) MF=1 (O) UF=100
Organics								
2-Methyl-4,6-dinitrophenol	1.0E-04	NA	1	1.0E-04	--	Oral	Increased basal metabolic rate	NA
Hexachlorobenzene	8.0E-04	NA	1	8.0E-04	--	Oral	Liver, kidneys, and thyroid	NA

[a] % GI absorption values from EPA 2000.

(O) indicates oral, (I) indicates inhalation.

MF = Modifying factor (the default modifying factor is 1).

NA = Not available.

RfD = Reference dose.

UF = Uncertainty factor.

-- = No value available.

Appendix Table B-6. Cancer Slope Factors for 40 mm Range COPCs

COPC	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	% GI absorption[a]	Dermal Slope Factor $(mg/kg\text{-}day)^{-1}$	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	EPA Class	TEF	Type of Cancer
Inorganics							
Arsenic	1.5E+00	0.95	1.5E+00	1.5E+01	A	--	Respiratory system tumors
Organics							
Benzo(a)pyrene	7.3E+00	0.58	7.3E+00	3.1E+00	B2	1	Stomach, nasal cavity, larynx, tracheak, and pharnyx
Bis(2-chloroethyl) ether	1.1E+00	1	1.1E+00	1.2E+00	B2	--	NA
Dibenz(a,h)anthracene	7.3E+00	0.58	7.3E+00	3.1E+00	B2	1	Immunodepressive effects (mouse)
Hexachlorobenzene	1.6E+00	1	1.6E+00	1.6E+00	B2	--	Liver, kidneys, and thyroid
N-Nitroso-di-n-propylamine	7.0E+00	1	7.0E+00	--	B2	--	Liver, nose, and stomach (animals)

[a] % GI absorption values from EPA 2000.

TEF = Toxicity Equivalency Factor is based on the relative potency of each carcinogenic polycyclic aromatic hydrocarbon (PAH) relative to that of benzo(a)pyrene.

-- = No value available.

Appendix Table B-7. 40 mm Range Deep Surface Soil Carcinogenic Risks - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Risk			Total Risk across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
National Guard - National Guard Trainee									
Aluminum	1.3E+04	6.9E-04	6.8E-06	1.8E-04					
Arsenic	1.5E+01	8.2E-07	2.4E-07	2.2E-07	1.2E-06	3.6E-07	3.3E-06	4.9E-06	R
Chromium	3.4E+01	1.8E-06	1.8E-08	4.9E-07					
Thallium	8.4E-01	4.6E-08	4.5E-10	1.2E-08					
Vanadium	2.3E+01	1.2E-06	1.2E-08	3.3E-07					
Inorganics Pathway Total					1.2E-06	3.6E-07	3.3E-06	4.9E-06	
2-Methyl-4,6-dinitrophenol	4.3E-01	2.4E-08	2.3E-08	6.3E-09					
Benzo(a)pyrene	2.2E-01	1.2E-08	1.5E-08	3.2E-09	8.6E-08	1.1E-07	9.8E-09	2.1E-07	
Bis(2-chloroethyl) ether	2.0E-01	1.1E-08	1.1E-08	2.9E-09	1.2E-08	1.2E-08	3.4E-09	2.7E-08	
Dibenz(a,h)anthracene	2.2E-01	1.2E-08	1.5E-08	3.2E-09	8.6E-08	1.1E-07	9.8E-09	2.1E-07	
Hexachlorobenzene	2.2E-01	1.2E-08	1.2E-08	3.2E-09	1.9E-08	1.9E-08	5.1E-09	4.3E-08	
N-Nitroso-di-n-propylamine	2.2E-01	1.2E-08	1.2E-08	3.2E-09	8.3E-08	8.2E-08		1.6E-07	
Organics Pathway Total					2.9E-07	3.3E-07	2.8E-08	6.5E-07	
Pathway Total - Chemicals					1.5E-06	7.0E-07	3.3E-06	5.5E-06	

[a] COPCs are identified as chemicals of concern (COCs) if the total ILCR across all pathways is > 1E-06 (R).

COPC = Chemical of Potential Concern.

EPC = Exposure Point Concentration.

ILCR = Incremental Lifetime Cancer Risk.

Appendix Table B-8. 40 mm Range Deep Surface Soil Non-carcinogenic Hazards - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Hazard Quotient (HQ)			Total HI across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
National Guard - National Guard Trainee									
Aluminum	1.3E+04	1.9E-03	1.9E-05	5.1E-04	1.9E-03	1.9E-05	3.6E-01	3.6E-01	
Arsenic	1.5E+01	2.3E-06	6.8E-07	6.1E-07	7.6E-03	2.3E-03		9.9E-03	
Chromium	3.4E+01	5.1E-06	5.1E-08	1.4E-06	3.4E-06	2.6E-06		6.0E-06	
Thallium	8.4E-01	1.3E-07	1.3E-09	3.4E-08	1.6E-03	1.6E-05		1.6E-03	
Vanadium	2.3E+01	3.4E-06	3.4E-08	9.1E-07	4.9E-04	1.9E-04		6.8E-04	
Inorganics Pathway Total					1.2E-02	2.5E-03	3.6E-01	3.7E-01	
2-Methyl-4,6-dinitrophenol	4.3E-01	6.6E-08	6.5E-08	1.8E-08	6.6E-04	6.5E-04		1.3E-03	
Benzo(a)pyrene	2.2E-01	3.3E-08	4.3E-08	8.8E-09					
Bis(2-chloroethyl) ether	2.0E-01	3.1E-08	3.0E-08	8.1E-09					
Dibenz(a,h)anthracene	2.2E-01	3.3E-08	4.3E-08	8.8E-09					
Hexachlorobenzene	2.2E-01	3.3E-08	3.3E-08	8.8E-09	4.1E-05	4.1E-05		8.2E-05	
N-Nitroso-di-n-propylamine	2.2E-01	3.3E-08	3.3E-08	8.8E-09					
Organics Pathway Total					7.0E-04	7.0E-04		1.4E-03	
Pathway Total - Chemicals					1.2E-02	3.2E-03	3.6E-01	3.7E-01	

[a] COPCs are identified as chemicals of concern (COCs) if the total HI across all pathways is > 1 (H).

COPC = Chemical of Potential Concern.

EPC = Exposure Point Concentration.

HI = Hazard Index.

Appendix Table B-9. 40 mm Range Shallow Surface Soil Carcinogenic Risks - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Risk			Total Risk across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
Maintained Industrial/Managed Recreational - Security Guard/Maintenance Worker									
Aluminum	1.2E+04	1.8E-04	1.0E-04	3.9E-08					
Arsenic	1.3E+01	1.8E-07	3.0E-06	3.9E-11	2.7E-07	4.5E-06	5.9E-10	4.8E-06	R
Chromium	4.4E+01	6.4E-07	3.5E-07	1.4E-10					
Thallium	8.0E-01	1.2E-08	6.5E-09	2.5E-12					
Vanadium	2.3E+01	3.3E-07	1.8E-07	7.2E-11					
Inorganics Pathway Total					2.7E-07	4.5E-06	5.9E-10	4.8E-06	
2-Methyl-4,6-dinitrophenol	4.6E-01	6.7E-09	3.7E-07	1.5E-12					
Benzo(a)pyrene	2.3E-01	3.3E-09	2.4E-07	7.3E-13	2.4E-08	1.8E-06	2.2E-12	1.8E-06	R
Dibenz(a,h)anthracene	2.3E-01	3.3E-09	2.4E-07	7.3E-13	2.4E-08	1.8E-06	2.2E-12	1.8E-06	R
Hexachlorobenzene	2.3E-01	3.3E-09	1.9E-07	7.3E-13	5.4E-09	3.0E-07	1.2E-12	3.0E-07	
N-Nitroso-di-n-propylamine	2.3E-01	3.3E-09	1.9E-07	7.3E-13	2.3E-08	1.3E-06		1.3E-06	R
Organics Pathway Total					7.8E-08	5.1E-06	5.7E-12	5.2E-06	
Pathway Total - Chemicals					3.5E-07	9.7E-06	6.0E-10	1.0E-05	
Open Residential - Resident Farmer Adult									
Aluminum	1.2E+04	7.3E-03	1.7E-04	1.6E-06					
Arsenic	1.3E+01	7.3E-06	5.0E-06	1.6E-09	1.1E-05	7.5E-06	2.4E-08	1.9E-05	R
Chromium	4.4E+01	2.6E-05	5.9E-07	5.6E-09					
Thallium	8.0E-01	4.7E-07	1.1E-08	1.0E-10					
Vanadium	2.3E+01	1.3E-05	3.0E-07	2.9E-09					
Inorganics Pathway Total					1.1E-05	7.5E-06	2.4E-08	1.9E-05	
2-Methyl-4,6-dinitrophenol	4.6E-01	2.7E-07	6.2E-07	5.8E-11					
Benzo(a)pyrene	2.3E-01	1.4E-07	4.0E-07	2.9E-11	9.9E-07	2.9E-06	9.1E-11	3.9E-06	R
Dibenz(a,h)anthracene	2.3E-01	1.4E-07	4.0E-07	2.9E-11	9.9E-07	2.9E-06	9.1E-11	3.9E-06	R
Hexachlorobenzene	2.3E-01	1.4E-07	3.1E-07	2.9E-11	2.2E-07	4.9E-07	4.7E-11	7.1E-07	
N-Nitroso-di-n-propylamine	2.3E-01	1.4E-07	3.1E-07	2.9E-11	9.5E-07	2.2E-06		3.1E-06	R
Organics Pathway Total					3.1E-06	8.5E-06	2.3E-10	1.2E-05	
Pathway Total - Chemicals					1.4E-05	1.6E-05	2.4E-08	3.0E-05	
Open Residential - Resident Farmer Child									
Aluminum	1.2E+04	1.4E-02	3.0E-05	7.4E-07					
Arsenic	1.3E+01	1.4E-05	9.0E-07	7.4E-10	2.1E-05	1.4E-06	1.1E-08	2.2E-05	R
Chromium	4.4E+01	4.8E-05	1.1E-07	2.6E-09					
Thallium	8.0E-01	8.8E-07	1.9E-09	4.8E-11					
Vanadium	2.3E+01	2.5E-05	5.5E-08	1.3E-09					
Inorganics Pathway Total					2.1E-05	1.4E-06	1.1E-08	2.2E-05	
2-Methyl-4,6-dinitrophenol	4.6E-01	5.0E-07	1.1E-07	2.7E-11					
Benzo(a)pyrene	2.3E-01	2.5E-07	7.2E-08	1.4E-11	1.8E-06	5.3E-07	4.2E-11	2.4E-06	R
Dibenz(a,h)anthracene	2.3E-01	2.5E-07	7.2E-08	1.4E-11	1.8E-06	5.3E-07	4.2E-11	2.4E-06	R
Hexachlorobenzene	2.3E-01	2.5E-07	5.5E-08	1.4E-11	4.0E-07	8.9E-08	2.2E-11	4.9E-07	
N-Nitroso-di-n-propylamine	2.3E-01	2.5E-07	5.5E-08	1.4E-11	1.8E-06	3.9E-07		2.2E-06	R
Organics Pathway Total					5.8E-06	1.5E-06	1.1E-10	7.4E-06	
Pathway Total - Chemicals					2.6E-05	2.9E-06	1.1E-08	2.9E-05	
Recreational - Hunter									
Aluminum	1.2E+04	1.0E-05	6.5E-07	2.3E-09					
Arsenic	1.3E+01	1.0E-08	2.0E-08	2.3E-12	1.6E-08	2.9E-08	3.4E-11	4.5E-08	
Chromium	4.4E+01	3.7E-08	2.3E-09	8.0E-12					
Thallium	8.0E-01	6.7E-10	4.2E-11	1.5E-13					
Vanadium	2.3E+01	1.9E-08	1.2E-09	4.1E-12					
Inorganics Pathway Total					1.6E-08	2.9E-08	3.4E-11	4.5E-08	
2-Methyl-4,6-dinitrophenol	4.6E-01	3.9E-10	2.4E-09	8.4E-14					
Benzo(a)pyrene	2.3E-01	1.9E-10	1.6E-09	4.2E-14	1.4E-09	1.1E-08	1.3E-13	1.3E-08	

Appendix Table B-9. 40 mm Range Shallow Surface Soil Carcinogenic Risks - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Risk			Total Risk across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
Dibenz(a,h)anthracene	2.3E-01	1.9E-10	1.6E-09	4.2E-14	1.4E-09	1.1E-08	1.3E-13	1.3E-08	
Hexachlorobenzene	2.3E-01	1.9E-10	1.2E-09	4.2E-14	3.1E-10	1.9E-09	6.7E-14	2.2E-09	
N-Nitroso-di-n-propylamine	2.3E-01	1.9E-10	1.2E-09	4.2E-14	1.4E-09	8.4E-09		9.8E-09	
Organics Pathway Total					4.5E-09	3.3E-08	3.3E-13	3.8E-08	
Pathway Total - Chemicals					2.0E-08	6.3E-08	3.4E-11	8.3E-08	

[a] COPCs are identified as chemicals of concern (COCs) if the total ILCR across all pathways is > 1E-06 (R).

COPC = Chemical of Potential Concern.

EPC = Exposure Point Concentration.

ILCR = Incremental Lifetime Cancer Risk.

Appendix Table B-10. 40 mm Range Shallow Surface Soil Non-carcinogenic Hazards - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Hazard Quotient (HQ)			Total HI across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
Maintained Industrial/Managed Recreational - Security Guard/Maintenance Worker									
Aluminum	1.2E+04	5.1E-04	2.8E-04	1.1E-07	5.1E-04	2.8E-04	7.7E-05	8.6E-04	
Arsenic	1.3E+01	5.1E-07	8.5E-06	1.1E-10	1.7E-03	2.8E-02		3.0E-02	
Chromium	4.4E+01	1.8E-06	9.9E-07	3.9E-10	1.2E-06	5.1E-05		5.2E-05	
Thallium	8.0E-01	3.3E-08	1.8E-08	7.1E-12	4.1E-04	2.3E-04		6.4E-04	
Vanadium	2.3E+01	9.3E-07	5.1E-07	2.0E-10	1.3E-04	2.8E-03		3.0E-03	
Inorganics Pathway Total					2.7E-03	3.2E-02	7.7E-05	3.4E-02	
2-Methyl-4,6-dinitrophenol	4.6E-01	1.9E-08	1.0E-06	4.1E-12	1.9E-04	1.0E-02		1.1E-02	
Benzo(a)pyrene	2.3E-01	9.4E-09	6.8E-07	2.0E-12					
Dibenz(a,h)anthracene	2.3E-01	9.4E-09	6.8E-07	2.0E-12					
Hexachlorobenzene	2.3E-01	9.4E-09	5.2E-07	2.0E-12	1.2E-05	6.5E-04		6.6E-04	
N-Nitroso-di-n-propylamine	2.3E-01	9.4E-09	5.2E-07	2.0E-12					
Organics Pathway Total					2.0E-04	1.1E-02		1.1E-02	
Pathway Total - Chemicals					2.9E-03	4.3E-02	7.7E-05	4.6E-02	
Open Residential - Resident Farmer Adult									
Aluminum	1.2E+04	1.7E-02	3.9E-04	3.7E-06	1.7E-02	3.9E-04	2.6E-03	2.0E-02	
Arsenic	1.3E+01	1.7E-05	1.2E-05	3.7E-09	5.7E-02	3.9E-02		9.6E-02	
Chromium	4.4E+01	6.0E-05	1.4E-06	1.3E-08	4.0E-05	7.0E-05		1.1E-04	
Thallium	8.0E-01	1.1E-06	2.5E-08	2.4E-10	1.4E-02	3.1E-04		1.4E-02	
Vanadium	2.3E+01	3.1E-05	7.1E-07	6.7E-09	4.4E-03	3.9E-03		8.3E-03	
Inorganics Pathway Total					9.2E-02	4.4E-02	2.6E-03	1.4E-01	
2-Methyl-4,6-dinitrophenol	4.6E-01	6.3E-07	1.4E-06	1.4E-10	6.3E-03	1.4E-02		2.1E-02	
Benzo(a)pyrene	2.3E-01	3.2E-07	9.3E-07	6.8E-11					
Dibenz(a,h)anthracene	2.3E-01	3.2E-07	9.3E-07	6.8E-11					
Hexachlorobenzene	2.3E-01	3.2E-07	7.2E-07	6.8E-11	3.9E-04	9.0E-04		1.3E-03	
N-Nitroso-di-n-propylamine	2.3E-01	3.2E-07	7.2E-07	6.8E-11					
Organics Pathway Total					6.7E-03	1.5E-02		2.2E-02	
Pathway Total - Chemicals					9.9E-02	5.9E-02	2.6E-03	1.6E-01	
Open Residential - Resident Farmer Child									
Aluminum	1.2E+04	1.6E-01	3.5E-04	8.6E-06	1.6E-01	3.5E-04	6.0E-03	1.6E-01	
Arsenic	1.3E+01	1.6E-04	1.1E-05	8.7E-09	5.3E-01	3.5E-02		5.7E-01	
Chromium	4.4E+01	5.6E-04	1.2E-06	3.0E-08	3.7E-04	6.3E-05		4.4E-04	
Thallium	8.0E-01	1.0E-05	2.3E-08	5.6E-10	1.3E-01	2.8E-04		1.3E-01	
Vanadium	2.3E+01	2.9E-04	6.4E-07	1.6E-08	4.1E-02	3.5E-03		4.5E-02	
Inorganics Pathway Total					8.6E-01	3.9E-02	6.0E-03	9.1E-01	
2-Methyl-4,6-dinitrophenol	4.6E-01	5.9E-06	1.3E-06	3.2E-10	5.9E-02	1.3E-02		7.2E-02	
Benzo(a)pyrene	2.3E-01	2.9E-06	8.4E-07	1.6E-10					
Dibenz(a,h)anthracene	2.3E-01	2.9E-06	8.4E-07	1.6E-10					
Hexachlorobenzene	2.3E-01	2.9E-06	6.5E-07	1.6E-10	3.7E-03	8.1E-04		4.5E-03	
N-Nitroso-di-n-propylamine	2.3E-01	2.9E-06	6.5E-07	1.6E-10					
Organics Pathway Total					6.2E-02	1.4E-02		7.6E-02	
Pathway Total - Chemicals					9.2E-01	5.3E-02	6.0E-03	9.8E-01	
Recreational - Hunter									
Aluminum	1.2E+04	2.4E-05	1.5E-06	5.3E-09	2.4E-05	1.5E-06	3.7E-06	2.9E-05	
Arsenic	1.3E+01	2.4E-08	4.6E-08	5.3E-12	8.2E-05	1.5E-04		2.3E-04	
Chromium	4.4E+01	8.6E-08	5.4E-09	1.9E-11	5.7E-08	2.7E-07		3.3E-07	
Thallium	8.0E-01	1.6E-09	9.8E-11	3.4E-13	2.0E-05	1.2E-06		2.1E-05	
Vanadium	2.3E+01	4.4E-08	2.8E-09	9.6E-12	6.3E-06	1.5E-05		2.2E-05	
Inorganics Pathway Total					1.3E-04	1.7E-04	3.7E-06	3.1E-04	
2-Methyl-4,6-dinitrophenol	4.6E-01	9.0E-10	5.6E-09	1.9E-13	9.0E-06	5.6E-05		6.5E-05	
Benzo(a)pyrene	2.3E-01	4.5E-10	3.7E-09	9.7E-14					

Appendix Table B-10. 40 mm Range Shallow Surface Soil Non-carcinogenic Hazards - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Hazard Quotient (HQ)			Total HI across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
Dibenz(a,h)anthracene	2.3E-01	4.5E-10	3.7E-09	9.7E-14					
Hexachlorobenzene	2.3E-01	4.5E-10	2.8E-09	9.7E-14	5.6E-07	3.5E-06		4.1E-06	
N-Nitroso-di-n-propylamine	2.3E-01	4.5E-10	2.8E-09	9.7E-14					
Organics Pathway Total					9.6E-06	6.0E-05		6.9E-05	
Pathway Total - Chemicals					1.4E-04	2.3E-04	3.7E-06	3.8E-04	

[a] COPCs are identified as chemicals of concern (COCs) if the total HI across all pathways is > 1 (H).

COPC = Chemical of Potential Concern.

EPC = Exposure Point Concentration.

HI = Hazard Index.

Appendix Table B-11. 40 mm Range Subsurface Soil Carcinogenic Risks - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Risk			Total Risk across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
Open Residential - Resident Farmer Adult									
Aluminum	1.4E+04	8.0E-03	1.8E-04	1.7E-06					
Arsenic	1.9E+01	1.1E-05	7.6E-06	2.4E-09	1.7E-05	1.1E-05	3.6E-08	2.8E-05	R
Chromium	1.9E+01	1.1E-05	2.6E-07	2.4E-09					
Thallium	1.1E+00	6.3E-07	1.4E-08	1.4E-10					
Inorganics Pathway Total					1.7E-05	1.1E-05	3.6E-08	2.8E-05	
2-Methyl-4,6-dinitrophenol	4.3E-01	2.5E-07	5.7E-07	5.4E-11					
Benzo(a)pyrene	2.1E-01	1.2E-07	3.7E-07	2.7E-11	9.0E-07	2.7E-06	8.3E-11	3.6E-06	R
Bis(2-chloroethyl) ether	2.0E-01	1.2E-07	2.7E-07	2.5E-11	1.3E-07	2.9E-07	2.9E-11	4.2E-07	
Dibenz(a,h)anthracene	2.1E-01	1.2E-07	3.7E-07	2.7E-11	9.0E-07	2.7E-06	8.3E-11	3.6E-06	R
Hexachlorobenzene	2.1E-01	1.2E-07	2.8E-07	2.7E-11	2.0E-07	4.5E-07	4.3E-11	6.5E-07	
N-Nitroso-di-n-propylamine	2.1E-01	1.2E-07	2.8E-07	2.7E-11	8.6E-07	2.0E-06		2.8E-06	R
Organics Pathway Total					3.0E-06	8.0E-06	2.4E-10	1.1E-05	
Pathway Total - Chemicals					2.0E-05	1.9E-05	3.7E-08	3.9E-05	
Open Residential - Resident Farmer Child									
Aluminum	1.4E+04	1.5E-02	3.3E-05	8.1E-07					
Arsenic	1.9E+01	2.1E-05	1.4E-06	1.1E-09	3.1E-05	2.1E-06	1.7E-08	3.3E-05	R
Chromium	1.9E+01	2.1E-05	4.6E-08	1.1E-09					
Thallium	1.1E+00	1.2E-06	2.6E-09	6.4E-11					
Inorganics Pathway Total					3.1E-05	2.1E-06	1.7E-08	3.3E-05	
2-Methyl-4,6-dinitrophenol	4.3E-01	4.7E-07	1.0E-07	2.5E-11					
Benzo(a)pyrene	2.1E-01	2.3E-07	6.6E-08	1.2E-11	1.7E-06	4.8E-07	3.9E-11	2.2E-06	R
Bis(2-chloroethyl) ether	2.0E-01	2.2E-07	4.8E-08	1.2E-11	2.4E-07	5.3E-08	1.4E-11	2.9E-07	
Dibenz(a,h)anthracene	2.1E-01	2.3E-07	6.6E-08	1.2E-11	1.7E-06	4.8E-07	3.9E-11	2.2E-06	R
Hexachlorobenzene	2.1E-01	2.3E-07	5.1E-08	1.2E-11	3.7E-07	8.1E-08	2.0E-11	4.5E-07	
N-Nitroso-di-n-propylamine	2.1E-01	2.3E-07	5.1E-08	1.2E-11	1.6E-06	3.5E-07		2.0E-06	R
Organics Pathway Total					5.6E-06	1.4E-06	1.1E-10	7.0E-06	
Pathway Total - Chemicals					3.7E-05	3.5E-06	1.7E-08	4.0E-05	

[a] COPCs are identified as chemicals of concern (COCs) if the total ILCR across all pathways is > 1E-06 (R).

COPC = Chemical of Potential Concern.

EPC = Exposure Point Concentration.

ILCR = Incremental Lifetime Cancer Risk.

Appendix Table B-12. 40 mm Range Subsurface Soil Non-carcinogenic Hazards - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Hazard Quotient (HQ)			Total HI across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
Open Residential - Resident Farmer Adult									
Aluminum	1.4E+04	1.9E-02	4.2E-04	4.0E-06	1.9E-02	4.2E-04	2.8E-03	2.2E-02	
Arsenic	1.9E+01	2.6E-05	1.8E-05	5.6E-09	8.7E-02	5.9E-02		1.5E-01	
Chromium	1.9E+01	2.6E-05	6.0E-07	5.7E-09	1.8E-05	3.1E-05		4.8E-05	
Thallium	1.1E+00	1.5E-06	3.4E-08	3.2E-10	1.8E-02	4.2E-04		1.9E-02	
Inorganics Pathway Total					1.2E-01	6.0E-02	2.8E-03	1.9E-01	
2-Methyl-4,6-dinitrophenol	4.3E-01	5.8E-07	1.3E-06	1.3E-10	5.8E-03	1.3E-02		1.9E-02	
Benzo(a)pyrene	2.1E-01	2.9E-07	8.5E-07	6.2E-11					
Bis(2-chloroethyl) ether	2.0E-01	2.7E-07	6.2E-07	5.9E-11					
Dibenz(a,h)anthracene	2.1E-01	2.9E-07	8.5E-07	6.2E-11					
Hexachlorobenzene	2.1E-01	2.9E-07	6.6E-07	6.2E-11	3.6E-04	8.2E-04		1.2E-03	
N-Nitroso-di-n-propylamine	2.1E-01	2.9E-07	6.6E-07	6.2E-11					
Organics Pathway Total					6.2E-03	1.4E-02		2.0E-02	
Pathway Total - Chemicals					1.3E-01	7.4E-02	2.8E-03	2.1E-01	
Open Residential - Resident Farmer Child									
Aluminum	1.4E+04	1.7E-01	3.8E-04	9.4E-06	1.7E-01	3.8E-04	6.6E-03	1.8E-01	
Arsenic	1.9E+01	2.4E-04	1.6E-05	1.3E-08	8.1E-01	5.3E-02		8.6E-01	
Chromium	1.9E+01	2.5E-04	5.4E-07	1.3E-08	1.6E-04	2.8E-05		1.9E-04	
Thallium	1.1E+00	1.4E-05	3.0E-08	7.5E-10	1.7E-01	3.8E-04		1.7E-01	
Inorganics Pathway Total					1.2E+00	5.4E-02	6.6E-03	1.2E+00	
2-Methyl-4,6-dinitrophenol	4.3E-01	5.4E-06	1.2E-06	2.9E-10	5.4E-02	1.2E-02		6.6E-02	
Benzo(a)pyrene	2.1E-01	2.7E-06	7.7E-07	1.5E-10					
Bis(2-chloroethyl) ether	2.0E-01	2.6E-06	5.6E-07	1.4E-10					
Dibenz(a,h)anthracene	2.1E-01	2.7E-06	7.7E-07	1.5E-10					
Hexachlorobenzene	2.1E-01	2.7E-06	5.9E-07	1.5E-10	3.4E-03	7.4E-04		4.1E-03	
N-Nitroso-di-n-propylamine	2.1E-01	2.7E-06	5.9E-07	1.5E-10					
Organics Pathway Total					5.8E-02	1.3E-02		7.0E-02	
Pathway Total - Chemicals					1.2E+00	6.7E-02	6.6E-03	1.3E+00	

[a] COPCs are identified as chemicals of concern (COCs) if the total HI across all pathways is > 1 (H).

COPC = Chemical of Potential Concern.

EPC = Exposure Point Concentration.

HI = Hazard Index.

Appendix Table B-13. 40 mm Range Shallow Surface Soil Carcinogenic Risks - Ingestion of Foodstuffs

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)				Risk				Total Risk across all pathways	COC[a]
		Milk	Beef	Vegetables	Venison	Milk	Beef	Vegetables	Venison		
Open Residential - Resident Farmer Adult											
Aluminum	1.2E+04	1.6E-02	1.3E-02	1.6E+00	6.9E-08						
Arsenic	1.3E+01	5.3E-06	1.9E-05	1.7E-03	9.2E-10	8.0E-06	2.9E-05	2.5E-03	1.4E-09	2.5E-03	R
Chromium	4.4E+01	3.1E-06	3.1E-04	5.6E-03	1.5E-08						
Thallium	8.0E-01	1.0E-05	2.3E-05	1.0E-04	1.2E-10						
Vanadium	2.3E+01	2.9E-06	4.1E-05	2.9E-03	2.9E-10						
Inorganics Pathway Total						8.0E-06	2.9E-05	2.5E-03	1.4E-09	2.5E-03	
2-Methyl-4,6-dinitrophenol	4.6E-01	4.5E-08	1.5E-08	1.1E-04	1.1E-12						
Benzo(a)pyrene	2.3E-01	1.5E-05	5.2E-06	3.0E-05	1.5E-11	1.1E-04	3.8E-05	2.2E-04	1.1E-10	3.6E-04	R
Dibenz(a,h)anthracene	2.3E-01	7.4E-05	2.6E-05	2.9E-05	2.9E-11	5.4E-04	1.9E-04	2.1E-04	2.2E-10	9.5E-04	R
Hexachlorobenzene	2.3E-01	2.6E-06	8.8E-07	3.0E-05	6.8E-12	4.1E-06	1.4E-06	4.8E-05	1.1E-11	5.4E-05	R
N-Nitroso-di-n-propylamine	2.3E-01	5.2E-09	1.6E-09	1.6E-04	1.6E-13	3.6E-08	1.1E-08	1.2E-03	1.1E-12	1.2E-03	R
Organics Pathway Total						6.6E-04	2.3E-04	1.6E-03	3.3E-10	2.5E-03	
Pathway Total						6.6E-04	2.6E-04	4.1E-03	1.7E-09	5.0E-03	
Open Residential - Resident Farmer Child											
Aluminum	1.2E+04	2.5E-02	1.2E-02	1.5E+00	6.4E-08						
Arsenic	1.3E+01	8.3E-06	1.8E-05	1.5E-03	8.6E-10	1.2E-05	2.7E-05	2.3E-03	1.3E-09	2.4E-03	R
Chromium	4.4E+01	4.9E-06	2.9E-04	5.2E-03	1.4E-08						
Thallium	8.0E-01	1.6E-05	2.1E-05	9.6E-05	1.1E-10						
Vanadium	2.3E+01	4.6E-06	3.8E-05	2.7E-03	2.7E-10						
Inorganics Pathway Total						1.2E-05	2.7E-05	2.3E-03	1.3E-09	2.4E-03	
2-Methyl-4,6-dinitrophenol	4.6E-01	7.0E-08	1.4E-08	9.9E-05	1.0E-12						
Benzo(a)pyrene	2.3E-01	2.3E-05	4.8E-06	2.8E-05	1.4E-11	1.7E-04	3.5E-05	2.0E-04	9.9E-11	4.1E-04	R
Dibenz(a,h)anthracene	2.3E-01	1.2E-04	2.4E-05	2.7E-05	2.7E-11	8.4E-04	1.8E-04	2.0E-04	2.0E-10	1.2E-03	R
Hexachlorobenzene	2.3E-01	4.0E-06	8.2E-07	2.8E-05	6.4E-12	6.4E-06	1.3E-06	4.5E-05	1.0E-11	5.3E-05	R
N-Nitroso-di-n-propylamine	2.3E-01	8.1E-09	1.5E-09	1.5E-04	1.5E-13	5.7E-08	1.0E-08	1.1E-03	1.0E-12	1.1E-03	R
Organics Pathway Total						1.0E-03	2.2E-04	1.5E-03	3.1E-10	2.8E-03	
Pathway Total						1.0E-03	2.4E-04	3.8E-03	1.6E-09	5.1E-03	

[a] COPCs are identified as chemicals of concern (COCs) if the total ILCR across all pathways is > 1E-06 (R).

COPC = Chemical of Potential Concern.

EPC = Exposure Point Concentration.

ILCR = Incremental Lifetime Cancer Risk.

Appendix Table B-14. 40 mm Range Shallow Surface Soil Non-carcinogenic Hazards - Ingestion of Foodstuffs

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)				Hazard Quotient (HQ)				Total HI across all pathways	COC[a]
		Milk	Beef	Vegetables	Venison	Milk	Beef	Vegetables	Venison		
Open Residential - Resident Farmer Adult											
Aluminum	1.2E+04	3.7E-02	3.1E-02	3.7E+00	1.6E-07	3.7E-02	3.1E-02	3.7E+00	1.6E-07	3.8E+00	H
Arsenic	1.3E+01	1.2E-05	4.5E-05	3.9E-03	2.2E-09	4.1E-02	1.5E-01	1.3E+01	7.2E-06	1.3E+01	H
Chromium	4.4E+01	7.3E-06	7.2E-04	1.3E-02	3.4E-08	4.8E-06	4.8E-04	8.7E-03	2.3E-08	9.2E-03	
Thallium	8.0E-01	2.4E-05	5.3E-05	2.4E-04	2.8E-10	3.0E-01	6.7E-01	3.0E+00	3.5E-06	4.0E+00	H
Vanadium	2.3E+01	6.9E-06	9.5E-05	6.8E-03	6.7E-10	9.8E-04	1.4E-02	9.7E-01	9.6E-08	9.8E-01	
Inorganics Pathway Total						3.8E-01	8.6E-01	2.1E+01	1.1E-05	2.2E+01	H
2-Methyl-4,6-dinitrophenol	4.6E-01	1.0E-07	3.4E-08	2.5E-04	2.6E-12	1.0E-03	3.4E-04	2.5E+00	2.6E-08	2	H
Benzo(a)pyrene	2.3E-01	3.5E-05	1.2E-05	6.9E-05	3.4E-11						
Dibenz(a,h)anthracene	2.3E-01	1.7E-04	6.1E-05	6.9E-05	6.9E-11						
Hexachlorobenzene	2.3E-01	6.0E-06	2.0E-06	7.0E-05	1.6E-11	7.5E-03	2.6E-03	8.8E-02	2.0E-08	9.8E-02	
N-Nitroso-di-n-propylamine	2.3E-01	1.2E-08	3.7E-09	3.8E-04	3.7E-13						
Organics Pathway Total						8.5E-03	2.9E-03	2.6E+00	4.6E-08	2.6E+00	H
Pathway Total						3.9E-01	8.7E-01	2.3E+01	1.1E-05	2.4E+01	H
Open Residential - Resident Farmer Child											
Aluminum	1.2E+04	2.9E-01	1.4E-01	1.7E+01	7.5E-07	2.9E-01	1.4E-01	1.7E+01	7.5E-07	1.8E+01	H
Arsenic	1.3E+01	9.7E-05	2.1E-04	1.8E-02	1.0E-08	3.2E-01	7.0E-01	6.0E+01	3.4E-05	6.1E+01	H
Chromium	4.4E+01	5.7E-05	3.3E-03	6.1E-02	1.6E-07	3.8E-05	2.2E-03	4.1E-02	1.1E-07	4.3E-02	
Thallium	8.0E-01	1.9E-04	2.5E-04	1.1E-03	1.3E-09	2.4E+00	3.1E+00	1.4E+01	1.6E-05	1.9E+01	H
Vanadium	2.3E+01	5.3E-05	4.4E-04	3.2E-02	3.1E-09	7.6E-03	6.3E-02	4.5E+00	4.5E-07	4.6E+00	H
Inorganics Pathway Total						3.0E+00	4.0E+00	9.6E+01	5.1E-05	1.0E+02	H
2-Methyl-4,6-dinitrophenol	4.6E-01	8.2E-07	1.6E-07	1.2E-03	1.2E-11	8.2E-03	1.6E-03	1.2E+01	1.2E-07	1.2E+01	H
Benzo(a)pyrene	2.3E-01	2.7E-04	5.6E-05	3.2E-04	1.6E-10						
Dibenz(a,h)anthracene	2.3E-01	1.3E-03	2.9E-04	3.2E-04	3.2E-10						
Hexachlorobenzene	2.3E-01	4.7E-05	9.5E-06	3.3E-04	7.5E-11	5.8E-02	1.2E-02	4.1E-01	9.3E-08	4.8E-01	
N-Nitroso-di-n-propylamine	2.3E-01	9.4E-08	1.7E-08	1.8E-03	1.7E-12						
Organics Pathway Total						6.6E-02	1.4E-02	1.2E+01	2.1E-07	1.2E+01	H
Pathway Total						3.0E+00	4.0E+00	1.1E+02	5.1E-05	1.1E+02	H

[a] COPCs are identified as chemicals of concern (COCs) if the total HI across all pathways is > 1 (H).

COPC = Chemical of Potential Concern.

EPC = Exposure Point Concentration.

HI = Hazard Index.

APPENDIX C

ECOLOGICAL RISK CHARACTERIZATION

APPENDIX C

ECOLOGICAL RISK CHARACTERIZATION

List of Appendix C Table numbers and brief descriptions of content for the 40 mm Range Soil Ecological Risk Screening, Ravenna, Ohio

Table No.	Description	
C- 1	Log Kow	
C- 2	Soil ESVs	
C- 3	Shallow Surface Soil (0-1 ft) ESV screen	
C- 4	Subsurface Soil (1-3 ft) ESV screen	
C- 5	Deep Surface Soil (0-3 ft) ESV screen	
C- 6	Cottontail parameters	
C- 7	Shrew parameters	
C- 8	Red fox parameters	
C- 9	Red-tailed hawk parameters	
C- 10	SPv, SPr, BAFi, Ba	
C- 11	AUFs-terrestrial	
C- 12	Ingestion Rates	
C- 13	TRVs plants	
C- 14	TRVs soil inverts	
C- 15	Mammal TRV Derivation	
C- 16	Mammal TRVs (NOAELs)	
C- 17	Bird TRV Derivation	
C- 18	Bird TRVs (NOAELs)	
C- 19	Shallow Surface Soil (0-1 ft) plant and EW HQs	plant and EW HQs
C- 20	Shallow Surface Soil (0-1 ft) Cottontail HQs	Cottontail HQs
C- 21	Shallow Surface Soil (0-1 ft) shrew HQs	shrew HQs
C- 22	Shallow Surface Soil (0-1 ft) fox HQs	fox HQs
C- 23	Shallow Surface Soil (0-1 ft) Hawk HQs	Hawk HQ
C- 24	Subsurface Soil (1-3 ft) plant and EW HQs	plants and worms HQs
C- 25	Subsurface Soil (1-3 ft) Cottontail HQs	Cottontail HQs
C- 26	Subsurface Soil (1-3 ft) shrew HQs	shrew HQs
C- 27	Subsurface Soil (1-3 ft) fox HQs	fox HQs
C- 28	Subsurface Soil (1-3 ft) Hawk HQs	Hawk HQ
C- 29	Deep Surface Soil (0-3 ft) plant and EW HQs	plants and worms HQs
C- 30	Deep Surface Soil (0-3 ft) Cottontail HQs	Cottontail HQs
C- 31	Deep Surface Soil (0-3 ft) shrew HQs	shrew HQs
C- 32	Deep Surface Soil (0-3 ft) fox HQs	fox HQs
C- 33	Deep Surface Soil (0-3 ft) Hawk HQs	Hawk HQ

Appendix Table C-1. Bioaccumulation Factors and Log Octanol-Water Partition Coefficients (Kows) For Analytes at 40 mm Range, Ravenna, Ohio

Chemical	CAS Registry Number	Log Kow* (L/kg)	Source	BAF MAX	Source
Aluminum		NA	NA	0.075	HAZWRAP (1994)
Ammonia		NA	NA	1	default value
Antimony		NA	NA	0.05	HAZWRAP (1994)
Arsenic		NA	NA	0.1	HAZWRAP (1994)
Barium		NA	NA	0.0075	HAZWRAP (1994)
Beryllium		NA	NA	0.05	HAZWRAP (1994)
Boron		NA	NA	1	default value
Cadmium		NA	NA	11	HAZWRAP (1994)
Calcium		NA	NA	1	default value
Chloride		NA	NA	1	default value
Chromium		NA	NA	0.28	HAZWRAP (1994)
Chromium, hexavalent		NA	NA	0.28	HAZWRAP (1994)
Cobalt		NA	NA	1	HAZWRAP (1994)
Copper		NA	NA	0.5	HAZWRAP (1994)
Cyanide		NA	NA	0	HAZWRAP (1994)
Fluoride		NA	NA	1	default value
Iron		NA	NA	1	default value
Lead		NA	NA	2	HAZWRAP (1994)
Magnesium		NA	NA	1	default value
Manganese		NA	NA	0.02	HAZWRAP (1994)
Mercury		NA	NA	13	HAZWRAP (1994)
Molybdenum		NA	NA	1	default value
Nickel		NA	NA	0.3	HAZWRAP (1994)
Nitrate		NA	NA	1	default value
Phosphorus		NA	NA	1	default value
Potassium		NA	NA	1	default value
Selenium		NA	NA	0.76	HAZWRAP (1994)
Silicon		NA	NA	1	default value
Silver		NA	NA	0.15	HAZWRAP (1994)
Sodium		NA	NA	1	default value
Sulfide		NA	NA	1	default value
Thallium		NA	NA	1	default value
Vanadium		NA	NA	0.13	HAZWRAP (1994)
Zinc		NA	NA	5	HAZWRAP (1994)
1,1,1-Trichloroethane	71-55-6	2.48	EPA 1995a in Jones, et al 1996	NA	NA
1,1,2,2-Tetrachloroethane	79-34-5	2.39	EPA 1995a in Jones, et al 1996	NA	NA
1,1,2,2-Tetrachloroethylene	127-18-4	2.67	EPA 1995e in Sample, et al 1996	NA	NA
1,1,2-Trichloroethane	79-00-5	2.17	EPA 1995	NA	NA
1,1'-Biphenyl	92-52-4	4.09	Schwarzenbach, et al 1993	NA	NA
1,1-Dichloroethane	75-34-3	4.00	EPA 1995a in Jones, et al 1996	NA	NA
1,1-Dichloroethene	75-35-4	2.13	EPA 1995a in Jones, et al 1996	NA	NA
1,1-Dichloroethylene	75-35-4	5.00	EPA 1995e in Sample, et al 1996	NA	NA
1,2,2-Trichloro-1,1,2-trifluoroe	76-13-1	3.16	Hansch and Leo 1985 in Syracuse 1996	NA	NA
1,2,3,4-Tetrachlorobenzene	634-66-2	4.55	Swarzenbch, et al 1993	NA	NA
1,2,3-Trichlorobenzene	87-61-6	4.05	Sangster 1994 in Syracuse 1996	NA	NA
1,2,3-Trichloropropane	96-18-4	1.98	Russom, et al 1996	NA	NA
1,2,4,5-Tetrachlorobenzene	95-94-3	4.64	Hansch and Leo 1985 in Syracuse 1996	NA	NA
1,2,4-Trichlorobenzene	120-82-1	4.02	EPA 1995d	NA	NA
1,2,4-Trimethyl benzene	95-63-6	3.63	Hansch, et al 1995 in Syracuse 1996	NA	NA
1,2-Dibromo-3-Chloropropane	96-12-8	2.96	Chem Inspect Test Inst. 1992 in Syracuse 1996	NA	NA
Indeno(1,2,3-cd)pyrene	193-39-5	6.92	EPA (1994b)	NA	NA
1,2-Dichloro-1,1,2,2-tetrafluor	76-14-2	2.82	Hansch and Leo 1985 in Syracuse 1996	NA	NA
1,2-Dichlorobenzene	95-50-1	3.38	EPA 1995d	NA	NA
1,2-Dichloroethane	107-06-2	1.47	EPA 1995a in Jones, et al 1996	NA	NA
1,2-Dichloroethene	540-59-0	1.86	EPA 1995a in Jones, et al 1996	NA	NA
1,2-Dichloroethylene	540-59-0	1.86	EPA 1995e in Sample, et al 1996	NA	NA

Appendix Table C-1. Bioaccumulation Factors and Log Octanol-Water Partition Coefficients (Kows) For Analytes at 40 mm Range, Ravenna, Ohio

Chemical	CAS Registry Number	Log Kow[a] (L/kg)	Source	BAF MAX	Source
1,2-Dimethylbenzene	95-47-6	3.12	Schwarzenbach, et al 1993	NA	NA
1,2-Diphenylhydrazine	122-66-7	2.94	Hansch and Leo 1985 in Syracuse 1996	NA	NA
1,3,5-Trinitrobenzene	99-35-4	1.18	Hansch and Leo 1985 in Syracuse 1996	NA	NA
1,3-Butadiene	106-99-0	1.99	Hansch and Leo 1985 in Syracuse 1996	NA	NA
1,3-Dichlorobenzene	541-73-1	3.43	EPA 1995a in Jones, et al 1996	NA	NA
1,3-Dichloropropene	542-75-6	2.00	EPA 1995a in Jones, et al 1996	NA	NA
1,3-Dinitrobenzene	99-65-0	1.49	Hansch and Leo 1985 in Syracuse 1996	NA	NA
1,4-Dichlorobenzene	95-50-1	3.42	EPA 1995a in Jones, et al 1996	NA	NA
1,4-Dinitrobenzene	100-25-4	1.46	Hansch and Leo 1985 in Syracuse 1996	NA	NA
1,4-Dioxane	123-91-1	-0.39	EPA 1995e in Sample, et al 1996	NA	NA
1,4-Naphthoquinone	130-15-4	1.71	Hansch, et al 1995 in Syracuse 1996	NA	NA
1-12'-Dimethybenz(a)anthracene	57-97-6	5.80	Hansch and Leo 1985 in Syracuse 1996	NA	NA
1-Hexanol	111-27-3	2.03	Schwarzenbach, et al 1993	NA	NA
HMX	2691-41-0	--	No Source	NA	NA
1-Methylnapthalene	90-12-0	3.87	Syracuse 1996 in Jones, et al 1996	NA	NA
1-Nitropropane	108-03-2	0.87	Hansch and Leo 1985 in Syracuse 1996	NA	NA
1-Octanol	111-87-5	2.84	Schwarzenbach, et al 1993	NA	NA
1-Pentanol	71-41-0	1.51	Syracuse 1996 in Jones, et al 1996	NA	NA
2,2'-oxybis(1-chloropropane)	108-60-1	2.48	Kawamoto, K and Urano, K 1989 in Syracuse 1996	NA	NA
2,3,4,5-Tetrachlorophenol	4901-51-3	4.21	Hansch and Leo 1985 in Syracuse 1996	NA	NA
2,3,4,6-Tetrachlorophenol	58-90-2	4.45	Russom, et al 1996[i]	NA	NA
2,3,5,6-Tetrachloroaniline	3481-20-7	4.10	Russom, et al 1996	NA	NA
Nitrocellulose	9004-70-0	--	No Source	NA	NA
n-nitrosodiphenylamine	86-30-6	3.13	Hansch and Leo 1985 in Syracuse 1996	NA	NA
2,3,7,8-Tetrachloro-Dibenzodioxin	1746-01-6	6.53	EPA 1995e in Sample, et al 1996[f]	NA	NA
Tetryl	479-45-8	--	No Source	NA	NA
2,4,5-Trichloroaniline	636-30-6	4.01	EPA 1995a in Jones, et al 1996	NA	NA
2,4,5-Trichlorophenoxyacetic acid	93-76-5	3.31	Hansch and Leo 1985 in Syracuse 1996	NA	NA
2,4,6-Trichlorophenol	88-06-2	3.69	Hansch and Leo 1985 in Syracuse 1996	NA	NA
2,4,6-Trinitrotoluene	118-96-7	1.60	Hansch and Leo 1985 in Syracuse 1996	NA	NA
2,4-D	94-75-7	2.81	EPA 1995c[k]	NA	NA
2,4-Dichloroaniline	554-00-7	2.78	Sangster 1994 in Syracuse 1996	NA	NA
2,4-Dichlorophenol	120-83-2	3.06	Russom, et al 1996	NA	NA
2,4-Dimethylphenol	105-67-9	2.35	Swarzenbch, et al 1993	NA	NA
2,4-Dinitrophenol	51-28-5	1.54	Howard 1990	NA	NA
2,4-Dinitrotoluene	121-14-2	1.98	Howard 1990	NA	NA
2,6-Dichlorophenol	87-65-0	2.75	Hansch, et al 1995 in Syracuse 1996	NA	NA
2,6-Dinitrotoluene	606-20-2	1.72	Howard 1990	NA	NA
2-Butanone	79-93-3	0.29	EPA 1995a in Jones et al 1996	NA	NA
2-Chloronaphthalene	91-58-7	3.98	Sangster 1994 in Syracuse 1996	NA	NA
2-Chlorophenol	95-57-8	2.15	Howard 1990.	NA	NA
2-Chloropropane	75-29-6	1.90	Hansch and Leo 1985 in Syracuse 1996	NA	NA
2-Chlorotoluene	95-49-8	3.42	Hansch and Leo 1985 in Syracuse 1996	NA	NA
2-Hexanone	591-78-6	1.38	EPA 1995a in Jones, et al 1996	NA	NA
2-Methylnaphthalene	91-57-6	-1.90	SCDM 1993 in HAZWRAP 1994	NA	NA
2-Methylnapthalene	91-57-6	3.86	Hansch and Leo 1985 in Syracuse 1996	NA	NA
2-Methylphenol	95-48-7	1.99	EPA 1995a in Jones, et al 1996	NA	NA
2-Naphthylamine	91-59-8	2.28	Hansch and Leo 1985 in Syracuse 1996	NA	NA
2-Nitrophenol	88-75-5	1.79	Howard 1990	NA	NA
2-Octanone	111-13-7	2.37	Syracuse 1996 in Jones, et al 1996	NA	NA
2-Picoline	109-06-8	1.11	Russom, et al 1996	NA	NA
2-Propanol	67-63-0	0.05	Hansch and Leo 1985 in Syracuse 1996	NA	NA
2-Propenoic acid	79-10-7	0.35	Hansch, et al 1995 in Syracuse 1996	NA	NA
3,3'-Dichlorobenzidine	91-94-1	3.51	Howard 1990[j]	NA	NA
3,3'-Dimethoxybenzidine	119-90-4	1.81	Debnath, et al 1992 in Syracuse 1996	NA	NA
3,3'-Dimethylbenziding	119-93-7	2.34	Hansch and Leo 1985 in Syracuse 1996	NA	NA

Appendix Table C-1. Bioaccumulation Factors and Log Octanol-Water Partition Coefficients (Kows) For Analytes at 40 mm Range, Ravenna, Ohio

Chemical	CAS Registry Number	Log Kow[a] (L/kg)	Source	BAF MAX	Source
3,4-Dichloroaniline	95-76-1	2.69	Russom, et al 1996	NA	NA
3,4-Dichlorophenol	95-77-2	3.33	Hansch and Leo 1985 in Syracuse 1996	NA	NA
3-Chloroaniline	108-42-9	1.88	Hansch and Leo 1985 in Syracuse 1996	NA	NA
3-Chlorophenol	108-43-0	2.50	Howard 1990	NA	NA
3-Nitroaniline	99-09-2	1.37	Hansch and Leo 1985 in Syracuse 1996	NA	NA
3-Pentanone	96-22-0	0.99	Hansch and Leo 1985 in Syracuse 1996	NA	NA
4,4-Methylenedianiline	101-77-9	1.59	Hansch and Leo 1985 in Syracuse 1996	NA	NA
4,6-Dinitro-2-methylphenol	534-52-1	2.12	Hansch and Leo 1985 in Syracuse 1996	NA	NA
4-Bromoaniline	106-40-1	2.26	Hansch and Leo 1985 in Syracuse 1996	NA	NA
4-Bromophenyl phenyl-ether	101-55-3	5.00	EPA 1995a in Jones et al 1996	NA	NA
4-Chloro-3-methylphenol	35421-08-0	3.10	Russom, et al 1996	NA	NA
4-chloroaniline	106-47-8	1.83	Howard 1990	NA	NA
4-Chlorophenol	106-48-9	2.39	Howard 1990	NA	NA
4-Chlorophenyl-phenyl ether	7005-72-3	4.08	Sangster 1994 in Syracuse 1996	NA	NA
4-Chlorotoluene	106-43-4	3.33	Hansch and Leo 1985 in Syracuse 1996	NA	NA
4-Methyl 2-Pentanone	108-10-1	1.31	Syracuse 1996 in Jones, et al 1996	NA	NA
4-Methylphenol	106-44-5	1.90	SCDM 1993 in HAZWRAP 1994	NA	NA
4-Nitroaniline	100-01-6	1.39	Hansch and Leo 1985 in Syracuse 1996	NA	NA
4-Nitrophenol	100-02-7	1.91	Howard 1990	NA	NA
4-Nitroquinoline-1-oxide	56-57-5	1.09	Hansch and Leo 1985 in Syracuse 1996	NA	NA
4-Toluidine	106-49-0	1.39	Russom, et al 1996	NA	NA
5-Nitro-o-Toluidine	99-55-8	1.87	Hansch, et al 1995 in Syracuse 1996	NA	NA
Acenaphthene	83-32-9	3.92	EPA 1995a in Jones, et al 1996	NA	NA
Acenaphthylene	208-96-8	4.10	SCDM 1993 in HAZWRAP 1994	NA	NA
Acetone	67-64-1	-0.24	EPA 1995a in Jones, et al 1996	NA	NA
Acetonitrile	75-05-8	0.25	Howard 1990	NA	NA
Acetonitrile	75-05-8	-0.34	Hansch and Leo 1995 in Syracuse 1996	NA	NA
Acrolein	107-02-8	-0.01	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Acrylamide	79-06-1	-0.67	Howard 1990	NA	NA
Aldicarb	116-06-3	1.13	EPA 1995c	NA	NA
Aldrin	309-00-2	6.50	EPA 1995e in Sample, et al 1996	NA	NA
alpha, alpha-Dimethylphenethylamine	122-09-8	1.90	Hansch and Leo 1985 in Syracuse 1996	NA	NA
alpha-BHC	319-84-6	3.80	SCDM 1993 in HAZWRAP 1994	NA	NA
2-Amino-4,6-dinitrotoluene	35572-78-2	1.94	(estimated, Talmage et al. 1999)	NA	NA
4-Amino-2,6-dinitrotoluene	19406-51-0	--	No Source	NA	NA
Aniline	62-53-3	0.90	Howard 1990	NA	NA
Anthracene	120-12-7	4.55	EPA 1995a in Jones, et al 1996	NA	NA
Aroclor 1016	1264-11-2	5.60	ATSDR 1989 in Jones, et al 1996	NA	NA
PCB-1016	1264-11-2	5.60	ATSDR 1989 in Jones, et al 1996	NA	NA
Aroclor 1221	11104-28-2	4.70	ATSDR 1989 in Jones, et al 1996	NA	NA
PCB-1221	11104-28-2	4.70	ATSDR 1989 in Jones, et al 1996	NA	NA
Aroclor 1232	11141-16-5	5.10	ATSDR 1989 in Jones, et al 1996	NA	NA
PCB-1232	11141-16-5	5.10	ATSDR 1989 in Jones, et al 1996	NA	NA
Aroclor 1242	53469-21-9	5.60	ATSDR 1989 in Jones, et al 1996	NA	NA
PCB-1242	53469-21-9	5.60	ATSDR 1989 in Jones, et al 1996	NA	NA
Aroclor 1248	12672-29-6	6.20	ATSDR 1989 in Jones, et al 1996	NA	NA
PCB-1248	12672-29-6	6.20	ATSDR 1989 in Jones, et al 1996	NA	NA
Aroclor 1254	27323-18-8	6.50	ATSDR 1989 in Jones, et al 1996	NA	NA
PCB-1254	27323-18-8	6.50	ATSDR 1989 in Jones, et al 1996	NA	NA
Aroclor 1260	11096-82-5	6.80	ATSDR 1989 in Jones, et al 1996	NA	NA
PCB-1260	11096-82-5	6.80	ATSDR 1989 in Jones, et al 1996	NA	NA
Atrazine	1912-24-9	2.75	EPA 1995c	NA	NA
Azobenzene	103-33-3	3.82	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Benzaldehyde	100-52-7	1.48	Schwarzenbach, et al 1993	NA	NA
Benzene	71-43-2	2.13	EPA 1995a in Jones et al 1996	NA	NA
Benzidine	92-87-5	1.66	EPA 1995a in Jones et al 1996	NA	NA
Benzo(a)anthracene	56-55-3	5.70	EPA 1995a in Jones et al 1996	NA	NA
Benzo(a)pyrene	50-32-8	6.11	EPA 1995a in Jones et al 1996	NA	NA
Benzo(b)fluoranthene	205-99-2	6.10	SCDM 1993 in HAZWRAP 1994	NA	NA
Benzo(e)pyrene	192-97-2	6.44	Devoogt, et al 1990 in Syracuse 1996	NA	NA
Benzo(g,h,i)perylene	191-24-2	6.60	SCDM 1993 in HAZWRAP 1994[c]	NA	NA
Benzo(k)fluoranthene	207-08-9	6.10	SCDM 1993 in HAZWRAP 1994	NA	NA
Benzoic acid	65-85-0	1.87	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Benzyl alcohol	100-51-6	1.11	EPA 1995a in Jones et al 1996	NA	NA
Benzyl chloride	100-44-7	2.30	Hansch and Leo 1985 in Syracuse 1996	NA	NA
beta-BHC	319-85-7	3.81	EPA 1995e in Sample, et al 1996	NA	NA
BHC-mixed isomers	---	5.89	EPA 1995e in Sample, et al 1996	NA	NA
Biphenyl	95-52-4	3.96	EPA 1995b in Jones et al 1996	NA	NA
bis(2-chloroethyl)ether	111-44-4	1.29	Howard 1990	NA	NA
Bis(2-ethylhexyl)phthalate	117-81-7	7.60	Syracuse 1996 in Jones, et al 1996[c]	NA	NA

Appendix Table C-1. Bioaccumulation Factors and Log Octanol-Water Partition Coefficients (Kows) For Analytes at 40 mm Range, Ravenna, Ohio

Chemical	CAS Registry Number	Log Kow[a] (L/kg)	Source	BAF MAX	Source
Bromobenzene	108-86-1	2.99	Schwarzenbach, et al 1993	NA	NA
Bromodichloromethane	75-27-4	1.41	Syracuse 1996 in Jones, et al 1996	NA	NA
Butane	106-97-8	2.89	Schwarzenbach, et al 1993	NA	NA
Butylbenzylphthalate	85-68-7	4.84	EPA 1995a in Jones, et al 1996	NA	NA
Captan	133-06-2	2.35	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Carbaryl	65-25-2	2.36	Schwarzenbach, et al 1993	NA	NA
Carbazole	86-74-8	3.76	Hansch and Leo 1979 in HAZWRAP 1994	NA	NA
Carbofuran	1563-66-2	2.32	EPA 1995c	NA	NA
Carbon Disulfide	75-15-0	2.00	EPA1995a in Jones, et al 1996	NA	NA
Carbon Tetrachloride	56-23-5	2.73	EPA 1995a in Jones, et al 1996	NA	NA
Chloracetamide	79-07-2	-0.53	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Chlordane	57-74-9	6.32	EPA 1995a in Jones, et al 1996	NA	NA
Chlordecone	143-50-0	5.30	EPA 1995e in Sample, et al 1996	NA	NA
Chlorobenzene	108-90-7	2.86	EPA 1995a in Jones, et al 1996	NA	NA
Chlorobenzilate	510-15-6	4.74	Chem Inspect Test Inst. 1992 in Syracuse 1996	NA	NA
Chlorodifluoromethane	75-45-6	1.08	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Chloroethane	75-00-3	1.43	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Chloroform	67-66-3	1.92	EPA 1995e in Sample, et al 1996	NA	NA
Chloromethane	74-87-3	0.91	Schwarzenbach, et al 1993	NA	NA
Chloropropene	107-05-1	2.03	Howard 1990	NA	NA
Chrysene	218-01-9	5.70	SCDM 1993 in HAZWRAP 1994	NA	NA
Cis-1,3-Dichloropropene	10061-02-6	2.06	Tomlin 1994 in Syracuse 1996	NA	NA
Cumene	98-82-8	3.66	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Cyanogen	460-19-5	0.07	Hansch, et al 1995 in Syracuse 1996	NA	NA
Cyclohexanol	108-93-0	1.23	Schwarzenbach, et al 1993	NA	NA
Cyclohexanone	108-94-1	0.81	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Cyclopentane	287-92-3	3.00	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Dalapon	75-99-0	0.78	EPA 1995c	NA	NA
DDT	50-29-3	6.53	EPA 1995a in Jones, et al 1996	NA	NA
4,4'-DDT	50-29-3	6.53	EPA 1995a in Jones, et al 1996	NA	NA
Decane	124-18-5	5.01	EPA 1995a in Jones, et al 1996	NA	NA
delta-BHC	319-86-8	4.10	SCDM 1993 in HAZWRAP 1994	NA	NA
Diallate	2303-16-4	4.49	Ellington and Stancil 1988 in Syracuse 1996	NA	NA
Diazinon	333-41-5	3.70	EPA 1995a in Jones, et al 1996	NA	NA
Dibenzo(a,h)anthracene	53-70-3	6.50	SCDM 1993 in HAZWRAP 1994	NA	NA
Dibenzofuran	132-64-9	4.12	EPA 1995a in Jones, et al 1996	NA	NA
Dibromochloromethane	124-48-1	2.16	Sangster 1994 in Syracuse 1996	NA	NA
Dibromomethane	74-95-3	1.70	Martiska, A, Bekarek, V 1990 in Syracuse 1996	NA	NA
Dichlorodifluromethane	74-71-8	2.53	Swarzenbch, et al1993	NA	NA
Dieldrin	60-57-1	5.37	EPA 1995a in Jones, et al 1996	NA	NA
Dienochlor	2227-17-0	3.50	British Crop Protection Council 1987 in ARS 1999	NA	NA
Diethyl Sulfide	352-93-2	1.95	Schwarzenbach, et al 1993	NA	NA
Diethylphthalate	84-66-2	2.50	EPA 1995a in Jones, et al 1996	NA	NA
Diisobutylphthalate	84-69-5	4.11	Schwarzenbach, et al 1993	NA	NA
Dimethoate	60-51-5	0.78	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Dimethylphthalate	131-11-3	1.53	Schwarzenbach, et al 1993	NA	NA
Di-n-butylphthalate	84-74-2	4.61	EPA 1995a in Jones, et al 1996	NA	NA
Di-n-octylphthalate	117-84-0	8.10	Ellington and Floyd 1996 in Syracuse 1996	NA	NA
Dinoseb	88-85-7	3.56	Hansch, et al 1995 in Syracuse 1996	NA	NA
Dioxin	1746-01-6	6.80	EPA 1995d[d]	NA	NA
Diphenyl ether	101-84-8	4.21	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Diphenylamine	122-39-4	3.50	Russom, et al 1996	NA	NA
Diquat	85-00-7	-3.05	EPA 1995c	NA	NA
Disulfoton	298-04-4	4.02	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Diuron	330-54-1	2.80	Dupon Cortporation Data 1989 in ARS 1999	NA	NA
Endosulfan	115-29-7	4.10	EPA 1995a in Jones, et al 1996	NA	NA
Endosulfan sulfate	1031-07-8	3.66	Hansch, et al 1995 in Syracuse 1996	NA	NA
Endosulfan I	959-98-8	3.83	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Endrin	72-20-8	5.06	EPA 1995a in Jones, et al 1996	NA	NA
Endrin Aldehyde	7421-93-4	3.14	Arthur D. Little, Inc. 1981 in HAZWRAP 1994	NA	NA
Epichlorohydrin	106-89-8	0.45	Deneer, et al 1988 in Syracuse 1996	NA	NA
Ethane	74-84-0	1.81	Schwarzenbach, et al 1993	NA	NA
Ethanol	64-17-5	-0.31	EPA 1992b in Sample, et al 1996	NA	NA

Appendix Table C-1. Bioaccumulation Factors and Log Octanol-Water Partition Coefficients (Kows) For Analytes at 40 mm Range, Ravenna, Ohio

Chemical	CAS Registry Number	Log Kow[a] (L/kg)	Source	BAF MAX	Source
Ethyl Acetate	141-78-6	0.69	EPA 1995e in Sample, et al 1996	NA	NA
Ethylbenzene	100-41-4	3.14	EPA 1995a in Jones, et al 1996	NA	NA
Ethyl carbamate	51-79-6	-0.15	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Ethyl ether	60-29-7	0.89	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Ethylene Dibromide	106-93-4	1.96	Hansch, et al 1995 in Syracuse 1996	NA	NA
Ethylene glycol	107-21-1	-1.36	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Famphur	52-85-7	2.23	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Fluometuron	2164-17-2	1.34	Schwarzenbch et al 1993	NA	NA
Fluoranthene	206-44-0	5.12	EPA 1995a in Jones, et al 1996	NA	NA
Fluorene	86-73-7	4.21	EPA 1995a in Jones, et al 1996	NA	NA
Fluorobenzene	462-06-6	2.27	Swarzenbch et al 1993	NA	NA
Formaldehyde	50-00-0	-0.05	EPA 1995e in Sample, et al 1996	NA	NA
Formamide	75-12-7	-1.51	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Formic acid	64-18-6	-0.54	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Furan	110-00-9	1.34	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Furfural	98-01-1	0.41	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Heptachlor	76-44-8	6.10	EPA 1995a in Jones, et al 1996	NA	NA
Heptachlor Epoxide	1024-57-3	5.40	SCDM 1993 in HAZWRAP 1994	NA	NA
Heptane	142-82-5	4.66	Miller, M.M., et al 1985 in Syracuse 1996	NA	NA
Hexachlorobenzene	118-74-1	5.50	Schwarzenbach, et al 1993	NA	NA
Hexachlorobutadiene	87-68-3	4.90	Schwarzenbach, et al 1993	NA	NA
Hexachlorocyclopentadiene	77-47-4	5.04	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Hexachloroethane	67-72-1	4.00	EPA 1995a in Jones, et al 1996	NA	NA
Hexachlorophene	70-30-4	7.54	Hansch, et al 1995 in Syracuse 1996	NA	NA
Imazaquin-ammonium	81335-47-9	0.34	Pesticide Manual, 1994in ARS 1999	NA	NA
Imazilil	35554-44-0	3.82	British Crop Protection Council 1986 in ARS 1999	NA	NA
Isobutyl alcohol	78-83-1	0.76	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Isophorone	78-59-1	1.70	Veith, G.D., et al 1980 in Syracuse 1996	NA	NA
Lindane (gamma-BHC)	58-89-9	3.73	EPA 1995a in Jones, et al 1996	NA	NA
Lindane	58-89-9	3.73	EPA 1995a in Jones, et al 1996	NA	NA
Malathion	121-75-5	2.89	Schwarzenbach, et al 1993	NA	NA
MCPA	94-74-6	2.80	Pionke, H.B., Deangelis, R.J. 1980 in ARS 1999	NA	NA
m-cresol	108-39-4	1.96	Howard 1990.	NA	NA
Methacrylonitril	126-98-7	0.68	Tanii and Hashimoto 1994 in Syracuse 1996	NA	NA
Methanol	67-56-1	-0.71	EPA 1995e in Sample, et al 1996	NA	NA
Methapyrilene	91-80-5	2.87	Sangster 1994 in Syracuse 1996	NA	NA
Methomyl	16752-77-5	0.57	Dupont Corporation Data 1989 In ARS 1999	NA	NA
Methoxychlor	72-43-5	5.08	EPA 1995a in Jones, et al 1996	NA	NA
Methyl bromide	74-83-9	1.19	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Methyl iodide	74-88-4	3.36	EPA 1995a in Jones, et al 1996	NA	NA
Methyl metharcrylate	80-62-6	1.38	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Methylcyclohexane	108-87-2	3.61	Hansch, et al 1995 in Syracuse 1996	NA	NA
Methylene Chloride	75-09-2	1.25	EPA 1995a in Jones, et al 1996	NA	NA
Methylhydrazine	60-34-4	-1.06	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Methylstyrene	98-83-9	3.48	Hansch, et al 1995 in Syracuse 1996	NA	NA
Mirex	2385-85-5	6.89	Veith, et al 1979 in Syracuse 1996	NA	NA
M-nitrosodiphenylamine	86-30-6	3.13	Hansch and Leo 1985 in Syracuse 1996	NA	NA
m-Nitrotoluene	99-08-1	2.45	Russom, et al 1996	NA	NA
3-Nitrotoluene	99-08-1	2.45	Russom, et al 1996	NA	NA
Naphthalene	91-20-3	3.36	EPA 1995a in Jones, et al 1996	NA	NA
n-Butyl benzene	104-51-8	4.38	DeBruijn, J, et al 1989 in Syracuse 1996	NA	NA
n-Hexane	110-54-3	4.11	Schwarzenbach, et al 1993	NA	NA
Nitrobenzene	98-95-3	1.83	Schwarzenbch et al 1993	NA	NA
Nitroglycerin	55-63-0	1.62	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Nitromethane	75-52-5	-0.35	Hansch and Leo 1985 in Syracuse 1996	NA	NA
n-Nitrochlorobenzene	100-00-5	2.39	Hansch and Leo 1985 in Syracuse 1996	NA	NA
N-Nitrosodiethylamine	55-18-5	0.48	Hansch and Leo 1985 in Syracuse 1996	NA	NA
N-Nitrosomorpholine	59-89-2	-0.44	Hansch and Leo 1985 in Syracuse 1996	NA	NA
N-Nitrosopiperidine	100-75-4	0.36	Hansch and Leo 1985 in Syracuse 1996	NA	NA

Appendix Table C-1. Bioaccumulation Factors and Log Octanol-Water Partition Coefficients (Kows) For Analytes at 40 mm Range, Ravenna, Ohio

Chemical	CAS Registry Number	Log Kow[a] (L/kg)	Source	BAF MAX	Source
N-Nitrosopyrrolidine	930-55-2	-0.19	Hansch and Leo 1985 in Syracuse 1996	NA	NA
n-Pentane	109-66-0	3.62	Swarzenbch, et al 1993	NA	NA
n-Pentylbenzene	538-68-1	4.90	Schwarzenbach, et al 1993	NA	NA
n-propyl benzene	103-65-1	3.69	Sangster 1994 in Syracuse 1996	NA	NA
o-Cresol	95-48-7	1.99	EPA 1995e in Sample, et al 1996	NA	NA
Octachloronaphthalene	2234-13-1	8.24	Opperhuizen, A 1985 in Syracuse 1996[b]	NA	NA
o-Dichlorobenzene	95-50-1	3.38	EPA 1995d	NA	NA
o-Dinitrobenzene	528-29-0	1.69	Hansch, et al 1995 in Syracuse 1996	NA	NA
o-Nitroaniline	88-74-4	1.85	Hansch and Leo 1985 in Syracuse 1996	NA	NA
o-Nitrophenol	88-75-5	1.79	Howard 1990	NA	NA
o-Nitrotoluene	88-72-2	2.30	Opperhuizen, A 1985 in Syracuse 1996	NA	NA
2-Nitrotoluene	88-72-2	2.30	Opperhuizen, A 1985 in Syracuse 1996	NA	NA
Oxadiazon	19666-30-9	4.70	Rhone-Poulenc Corporation Data in ARS 1999	NA	NA
p,p'-DDD	72-54-8	6.10	EPA 1995a in Jones, et al 1996	NA	NA
4,4'-DDD	72-54-8	6.10	EPA 1995a in Jones, et al 1996	NA	NA
4,4'-DDE	72-55-9	6.26	EPA 1994b	NA	NA
Parathion	56-38-2	3.81	Schwarzenbach, et al 1993	NA	NA
p-Cresol	106-44-5	1.94	Hansch and Leo 1985 in Syracuse 1996	NA	NA
p-Dichlorobenzene	106-46-7	3.37	EPA 1995d	NA	NA
Pentachloroaniline	527-20-8	4.82	Sangster 1994 in Syracuse 1996	NA	NA
Pentachlorobenzene	608-93-5	5.26	EPA1995a in Jones, et al 1996	NA	NA
Pentachloroethane	76-01-7	3.63	Russom, et al 1996	NA	NA
Pentachloro-nitrobenzene	82-68-8	4.64	EPA 1995e in Sample, et al 1996	NA	NA
Pentachlorophenol	87-86-5	5.09	EPA 1995e in Sample, et al 1996	NA	NA
Phenacetin	62-44-2	1.58	Nakagawa, Y, et al 1992 in Syracuse 1996	NA	NA
Phenanthrene	85-01-8	4.55	EPA1995a in Jones, et al 1996	NA	NA
Phenmediphan	13684-63-4	3.59	Noram Company Data in ARS 1999	NA	NA
Phenol	108-95-2	1.48	EPA1995a in Jones, et al 1996	NA	NA
Phorate	298-02-2	3.56	Hansch, et al 1995 in Syracuse 1996	NA	NA
Phosmet	732-11-6	3.00	Beguhn, M.A. 1989 in ARS 1989	NA	NA
Phthalic acid	100-21-0	2.00	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Phthalic anhydride	85-44-9	1.60	Panoma 1987 in Syracuse 1996	NA	NA
p-Nitrophenol	100-02-07	1.91	Howard 1990	NA	NA
p-Nitrotoluene	99-99-0	2.37	Howard 1990	NA	NA
4-Nitrotoluene	99-99-0	2.37	Howard 1990	NA	NA
p-Phenylenediamine	106-50-3	-0.30	Hansch, et al 1995 in Syracuse 1996	NA	NA
Profenofos	41198-08-7	1.70	Ciba-Geigy Corporation Data 1989 in ARS 1999	NA	NA
Pronamide	23950-58-5	0.05	EPA1995a in Jones, et al 1996	NA	NA
Propionitril	107-12-0	0.16	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Pryidine	110-86-1	0.65	Russom, et al 1996	NA	NA
Pyrene	129-00-0	5.13	Schwarzenbach, et al 1993g	NA	NA
Quinoline	91-22-5	2.03	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Quinone	106-51-4	0.20	Hansch and Leo 1985 in Syracuse 1996	NA	NA
RDX	121-82-4	0.87	Schwarzenbach, et al 1993	NA	NA
sec-Butyl benzene	135-98-8	4.57	Sherblom, et al 1988 in Syracuse 1996	NA	NA
Silvex	93-72-1	3.80	Hansch , et al 1995 in Syracuse 1996	NA	NA
Simazine	122-34-9	2.18	EPA 1995c	NA	NA
Strychnine	57-24-9	1.93	Panoma 1987 in Syracuse 1996	NA	NA
Styrene	100-42-5	2.95	Schwarzenbach, et al 1993	NA	NA
Tebuthiuron	34014-18-1	1.79	ARS 1999	NA	NA
Temephos	3383-96-8	4.90	British Crop Protection Council 1994 in ARS 1999	NA	NA
tert-Butyl benzene	98-06-6	4.11	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Tetrachloroethane	25322-20-7	2.39	Schwarzenbach, et al 1993	NA	NA
Tetrachloroethene	127-18-4	2.88	Schwarzenbach, et al 1993	NA	NA
Tetrachloroethylene	127-18-4	3.40	EPA 1995d	NA	NA
Tetrachloromethane	56-23-5	2.73	EPA 1995a in Jones, et al 1996	NA	NA
Tetrahydrofuran	109-99-9	0.46	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Toluene	108-883	2.75	EPA 1995a in Jones, et al 1996	NA	NA
Toxaphene	8001-35-2	5.50	EPA 1995e in Sample, et al 1996	NA	NA
Trans-1,3-Dichloropropene	10061-02-6	2.03	Tomlin 1994 in Syracuse 1996	NA	NA
Tribromomethane	75-25-2	2.35	EPA 1995a in Jones, et al 1996	NA	NA
Tributyl phosphate	126-73-8	4.00	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Trichloroethene	636-30-6	2.71	EPA 1995a in Jones, et al 1996	NA	NA
Trichloroethylene	79-01-6	2.71	EPA 1995e in Sample, et al 1996	NA	NA
Trichlorofluoromethane	75-69-4	2.16	Schwarzenbach, et al 1993	NA	NA
Triethylamine	121-44-8	1.45	Hansch and Leo 1985 in Syracuse 1996	NA	NA
Trifluorobromomethane	75-63-8	1.86	Hansch and Leo 1985 in Syracuse 1996	NA	NA

Appendix Table C-1. Bioaccumulation Factors and Log Octanol-Water Partition Coefficients (Kows) For Analytes at 40 mm Range, Ravenna, Ohio

Chemical	CAS Registry Number	Log Kow[a] (L/kg)	Source	BAF MAX	Source
Vinyl acetate	108-05-4	0.73	EPA 1995a in Jones, et al 1996	NA	NA
Vinyl Chloride	75-01-4	1.50	EPA 1995e in Sample, et al 1996	NA	NA
Xylene	1330-20-7	3.13	EPA 1995a in Jones, et al 1996	NA	NA
Xylene (mixed isomers)	1330-20-7	3.20	EPA 1995e in Sample, et al 1996	NA	NA
Ziram	137-30-4	1.09	British Crop Protection Council 1994 in ARS 1999	NA	NA

[a] Log Octanol-Water partition coefficient.

BAF Max = Bioaccumulation factor maximum (if BAF Max is > 1, the inorganic chemical is likely to bioaccumulate)

-- = no log Kow found

NA = not applicable

[b] Syracuse 1996. Syracuse Research Corporation, Environmental Sciences Center's on-line experimental Log P database conducted June 7, 1996.

[c] Jones, D.S., R N. Hull, G.W. Suter II. 1996. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Sediment-Associated Biota: 1996 Revision.* Lockheed Martin Energy Systems, Inc. Oak Ridge, TN 37831.-

[d] EPA. 1995d. National Primary Drinking Water Regulations; Contaminated Specific Fact Sheets Volatile Organic Chemicals, Technical Version. USEPA Office of Water. EPA 811-F-95-004-T.

[e] HAZWRAP (Hazardous Waste Remedial Action Program). 1994. Loring Air Force Base. Ecological Risk Assessment Methodology.

[f] Sample, B.E., D.M. Opresko, G.W. Suter II. 1996. *Toxicological Benchmarks for Wildlife.* Lockheed Martin Energy Systems, Inc. Oak Ridge, Tn. 37381

[g] Schwarzenbach, R.E., P.M. Gschwend, D.M. Imboden. 1993. Environmental Organic Chemistry. John Wiley & Sons, New York.

[h] United States Department of Agriculture, Agricultural Research Service (ARS) 1999. Remote Sensing and Modeling Lab. 10300 Baltimore Ave. Bldg. 007. Beltsville, MD. 20705.

[i] Russon, C.L., S. Bradbury, S. Broderius. 1996. Environmental Toxicology and Chemistry. V. 16. No. 5, pp.948-967. *Predicting Modes of Toxic Action from chemical* Structure: Acute Toxicity in the Fathead Minnow (*pimephales Promela*).

[j] Howard, Philip, H. 1990. *Handbook of Environmental Fate and Exposure Data for Organic Chemicals VI.* Lewis Publishers, Chelsea, Michigan.

[k] EPA. 1995c. National Primary Drinking Water Regulations; Contaminant Specific Fact Sheets. USEPA Ofice of Water. EPA 811-F-95-004-T.

U.S. EPA 1994b. Draft Report-Chemical Properties for Soil Screening Levels. Prepared for the OERR. Washington, D.C. July 26.

Appendix Table C-2. Soil Ecological Screening Values For Level II Screen For 40 mm Range at Ravenna, Ohio

Chemicals	CAS Registry Number	Efroymson et al. (1997a) Preliminary Remediation Goals for Ecological Endpoints[a] Number (mg/kg)	Efroymson et al. (1997a) Source	Screening Value for Earthworms and Soil Microorganisms (Efroymson et al. 1997b)[b]: Benchmarks for Earthworm Number (mg/kg)	Benchmarks for Earthworm Source	Benchmarks for soil microorganism Number (mg/kg)	Benchmarks for soil microorganism Source	Soil Screening values for Plants (Efroymson et al. 1997c)[c] Number mg/kg mg/L	Soil Screening values for Plants Source (Soil) (Solution)	Ecological Screening Level (ESL)[d] Number (mg/kg)	Ecological Screening Level Source	Preferred Ecological Screening Value (ESV)[e] Number (mg/kg)	Preferred Ecological Screening Value Source
Inorganics													
(Target Analyte List)													
Aluminum	7429-90-5	–		–		600	LOEC	50	Soil, LOEC	–		6.00E+02	LOEC
Antimony	7440-36-0	5	PRGs	–		–		5	Soil, LOEC	0.1423	ESL EPA Region 5 (2003)	5.00E+00	PRGs
Arsenic	7440-38-2	9.9	PRGs	60	LOEC	100	LOEC	10	Soil, NOEC	5.7	ESL EPA Region 5 (2003)	9.90E+00	PRGs
Barium	7440-39-3	283	PRGs	–		3000	LOEC	500	Soil, LOEC	1.04	ESL EPA Region 5 (2003)	2.83E+02	PRGs
Beryllium		10	PRGs							1.06	ESL EPA Region 5 (2003)	1.00E+01	PRGs
Bismuth	7440-69-9	–		–		–		20	No Soil, only Solution, LOEC	–		2.00E+01	No Soil, only Solution, LOEC
Boron	7440-42-8	0.5	PRGs	–		20	LOEC	0.5	Soil, LOEC	–		5.00E-01	PRGs
Bromine	7726-95-6	10	PRGs	–		–		10	Soil, LOEC	–		1.00E+01	PRGs
Cadmium	7440-43-9	4	PRGs	20	LOEC	20	LOEC	4	Soil, LOEC	0.00222	ESL EPA Region 5 (2003)	4.00E+00	PRGs
Calcium	7440-70-2	–		–		–		–		–		No ESV	No Source
Chromium	16065-83-1	0.4	PRGs	0.4	LOEC	10	NOEC	1	Soil, LOEC	0.4	ESL EPA Region 5 (2003)	4.00E-01	PRGs
Chromium, hexavalent	18540-29-9	0.4	PRGs	0.4	LOEC	10	NOEC	1	Soil, LOEC	–		4.00E-01	PRGs
Cobalt	7440-48-4	20	PRGs	–		1000	LOEC	20	Soil, LOEC	0.14033	ESL EPA Region 5 (2003)	2.00E+01	PRGs
Copper	7440-50-8	60	PRGs	60	LOEC	100	LOEC	100	Soil ,NOEC	5.4	ESL EPA Region 5 (2003)	1.39E+01	PPL (SAIC 2002)
Cyanide	57-12-5	–		–		–		–		1.33	ESL EPA Region 5 (2003)	1.08E+00	PPL (SAIC 2002)
Fluorine	7782-41-4	200	PRGs	–		30	LOEC	200	Soil, LOEC	–		2.00E+02	PRGs
Iodine	7553-56-2	4	PRGs	–		–		4	Soil, LOEC	–		4.00E+00	PRGs
Iron	7439-89-6	–		–		200	NOEC	10	No Soil, only Solution, LOEC	–		2.00E+02	NOEC
Lanthanum	7439-91-0	–		–		50	LOEC	–		–		5.00E+01	LOEC
Lead	7439-92-1	40.5	PRGs	500	NOEC	900	NOEC	50	Soil ,NOEC	0.05373	ESL EPA Region 5 (2003)	4.05E+01	PRGs
Lithium	7439-93-2	2	PRGs	–		10	LOEC	2	Soil, LOEC	–		2.00E+00	PRGs
Magnesium	7439-95-4	–		–		–		–		–		No ESV	No Source
Manganese	7439-96-5	–		–		100	LOEC	500	Soil, LOEC	–		1.00E+02	LOEC
Mercury	7439-97-6	0.00051	PRGs	0.1	LOEC	30	NOEC	0.3	Soil, LOEC	0.1	ESL EPA Region 5 (2003)	5.10E-04	PRGs
Molybdenum	7439-98-7	2	PRGs	–		200	LOEC	2	Soil, LOEC	–		2.00E+00	PRGs
Nickel	7440-02-0	30	PRGs	200	NOEC	90	LOEC	30	Soil ,NOEC	13.6	ESL EPA Region 5 (2003)	3.00E+01	PRGs
Nitrate/nitrite		–		–		–		–		–		No ESV	No Source
Potassium	7440-09-7	–		–		–		–		–		No ESV	No Source
Selenium	7782-49-2	0.21	PRGs	70	LOEC	100	LOEC	1	Soil, LOEC	0.02765	ESL EPA Region 5 (2003)	2.10E-01	PRGs
Silver	7440-22-4	2	PRGs	–		50	NOEC	2	Soil, LOEC	4.04	ESL EPA Region 5 (2003)	2.00E+00	PRGs
Sodium	7440-23-5	–		–		–		–		–		No ESV	No Source
Sulfide	18496-25-8	–		–		–		–		0.00358	ESL EPA Region 5 (2003)	3.58E-03	ESL EPA Region 5 (2003)
Technetium	7440-26-8	0.2	PRGs	–		–		0.2	Soil ,NOEC	–		2.00E-01	PRGs
Tellurium	13494-80-9	–		–		–		2	No Soil, only Solution, LOEC	–		2.00E+00	No Soil, only Solution, LOEC
Thallium	7440-28-0	1	PRGs	–		–		1	Soil, LOEC	0.05692	ESL EPA Region 5 (2003)	1.00E+00	PRGs
Tin	7440-31-5	50	PRGs	–		2000	LOEC	50	Soil, LOEC	7.62	ESL EPA Region 5 (2003)	5.00E+01	PRGs
Titanium	7440-32-6	–		–		1000	LOEC	0.06	No Soil, only Solution, LOEC	–		1.00E+03	LOEC
Tungsten	7440-33-7	–		–		400	NOEC	–		–		4.00E+02	NOEC
Uranium	7440-61-1	5	PRGs	–		–		5	Soil, NOEC	–		5.00E+00	PRGs

Appendix Table C-2. Soil Ecological Screening Values For Level II Screen For 40 mm Range at Ravenna, Ohio

		Soil Screening Values											
		Efroymson et al. (1997a) Preliminary Remediation Goals for Ecological Endpoints[a]		Screening Value for Earthworms and Soil Microorganisms (Efroymson et al. 1997b)[b]				Soil Screening values for Plants (Efroymson et al. 1997c)[c]		Ecological Screening Level (ESL)[d]		Preferred Ecological Screening Value (ESV)[e]	
	CAS			Benchmarks for Earthworm		Benchmarks for soil microorganism							
Chemicals	Registry Number	Number (mg/kg)	Source	Number (mg/kg)	Source	Number (mg/kg)	Source	Number mg/kg mg/L	Source (Soil) (Solution)	Number (mg/kg)	Source	Number (mg/kg)	Source
Vanadium	7440-62-2	2	PRGs	--		20	LOEC	2	Soil, LOEC	1.59	ESL EPA Region 5 (2003)	2.00E+00	PRGs
Zinc	7440-66-6	8.5	PRGs	200	LOEC	100	NOEC	50	Soil, NOEC	6.62	ESL EPA Region 5 (2003)	8.50E+00	PRGs
Organic Compounds													No Source
Acenaphthene	83-32-9	20	PRGs	--		--		20	Soil, LOEC	682		2.00E+01	PRGs
Acenaphthylene	208-96-8	--		--		--		--		682		6.82E+02	No Source
Acetone	67-64-1	--		--		--		--		2.5	ESL EPA Region 5 (2003)	2.50E+00	ESL EPA Region 5 (2003)
Acrylonitrile	107-13-1	--		--		1000	LOEC	--		1.37		1.00E+03	LOEC
Aldrin	309-00-2	--		--		--		--		0.00332		3.32E-03	No Source
4-Aminobiphenyl	92-67-1	--		--		--		--		0.00305	ESL EPA Region 5 (2003)	3.05E-03	ESL EPA Region 5 (2003)
2-Amino-4,6-dinitrotoluene	35572-78-2	--		--		--		--		--		No ESV	No Source
4-Amino-2,6-dinitrotoluene	19406-51-0	--		--		--		--		--		No ESV	No Source
Aniline	62-53-3	--		--		--		200	No Soil, only Solution, LOEC	0.05678	ESL EPA Region 5 (2003)	2.00E+02	No Soil, only Solution, LOEC
Anthracene	120-12-7	--		--		--		--		1480	ESL EPA Region 5 (2003)	1.48E+03	ESL EPA Region 5 (2003)
PCB-1016	12674-11-2	--		--		--		--		--		No ESV	No Source
Arochlor-1221	11104-28-2	--		--		--		--		--		No ESV	No Source
Arochlor-1232	11141-16-5	--		--		--		--		--		No ESV	No Source
Arochlor-1242	53469-21-9	--		--		--		--		--		No ESV	No Source
Arochlor-1248	12672-29-6	--		--		--		--		--		No ESV	No Source
PCB-1254	11097-69-1	--		--		--		--		--		No ESV	No Source
Arochlor-1260	11096-82-5	--		--		--		--		--		No ESV	No Source
Benzene	71-43-2	--		--		--		--		0.25462	ESL EPA Region 5 (2003)	2.55E-01	ESL EPA Region 5 (2003)
Benzo(a)anthracene	56-55-3	--		--		--		--		5.21	ESL EPA Region 5 (2003)	5.21E+00	ESL EPA Region 5 (2003)
Benzo(a)pyrene	50-32-8	--		--		--		--		1.52	ESL EPA Region 5 (2003)	1.52E+00	ESL EPA Region 5 (2003)
Benzo(b)fluoranthene	205-99-2	--		--		--		--		59.8	ESL EPA Region 5 (2003)	5.98E+01	ESL EPA Region 5 (2003)
Benzo(g,h,i)perylene	191-24-2	--		--		--		--		119	ESL EPA Region 5 (2003)	1.19E+02	ESL EPA Region 5 (2003)
Benzo(k)fluoranthene	207-08-9	--		--		--		--		148	ESL EPA Region 5 (2003)	1.48E+02	ESL EPA Region 5 (2003)
BHC	608-73-1	--		--		--		--		--		No ESV	No Source
BHC, alpha	319-84-6	--		--		--		--		0.09939	ESL EPA Region 5 (2003)	9.94E-02	ESL EPA Region 5 (2003)
beta-BHC	319-85-7	--		--		--		--		0.00398	ESL EPA Region 5 (2003)	3.98E-03	ESL EPA Region 5 (2003)
BHC, delta	319-86-8	--		--		--		--		9.94	ESL EPA Region 5 (2003)	9.94E+00	ESL EPA Region 5 (2003)
BHC, gamma	58-89-9	--		--		--		--		0.005	ESL EPA Region 5 (2003)	5.00E-03	ESL EPA Region 5 (2003)
Biphenyl	92-52-4	60	PRGs	--		--		60	Soil, LOEC	--		6.00E+01	PRGs
bis(2-chloroethoxy) methane	111-91-1	--		--		--		--		0.302	ESL EPA Region 5 (2003)	3.02E-01	ESL EPA Region 5 (2003)
bis(2-Chloroethyl) ether	111-44-4	--		--		--		--		23.7	ESL EPA Region 5 (2003)	2.37E+01	ESL EPA Region 5 (2003)
bis(2-Ethylhexyl)phthalate	117-81-7	--		--		--		--		0.92594	ESL EPA Region 5 (2003)	9.26E-01	ESL EPA Region 5 (2003)
4-Bromoaniline	106-40-1	--		--		--		100	No Soil, only Solution, LOEC	--		1.00E+02	No Soil, only Solution, LOEC
Bromodichloromethane	75-27-4	--		--		--		--		0.54	ESL EPA Region 5 (2003)	5.40E-01	ESL EPA Region 5 (2003)
Bromoform	75-25-2	--		--		--		--		15.9	ESL EPA Region 5 (2003)	1.59E+01	ESL EPA Region 5 (2003)
Bromomethane	74-83-9	--		--		--		--		--		No ESV	No Source
4-bromophenyl-phenylether	101-55-3	--		--		--		--		--		No ESV	No Source
2-Butanone	78-93-3	--		--		--		--		89.6	ESL EPA Region 5 (2003)	8.96E+01	ESL EPA Region 5 (2003)

Appendix Table C-2. Soil Ecological Screening Values For Level II Screen For 40 mm Range at Ravenna, Ohio

Chemicals	CAS	Soil Screening Values											
		Efroymson et al. (1997a) Preliminary Remediation Goals for Ecological Endpoints[a]		Screening Value for Earthworms and Soil Microorganisms (Efroymson et al. 1997b)[b]				Soil Screening values for Plants (Efroymson et al. 1997c)[c]		Ecological Screening Level (ESL)[d]		Preferred Ecological Screening Value (ESV)[e]	
				Benchmarks for Earthworm		Benchmarks for soil microorganism							
	Registry Number	Number (mg/kg)	Source	Number (mg/kg)	Source	Number (mg/kg)	Source	Number mg/kg mg/L	Source (Soil) (Solution)	Number (mg/kg)	Source	Number (mg/kg)	Source
Butylbenzyl phthalate	85-68-7	--		--		--		--		0.239	ESL EPA Region 5 (2003)	2.39E-01	ESL EPA Region 5 (2003)
N-Nitrosodi-n-Butylamine	924-16-3	--		--		--		--		0.26707	ESL EPA Region 5 (2003)	2.67E-01	ESL EPA Region 5 (2003)
Carbazole	86-74-8	--		--		--		--		--		No ESV	No Source
Carbon disulfide	75-15-0	--		--		--		--		0.09412	ESL EPA Region 5 (2003)	9.41E-02	ESL EPA Region 5 (2003)
Carbon tetrachloride	56-23-5	--		--		1000	LOEC	--		2.98	ESL EPA Region 5 (2003)	1.00E+03	LOEC
Chloroacetamide	79-07-2	2	PRGs	2	LOEC	--		--		--		2.00E+00	PRGs
p-chloroaniline	106-47-8	--		--		--		--		1.1	ESL EPA Region 5 (2003)	1.10E+00	ESL EPA Region 5 (2003)
3-Chloroaniline	108-42-9	20	PRGs	30	LOEC	--		20	Soil, LOEC	--		2.00E+01	PRGs
4-chloroaniline	106-47-8	--		--		--		--		1.1	ESL EPA Region 5 (2003)	1.10E+00	ESL EPA Region 5 (2003)
Chlorobenzene	108-90-7	40	PRGs	40	LOEC	--		--		13.1	ESL EPA Region 5 (2003)	4.00E+01	PRGs
Chlorobenzilate	510-15-6	--		--		--		--		5.05	ESL EPA Region 5 (2003)	5.05E+00	ESL EPA Region 5 (2003)
Chlordane	12789-03-6	--		--		--		--		0.224	ESL EPA Region 5 (2003)	2.24E-01	ESL EPA Region 5 (2003)
alpha-Chlordane	12789-03-6	--		--		--		--		0.224	ESL EPA Region 5 (2003)	2.24E-01	ESL EPA Region 5 (2003)
gamma-Chlordane	12789-03-6	--		--		--		--		0.224	ESL EPA Region 5 (2003)	2.24E-01	ESL EPA Region 5 (2003)
Chloroethane	75-00-3	--		--		--		--		--		No ESV	No Source
Chloroform	67-66-3	--		--		--		--		1.19	ESL EPA Region 5 (2003)	1.19E+00	ESL EPA Region 5 (2003)
Chloromethane	74-87-3	--		--		--		--		--		No ESV	No Source
2-Chloronaphthalene	91-58-7	--		--		--		--		0.0122	ESL EPA Region 5 (2003)	1.22E-02	ESL EPA Region 5 (2003)
2-Chlorophenol	95-57-8	--		--		--		60	No Soil, only Solution, LOEC	0.243	ESL EPA Region 5 (2003)	6.00E+01	No Soil, only Solution, LOEC
3-Chlorophenol	108-43-0	7	PRGs	10	LOEC	--		7	Soil, LOEC	--		7.00E+00	PRGs
4-Chlorophenol	106-48-9	--		--		--		50	No Soil, only Solution, LOEC	--		5.00E+01	No Soil, only Solution, LOEC
4-Chlorophenyl-phenyl ether	7005-72-3	--		--		--		--		--		No ESV	No Source
4-chloro-3-methylphenol	59-50-7	--		--		--		--		--		No ESV	No Source
Chloropropene	107-05-1	--		--		--		--		0.0029	ESL EPA Region 5 (2003)	2.90E-03	ESL EPA Region 5 (2003)
Chrysene	218-01-9	--		--		--		--		4.73	ESL EPA Region 5 (2003)	4.73E+00	ESL EPA Region 5 (2003)
4,6-dinitro-o-Cresol	534-52-1	--		--		--		--		0.144	ESL EPA Region 5 (2003)	1.44E-01	ESL EPA Region 5 (2003)
m-Cresol	108-39-4	--		--		--		--		3.49	ESL EPA Region 5 (2003)	3.49E+00	ESL EPA Region 5 (2003)
o-Cresol	95-48-7	--		--		--		--		40.4	ESL EPA Region 5 (2003)	4.04E+01	ESL EPA Region 5 (2003)
2-Cresol	95-48-7	--		--		--		--		40.4	ESL EPA Region 5 (2003)	4.04E+01	ESL EPA Region 5 (2003)
p-chloro-m-Cresol	59-50-7	--		--		--		--		7.95	ESL EPA Region 5 (2003)	7.95E+00	ESL EPA Region 5 (2003)
p-Cresol	106-44-5	--		--		--		--		163	ESL EPA Region 5 (2003)	1.63E+02	ESL EPA Region 5 (2003)
Diallate	2303-16-4	--		--		--		--		0.452	ESL EPA Region 5 (2003)	4.52E-01	ESL EPA Region 5 (2003)
2,4-D	94-75-7	--		--		--		--		0.0272	ESL EPA Region 5 (2003)	2.72E-02	ESL EPA Region 5 (2003)
4,4'-DDD	72-54-8	--		--		--		--		0.758	ESL EPA Region 5 (2003)	7.58E-01	ESL EPA Region 5 (2003)
4,4'-DDE	72-55-9	--		--		--		--		0.596	ESL EPA Region 5 (2003)	5.96E-01	ESL EPA Region 5 (2003)
4,4'-DDT	50-29-3	--		--		--		--		0.0035	ESL EPA Region 5 (2003)	3.50E-03	ESL EPA Region 5 (2003)
Diazinon	333-41-5	--		--		--		--		--		No ESV	No Source
Dibenzo(a,h)anthracene	53-70-3	--		--		--		--		18.4	ESL EPA Region 5 (2003)	1.84E+01	ESL EPA Region 5 (2003)
Dibenzofuran	132-64-9	--		--		--		--		--		No ESV	No Source
1,2-Dibromo-3-Chloropropane	96-12-8	--		--		--		--		0.0352	ESL EPA Region 5 (2003)	3.52E-02	ESL EPA Region 5 (2003)
Dibromochloromethane	124-48-1	--		--		--		--		2.05	ESL EPA Region 5 (2003)	2.05E+00	ESL EPA Region 5 (2003)

Appendix Table C-2. Soil Ecological Screening Values For Level II Screen For 40 mm Range at Ravenna, Ohio

Chemicals	CAS Registry Number	Soil Screening Values: Efroymson et al. (1997a) Preliminary Remediation Goals for Ecological Endpoints[a] Number (mg/kg)	Source	Screening Value for Earthworms and Soil Microorganisms (Efroymson et al. 1997b)[b]: Benchmarks for Earthworm Number (mg/kg)	Source	Benchmarks for soil microorganism Number (mg/kg)	Source	Soil Screening values for Plants (Efroymson et al. 1997c)[c] Number mg/kg mg/L	Source (Soil) (Solution)	Ecological Screening Level (ESL)[d] Number (mg/kg)	Source	Preferred Ecological Screening Value (ESV)[e] Number (mg/kg)	Source
Dibromoethane	106-93-4	--		--		--		--		1.23	ESL EPA Region 5 (2003)	1.23E+00	ESL EPA Region 5 (2003)
2,4-Dichloroaniline	554-00-7	100	PRGs	100	NOEC	--		--		--		1.00E+02	PRGs
3,4-Dichloroaniline	95-76-1	20	PRGs	20	LOEC	--		10	No Soil, only Solution, LOEC	--		2.00E+01	PRGs
o-Dichlorobenzene	95-50-1	--		--		--		--		2.96	ESL EPA Region 5 (2003)	2.96E+00	ESL EPA Region 5 (2003)
p-Dichlorobenzene	106-46-7	20	PRGs	20	LOEC	--		--		0.546	ESL EPA Region 5 (2003)	2.00E+01	PRGs
1,2-Dichlorobenzene	95-50-1	--		--		--		--		2.96	ESL EPA Region 5 (2003)	2.96E+00	ESL EPA Region 5 (2003)
1,3-Dichlorobenzene	541-73-1	--		--		--		--		37.7	ESL EPA Region 5 (2003)	3.77E+01	ESL EPA Region 5 (2003)
1,4-Dichlorobenzene	106-46-7	20	PRGs	20	LOEC	--		--		0.546	ESL EPA Region 5 (2003)	2.00E+01	PRGs
3,3'-Dichlorobenzidine	91-94-1	--		--		--		--		0.646	ESL EPA Region 5 (2003)	6.46E-01	ESL EPA Region 5 (2003)
Cis-1,4-dichloro-2-butene	1476-11-5	--		--		1000	LOEC	--		--		1.00E+03	LOEC
Trans-1,4-dichloro-2-butene	110-57-6	--		--		1000	LOEC	--		--		1.00E+03	LOEC
1,1-Dichloroethane	75-34-3	--		--		--		--		20.1	ESL EPA Region 5 (2003)	2.01E+01	ESL EPA Region 5 (2003)
1,2-Dichloroethane	107-06-2	--		--		--		--		21.2	ESL EPA Region 5 (2003)	2.12E+01	ESL EPA Region 5 (2003)
1,1-Dichloroethene	75-35-4	--		--		--		--		8.28	ESL EPA Region 5 (2003)	8.28E+00	ESL EPA Region 5 (2003)
1,2-Dichloroethene	540-59-0	--		--		--		--		--		No ESV	No Source
Dichlorodifluromethane	75-71-8	--		--		--		--		39.5	ESL EPA Region 5 (2003)	3.95E+01	ESL EPA Region 5 (2003)
2,4-Dichlorophenol	120-83-2	--		--		--		20	No Soil, only Solution, LOEC	87.5	ESL EPA Region 5 (2003)	2.00E+01	No Soil, only Solution, LOEC
2,6-Dichlorophenol	87-65-0	--		--		--		--		1.17	ESL EPA Region 5 (2003)	1.17E+00	ESL EPA Region 5 (2003)
3,4-Dichlorophenol	95-77-2	20	PRGs	20	LOEC	--		20	Soil, LOEC	--		2.00E+01	PRGs
1,2-Dichloropropane	78-87-5	700	PRGs	700	LOEC	--		--		32.7	ESL EPA Region 5 (2003)	7.00E+02	PRGs
cis-1,3-Dichloropropene	10061-01-5	--		--		--		--		0.398	ESL EPA Region 5 (2003)	3.98E-01	ESL EPA Region 5 (2003)
trans-1,3-Dichloropropene	10061-02-6	--		--		--		--		0.398	ESL EPA Region 5 (2003)	3.98E-01	ESL EPA Region 5 (2003)
Dieldrin	60-57-1	--		--		--		--		0.00238	ESL EPA Region 5 (2003)	2.38E-03	ESL EPA Region 5 (2003)
Diethylphthalate	84-66-2	100	PRGs	--		--		100	Soil, LOEC	24.8	ESL EPA Region 5 (2003)	1.00E+02	PRGs
3,3'-Dimethylbenzidine	119-93-7	--		--		--		--		0.104	ESL EPA Region 5 (2003)	1.04E-01	ESL EPA Region 5 (2003)
Dimethoate	60-51-5	--		--		--		--		0.218	ESL EPA Region 5 (2003)	2.18E-01	ESL EPA Region 5 (2003)
7,12'-Dimethylbenz(a)anthracene	57-97-6	--		--		--		--		16.3	ESL EPA Region 5 (2003)	1.63E+01	ESL EPA Region 5 (2003)
Dimethylphthalate	131-11-3	200	PRGs	200	LOEC	--		--		734	ESL EPA Region 5 (2003)	2.00E+02	PRGs
alpha,alpha-Dimethylphenethylamine	122-09-8	--		--		--		--		0.3	ESL EPA Region 5 (2003)	3.00E-01	ESL EPA Region 5 (2003)
2,4-Dimethylphenol	105-67-9	--		--		--		--		0.01	ESL EPA Region 5 (2003)	1.00E-02	ESL EPA Region 5 (2003)
Di-n-butylphthalate	84-74-2	200	PRGs	--		--		200	Soil, NOEC	0.15	ESL EPA Region 5 (2003)	2.00E+02	PRGs
Di-n-octylphthalate	117-84-0	--		--		--		--		709	ESL EPA Region 5 (2003)	7.09E+02	ESL EPA Region 5 (2003)
m-Dinitrobenzene	99-65-0	--		--		--		--		0.655	ESL EPA Region 5 (2003)	6.55E-01	ESL EPA Region 5 (2003)
1,3-Dinitrobenzene	99-65-0	--		--		--		--		0.655	ESL EPA Region 5 (2003)	6.55E-01	ESL EPA Region 5 (2003)
2,4-Dinitrophenol	51-28-5	20	PRGs	--		--		20	Soil, NOEC	0.0609	ESL EPA Region 5 (2003)	2.00E+01	PRGs
2,4-Dinitrotoluene	121-14-2	--		--		--		--		1.28	ESL EPA Region 5 (2003)	1.28E+00	ESL EPA Region 5 (2003)
2,6-Dinitrotoluene	606-20-2	--		--		--		--		0.0328	ESL EPA Region 5 (2003)	3.28E-02	ESL EPA Region 5 (2003)
4,6-Dinitro-2-methylphenol	534-52-1	--		--		--		--		--		No ESV	No Source
Dinoseb	88-85-7	--		--		--		--		0.0218	ESL EPA Region 5 (2003)	2.18E-02	ESL EPA Region 5 (2003)
1,4-Dioxane	123-91-1	--		--		--		--		2.05	ESL EPA Region 5 (2003)	2.05E+00	ESL EPA Region 5 (2003)
Diphenylamine	122-39-4	--		--		--		--		1.01	ESL EPA Region 5 (2003)	1.01E+00	ESL EPA Region 5 (2003)

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	CAS	Soil Screening Values											
		Efroymson et al. (1997a) Preliminary Remediation Goals for Ecological Endpoints[a]		Screening Value for Earthworms and Soil Microorganisms (Efroymson et al. 1997b)[b]				Soil Screening values for Plants (Efroymson et al. 1997c)[c]		Ecological Screening Level (ESL)[d]		Preferred Ecological Screening Value (ESV)[e]	
				Benchmarks for Earthworm		Benchmarks for soil microorganism							
Chemicals	Registry Number	Number (mg/kg)	Source	Number (mg/kg)	Source	Number (mg/kg)	Source	Number mg/kg mg/L	Source (Soil) (Solution)	Number (mg/kg)	Source	Number (mg/kg)	Source
Disulfoton	298-04-4	--		--		--		--		0.0199	ESL EPA Region 5 (2003)	1.99E-02	ESL EPA Region 5 (2003)
Endosulfan, alpha	959-98-8	--		--		--		--		0.119	ESL EPA Region 5 (2003)	1.19E-01	ESL EPA Region 5 (2003)
Endosulfan, beta	33213-65-9	--		--		--		--		0.119	ESL EPA Region 5 (2003)	1.19E-01	ESL EPA Region 5 (2003)
Endosulfan, mixed isomers		--		--		--		--		--		No ESV	No Source
Endosulfan sulfate	1031-07-8	--		--		--		--		0.0358	ESL EPA Region 5 (2003)	3.58E-02	ESL EPA Region 5 (2003)
Endrin	72-20-8	--		--		--		--		0.0101	ESL EPA Region 5 (2003)	1.01E-02	ESL EPA Region 5 (2003)
Endrin aldehyde	7421-93-4	--		--		--		--		0.0105	ESL EPA Region 5 (2003)	1.05E-02	ESL EPA Region 5 (2003)
Ethyl metharcrylate	97-63-2	--		--		--		--		30	ESL EPA Region 5 (2003)	3.00E+01	ESL EPA Region 5 (2003)
Ethylbenzene	100-41-4	--		--		--		--		5.16	ESL EPA Region 5 (2003)	5.16E+00	ESL EPA Region 5 (2003)
Famphur	52-85-7	--		--		--		--		0.0497	ESL EPA Region 5 (2003)	4.97E-02	ESL EPA Region 5 (2003)
Fluoranthene	206-44-0	--		--		--		--		122	ESL EPA Region 5 (2003)	1.22E+02	ESL EPA Region 5 (2003)
Fluorene	86-73-7	30	PRGs	30	LOEC	--		--		122	ESL EPA Region 5 (2003)	3.00E+01	PRGs
Furan	110-00-9	600	PRGs	--		--		600	Soil, LOEC	--		6.00E+02	PRGs
gamma-BHC (lindane)	58-89-9	--		--		--		--		0.005	ESL EPA Region 5 (2003)	5.00E-03	ESL EPA Region 5 (2003)
Lindane	58-89-9	--		--		--		--		0.005	ESL EPA Region 5 (2003)	5.00E-03	ESL EPA Region 5 (2003)
Heptane	142-82-5	--		--		--		1	No Soil, only Solution, LOEC	--		1.00E+00	No Soil, only Solution, LOEC
Heptachlor	76-44-8	--		--		--		--		0.00598	ESL EPA Region 5 (2003)	5.98E-03	ESL EPA Region 5 (2003)
Heptachlor Epoxide	1024-57-3	--		--		--		--		0.152	ESL EPA Region 5 (2003)	1.52E-01	ESL EPA Region 5 (2003)
Hexachlorobenzene	118-74-1	--		--		1000	LOEC	--		0.199	ESL EPA Region 5 (2003)	1.00E+03	LOEC
Hexachlorobutadiene	87-68-3	--		--		--		--		0.0398	ESL EPA Region 5 (2003)	3.98E-02	ESL EPA Region 5 (2003)
Hexachlorocyclopentadiene	77-47-4	10	PRGs	--		--		10	Soil, LOEC	0.755	ESL EPA Region 5 (2003)	1.00E+01	PRGs
Hexachloroethane	67-72-1	--		--		--		--		0.596	ESL EPA Region 5 (2003)	5.96E-01	ESL EPA Region 5 (2003)
Hexachorophene	70-30-4	--		--		--		--		0.199	ESL EPA Region 5 (2003)	1.99E-01	ESL EPA Region 5 (2003)
2-Hexanone	591-78-6	--		--		--		--		12.6	ESL EPA Region 5 (2003)	1.26E+01	ESL EPA Region 5 (2003)
HMX	2691-41-0	--		--		--		--		--		No ESV	No Source
Indeno(1,2,3-cd)pyrene	193-39-5	--		--		--		--		109	ESL EPA Region 5 (2003)	1.09E+02	ESL EPA Region 5 (2003)
Isobutyl alcohol	78-83-1	--		--		--		--		20.8	ESL EPA Region 5 (2003)	2.08E+01	ESL EPA Region 5 (2003)
Isodrin	465-73-6	--		--		--		--		0.00332	ESL EPA Region 5 (2003)	3.32E-03	ESL EPA Region 5 (2003)
Isophorone	78-59-1	--		--		--		--		139	ESL EPA Region 5 (2003)	1.39E+02	ESL EPA Region 5 (2003)
Isosafrole	120-58-1	--		--		--		--		9.94	ESL EPA Region 5 (2003)	9.94E+00	ESL EPA Region 5 (2003)
Kepone	143-50-0	--		--		--		--		0.0327	ESL EPA Region 5 (2003)	3.27E-02	ESL EPA Region 5 (2003)
Malathion	121-75-5	--		--		--		--		--		No ESV	No Source
Methacrylonitrile	126-98-7	--		--		--		--		0.057	ESL EPA Region 5 (2003)	5.70E-02	ESL EPA Region 5 (2003)
Methapyrilene	91-80-5	--		--		--		--		2.78	ESL EPA Region 5 (2003)	2.78E+00	ESL EPA Region 5 (2003)
Methoxychlor	72-43-5	--		--		--		--		0.0199	ESL EPA Region 5 (2003)	1.99E-02	ESL EPA Region 5 (2003)
Methyl bromide	74-83-9	--		--		--		--		0.235	ESL EPA Region 5 (2003)	2.35E-01	ESL EPA Region 5 (2003)
Methyl chloride	74-87-3	--		--		--		--		10.4	ESL EPA Region 5 (2003)	1.04E+01	ESL EPA Region 5 (2003)
Methyl iodide	74-88-4	--		--		--		--		1.23	ESL EPA Region 5 (2003)	1.23E+00	ESL EPA Region 5 (2003)
Methylene chloride	75-09-2	--		--		--		--		1.05	ESL EPA Region 5 (2003)	1.05E+00	ESL EPA Region 5 (2003)
2-Methylnaphthalene	91-57-6	--		--		--		--		3.24	ESL EPA Region 5 (2003)	3.24E+00	ESL EPA Region 5 (2003)
2-Methylphenol	95-48-7	--		--		--		--		--		No ESV	No Source

Appendix Table C-2. Soil Ecological Screening Values For Level II Screen For 40 mm Range at Ravenna, Ohio

Chemicals	CAS Registry Number	Efroymson et al. (1997a) Preliminary Remediation Goals for Ecological Endpoints[a] Number (mg/kg)	Efroymson et al. (1997a) Source	Screening Value for Earthworms and Soil Microorganisms (Efroymson et al. 1997b)[b]: Benchmarks for Earthworm Number (mg/kg)	Benchmarks for Earthworm Source	Benchmarks for soil microorganism Number (mg/kg)	Benchmarks for soil microorganism Source	Soil Screening values for Plants (Efroymson et al. 1997c)[c] Number mg/kg mg/L	Soil Screening values for Plants Source (Soil) (Solution)	Ecological Screening Level (ESL)[d] Number (mg/kg)	Ecological Screening Level (ESL) Source	Preferred Ecological Screening Value (ESV)[e] Number (mg/kg)	Preferred Ecological Screening Value Source
4-Methylphenol	106-44-5	--		--		--		--		--		No ESV	No Source
4-Methyl-2-pentanone	108-10-1	--		--		--		--		443	ESL EPA Region 5 (2003)	4.43E+02	ESL EPA Region 5 (2003)
Mirex	2385-85-5	--		--		--		--		--		No ESV	No Source
Naphthalene	91-20-3	--		--		--		10	No Soil, only Solution, LOEC	0.0994	ESL EPA Region 5 (2003)	1.00E+01	No Soil, only Solution, LOEC
1-Naphthylamine	134-32-7	--		--		--		--		9.34	ESL EPA Region 5 (2003)	9.34E+00	ESL EPA Region 5 (2003)
2-Naphthylamine	91-59-8	--		--		--		--		3.03	ESL EPA Region 5 (2003)	3.03E+00	ESL EPA Region 5 (2003)
1,4-Naphthoquinone	130-15-4	--		--		--		--		1.67	ESL EPA Region 5 (2003)	1.67E+00	ESL EPA Region 5 (2003)
m-Nitroaniline	99-09-2	--		--		--		--		3.16	ESL EPA Region 5 (2003)	3.16E+00	ESL EPA Region 5 (2003)
o-Nitroaniline	88-74-4	--		--		--		--		74.1	ESL EPA Region 5 (2003)	7.41E+01	ESL EPA Region 5 (2003)
p-Nitroaniline	100-01-6	--		--		--		--		21.9	ESL EPA Region 5 (2003)	2.19E+01	ESL EPA Region 5 (2003)
2-Nitroaniline	88-74-4	--		--		--		--		74.1	ESL EPA Region 5 (2003)	7.41E+01	ESL EPA Region 5 (2003)
3-Nitroaniline	99-09-2	--		--		--		--		3.16	ESL EPA Region 5 (2003)	3.16E+00	ESL EPA Region 5 (2003)
4-Nitroaniline	100-01-6	--		--		--		--		21.9	ESL EPA Region 5 (2003)	2.19E+01	ESL EPA Region 5 (2003)
Nitrobenzene	99-95-3	40	PRGs	40	LOEC	1000	LOEC	8	No Soil, only Solution, LOEC	1.31	ESL EPA Region 5 (2003)	4.00E+01	PRGs
Nitrocellulose	9004-70-0	--		--		--		--		--		No ESV	No Source
Nitroglycerin	55-63-0	--		--		--		--		--		No ESV	No Source
Nitroquanidine		--		--		--		--		--		No ESV	No Source
o-Nitrophenol	88-75-5	--		--		--		--		1.6	ESL EPA Region 5 (2003)	1.60E+00	ESL EPA Region 5 (2003)
p-Nitrophenol	100-02-7	--		--		--		--		5.12	ESL EPA Region 5 (2003)	5.12E+00	ESL EPA Region 5 (2003)
2-Nitrophenol	88-75-5	--		--		--		--		1.6	ESL EPA Region 5 (2003)	1.60E+00	ESL EPA Region 5 (2003)
4-Nitrophenol	100-02-7	--		--		--		--		5.12	ESL EPA Region 5 (2003)	5.12E+00	ESL EPA Region 5 (2003)
4-Nitroquinoline-1-oxide	56-57-5	--		--		--		--		0.122	ESL EPA Region 5 (2003)	1.22E-01	ESL EPA Region 5 (2003)
3-Nitrotoluene	99-08-1	--		--		--		--		--		No ESV	No Source
N-Nitrosodiethylamine	55-18-5	--		--		--		--		0.0693	ESL EPA Region 5 (2003)	6.93E-02	ESL EPA Region 5 (2003)
N-Nitrosodimethylamine	62-75-9	--		--		--		--		3.2E-05	ESL EPA Region 5 (2003)	3.21E-05	ESL EPA Region 5 (2003)
N-Nitrosomethylamine	10595-95-6	--		--		--		--		0.00166	ESL EPA Region 5 (2003)	1.66E-03	ESL EPA Region 5 (2003)
N-Nitrosomorpholine	59-89-2	--		--		--		--		0.0706	ESL EPA Region 5 (2003)	7.06E-02	ESL EPA Region 5 (2003)
N-Nitrosopiperidine	100-75-4	--		--		--		--		0.00665	ESL EPA Region 5 (2003)	6.65E-03	ESL EPA Region 5 (2003)
N-Nitrosopyrrolidine	930-55-2	--		--		--		--		0.0126	ESL EPA Region 5 (2003)	1.26E-02	ESL EPA Region 5 (2003)
N-nitroso-di-n-dipropylamine	621-64-7	--		--		--		--		--		No ESV	No Source
N-nitrosodiphenylamine	86-30-6	20	PRGs	20	LOEC	--		--		0.545	ESL EPA Region 5 (2003)	2.00E+01	PRGs
2-Nitrotoluene	88-72-2	--		--		--		--		--		No ESV	No Source
5-nitro-o-Toluidine	99-55-8	--		--		--		--		8.73	ESL EPA Region 5 (2003)	8.73E+00	ESL EPA Region 5 (2003)
2,2'- oxybis(1-Chloropropane)	108-60-1	--		--		--		--		--		No ESV	No Source
Parathion	56-38-2	--		--		--		--		3.40E-04	ESL EPA Region 5 (2003)	3.40E-04	ESL EPA Region 5 (2003)
PCDD-S		--		--		--		--		1.99E-07	ESL EPA Region 5 (2003)	1.99E-07	ESL EPA Region 5 (2003)
Pentachlorophenol	87-86-5	3	PRGs	6	NOEC	400	LOEC	3	Soil, LOEC	0.119	ESL EPA Region 5 (2003)	3.00E+00	PRGs
Pentachloroaniline	527-20-8	100	PRGs	100	LOEC	--		--		--		1.00E+02	PRGs
Pentachlorobenzene	608-93-5	20	PRGs	20	LOEC	--		--		0.497	ESL EPA Region 5 (2003)	2.00E+01	PRGs
Pentachloroethane	76-01-7	--		--		--		--		10.7	ESL EPA Region 5 (2003)	1.07E+01	ESL EPA Region 5 (2003)
Pentachloronitrobenzene	82-68-8	--		--		--		--		7.09	ESL EPA Region 5 (2003)	7.09E+00	ESL EPA Region 5 (2003)

Appendix Table C-2. Soil Ecological Screening Values For Level II Screen For 40 mm Range at Ravenna, Ohio

	CAS	Soil Screening Values											
		Efroymson et al. (1997a) Preliminary Remediation Goals for Ecological Endpoints[a]		Screening Value for Earthworms and Soil Microorganisms (Efroymson et al. 1997b)[b]				Soil Screening values for Plants (Efroymson et al. 1997c)[c]		Ecological Screening Level (ESL)[d]		Preferred Ecological Screening Value (ESV)[e]	
				Benchmarks for Earthworm		Benchmarks for soil microorganism							
Chemicals	Registry Number	Number (mg/kg)	Source	Number (mg/kg)	Source	Number (mg/kg)	Source	Number mg/kg mg/L	Source (Soil) (Solution)	Number (mg/kg)	Source	Number (mg/kg)	Source
Phenacetin	62-44-2	--		--		--		--		11.7	ESL EPA Region 5 (2003)	1.17E+01	ESL EPA Region 5 (2003)
Phenanthrene	85-01-8	--		--		--		--		45.7	ESL EPA Region 5 (2003)	4.57E+01	ESL EPA Region 5 (2003)
Phenol	108-95-2	30	PRGs	30	LOEC	100	LOEC	70	Soil, LOEC	120	ESL EPA Region 5 (2003)	3.00E+01	PRGs
p-Phenylenediamine	106-50-3	--		--		--		--		6.16	ESL EPA Region 5 (2003)	6.16E+00	ESL EPA Region 5 (2003)
phorate	298-02-2	--		--		--		--		4.96E-04	ESL EPA Region 5 (2003)	4.96E-04	ESL EPA Region 5 (2003)
2-Picoline	109-06-8	--		--		--		--		9.9	ESL EPA Region 5 (2003)	9.90E+00	ESL EPA Region 5 (2003)
Polynuclear aromatic hydrocarbons		--		--		--		--		--		No ESV	No Source
Polychlorinated biphenyls	1336-36-3	0.371	PRGs	--		--		40	Soil, NOEC	3.32E-04	ESL EPA Region 5 (2003)	3.71E-01	PRGs
Polychlorinated dibenzofurans	51207-31-9	--		--		--		--		3.86E-05	ESL EPA Region 5 (2003)	3.86E-05	ESL EPA Region 5 (2003)
Pronamide	23950-58-5	--		--		--		--		0.0136	ESL EPA Region 5 (2003)	1.36E-02	ESL EPA Region 5 (2003)
Propionitrile	107-12-0	--		--		--		--		0.0498	ESL EPA Region 5 (2003)	4.98E-02	ESL EPA Region 5 (2003)
4-Nitrotoluene	99-99-0	--		--		--		--		--		No ESV	No Source
Pyrene	129-00-0	--		--		--		--		78.5	ESL EPA Region 5 (2003)	7.85E+01	ESL EPA Region 5 (2003)
Pryidine	110-86-1	--		--		--		--		1.03	ESL EPA Region 5 (2003)	1.03E+00	ESL EPA Region 5 (2003)
RDX (cyclonite) Hexahydro-1,3,5-trinitro-1,3,5-triazine	121-82-4	--		--		--		--		--		No ESV	No Source
RDX	121-82-4	--		--		--		--		--		No ESV	No Source
Safrole	94-59-7	--		--		--		--		0.404	ESL EPA Region 5 (2003)	4.04E-01	ESL EPA Region 5 (2003)
2,4,5-TP (Silvex)	93-72-1	--		--		--		--		0.109	ESL EPA Region 5 (2003)	1.09E-01	ESL EPA Region 5 (2003)
Styrene	100-42-5	300	PRGs	--		--		300	Soil	4.69	ESL EPA Region 5 (2003)	3.00E+02	PRGs
TCDD	1746-1-6	3.15E-06	PRGs							1.99E-08	ESL EPA Region 5 (2003)	3.15E-06	PRGs
TCDF		8.40E-04	PRGs							--		8.40E-04	PRGs
2,3,5,6-Tetrachloroaniline	3481-20-7	20	PRGs	20	LOEC	--		20	Soil, LOEC	--		2.00E+01	PRGs
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	--		--		--		--		1.99E-07	ESL EPA Region 5 (2003)	1.99E-07	ESL EPA Region 5 (2003)
1,2,4,5-Tetrachlorobenzene	95-94-3	--		--		--		--		2.02	ESL EPA Region 5 (2003)	2.02E+00	ESL EPA Region 5 (2003)
1,2,3,4-Tetrachlorobenzene	634-66-2	10	PRGs	10	LOEC	--		--		--		1.00E+01	PRGs
Tetrachloroethene	127-18-4	--		--		--		10	No Soil, only Solution	9.92	ESL EPA Region 5 (2003)	1.00E+01	No Soil, only Solution
Tetrachloroethylene	127-18-4	--		--		--		--		9.92	ESL EPA Region 5 (2003)	9.92E+00	ESL EPA Region 5 (2003)
1,1,1,2-Tetrachloroethane	630-20-6	--		--		--		--		225	ESL EPA Region 5 (2003)	2.25E+02	ESL EPA Region 5 (2003)
1,1,2,2-Tetrachloroethane	79-34-5	--		--		--		--		0.127	ESL EPA Region 5 (2003)	1.27E-01	ESL EPA Region 5 (2003)
Tetrachloromethane	56-23-5	--		--		--		--		--		No ESV	No Source
2,3,4,5-Tetrachlorophenol	4901-51-3	20	PRGs	20	LOEC	--		--		--		2.00E+01	PRGs
2,3,4,6-Tetrachlorophenol	58-90-2	--		--		--		--		0.199	ESL EPA Region 5 (2003)	1.99E-01	ESL EPA Region 5 (2003)
Tetraethyl dithiopyrophosphate	3689-24-5	--		--		--		--		0.596	ESL EPA Region 5 (2003)	5.96E-01	ESL EPA Region 5 (2003)
Tetryl	479-45-8	--		--		--		--		--		No ESV	No Source
Toluene	108-88-3	200	PRGs	--		--		200	Soil, NOEC	5.45	ESL EPA Region 5 (2003)	2.00E+02	PRGs
o-Toluidine	95-53-4	--		--		--		--		2.97	ESL EPA Region 5 (2003)	2.97E+00	ESL EPA Region 5 (2003)
4-Toluidine	106-49-0	--		--		--		100	No Soil, only Solution, LOEC	--		1.00E+02	No Soil, only Solution, LOEC
Toxaphene	8001-35-2	--		--		--		--		0.119	ESL EPA Region 5 (2003)	1.19E-01	ESL EPA Region 5 (2003)
Tribromomethane	75-25-2	--		--		--		--		--		No ESV	No Source
2,4,5-Trichloroaniline	636-30-6	20	PRGs	20	LOEC	--		20	Soil, LOEC	--		2.00E+01	PRGs
Trichloroethene	79-01-6	--		--		--		100	No Soil, only Solution	12.4	ESL EPA Region 5 (2003)	1.00E+02	No Soil, only Solution

Appendix Table C-2. Soil Ecological Screening Values For Level II Screen For 40 mm Range at Ravenna, Ohio

Chemicals	CAS Registry Number	Soil Screening Values											
		Efroymson et al. (1997a) Preliminary Remediation Goals for Ecological Endpoints[a]		Screening Value for Earthworms and Soil Microorganisms (Efroymson et al. 1997b)[b]				Soil Screening values for Plants (Efroymson et al. 1997c)[c]		Ecological Screening Level (ESL)[d]		Preferred Ecological Screening Value (ESV)[e]	
				Benchmarks for Earthworm		Benchmarks for soil microorganism							
		Number (mg/kg)	Source	Number (mg/kg)	Source	Number (mg/kg)	Source	Number mg/kg mg/L	Source (Soil) (Solution)	Number (mg/kg)	Source	Number (mg/kg)	Source
1,2,3-Trichlorobenzene	87-61-6	20	PRGs	20	LOEC	--		--		--		2.00E+01	PRGs
1,2,4-Trichlorobenzene	120-82-1	20	PRGs	20	LOEC	--		--		11.1	ESL EPA Region 5 (2003)	2.00E+01	PRGs
1,1,1-Trichloroethane	71-55-6	--		--		--		--		29.8	ESL EPA Region 5 (2003)	2.98E+01	ESL EPA Region 5 (2003)
1,1,2-Trichloroethane	79-00-5	--		--		--		--		28.6	ESL EPA Region 5 (2003)	2.86E+01	ESL EPA Region 5 (2003)
Trichloroethylene	79-01-6	--		--		--		--		12.4	ESL EPA Region 5 (2003)	1.24E+01	ESL EPA Region 5 (2003)
Trichlorofluoromethane	75-69-4	--		--		--		--		16.4	ESL EPA Region 5 (2003)	1.64E+01	ESL EPA Region 5 (2003)
2,4,5-Trichlorophenol	95-95-4	9	PRGs	9	LOEC	--		4	Soil, LOEC	14.1	ESL EPA Region 5 (2003)	9.00E+00	PRGs
2,4,6-Trichlorophenol	88-06-2	4	PRGs	10	LOEC	--		10	No Soil, only Solution, LOEC	9.94	ESL EPA Region 5 (2003)	4.00E+00	PRGs
1,2,3-Trichloropropane	96-18-4	--		--		--		--		3.36	ESL EPA Region 5 (2003)	3.36E+00	ESL EPA Region 5 (2003)
2,4,5-Trichlorophenoxyacetic acid	93-76-5	--		--		--		--		0.596	ESL EPA Region 5 (2003)	5.96E-01	ESL EPA Region 5 (2003)
1,3,5-Trinitrobenzene	99-35-4	--		--		--		--		0.376	ESL EPA Region 5 (2003)	8.60E-01	PPL (SAIC 2002)
2,4,6-Trinitrotoluene	118-96-7	--		--		--		--		--		7.10E+01	PPL (SAIC 2002)
Vinyl acetate	108-05-4	--		--		--		--		12.7	ESL EPA Region 5 (2003)	1.27E+01	ESL EPA Region 5 (2003)
Vinyl chloride	75-01-4	--		--		--		--		0.646	ESL EPA Region 5 (2003)	6.46E-01	ESL EPA Region 5 (2003)
Xylenes (total)	1330-20-7	--		--		--		100	No Soil, only Solution, LOEC	10	ESL EPA Region 5 (2003)	1.00E+02	No Soil, only Solution, LOEC

[a] Efroymson, R.A, G.W Suter, II, B.E. Sample, and D.S. Jones. (1997a). Preliminary Remediation Goals for Ecological Endpoints. ES/ER/TM-162/R2.

[b] Efroymson, R.A, M.E Will., and G.W Suter, 1997b Toxicological Benchmarks for Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process

Martin Marietta Energy Systems, INC. ES/ER/TM-126/R1 Oak Ridge National Laboratory, Oak Ridge, TN

[c] Efroymson,R. A., M.E. Will, G.W. Suter , and A.C. Wooten, 1997c. Toxicological Benchmarks for Screening Contaminants of Concern for Effects on Terrestrial Plants: 1997 Revision

Lockheed Martin Energy Systems, INC. ES/ER/TM-85/R3 Oak Ridge National Laboratory, Oak Ridge, TN

[d] Ecological Screening Levels (ESL), U.S. EPA Region 5, Updated per website: http://www.epa.gov/reg5rcra/ca/edql.htm, August 2003

[e] The Prefered Soil Value heirarcy is as follows: Efroymson et al. (1997a), followed by Efroymson et al. (1997b), followed by Efroymson et al. (1997c), followed by ESLs. Note that plant protection levels (PPLs) (SAIC 2002) that were developed for Winklepeck Burning Grounds are used for copper, cyanide, 1,3,5-trinitrobenzene, and 2,4,6-trinitrotoluene.

NOEC = No Observed Effect Concentration

LOEC = Lowest Observed Effect Concentration

Diss = Dissolved Analyte

-- = no value

PRGs = Preliminary Remediation Goals

Appendix Table C-3. Soil Screening in Shallow Surface Soil (0-1 ft) at 40 mm Range at RVAAP

DRAFT

Analyte	CAS Registry Number	Units	Results >Detection Limit	% Results >Detection Limit	Minimum Nondetect	Maximum Nondetect	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background Criteria
Metals												
Aluminum	7429905	mg/kg	40/ 40	100			11100	3470	21000	12400	12400	17700
Antimony	7440360	mg/kg	0/ 40	0	0.18	0.52	0.157			0.167	0.167	0.96
Arsenic	7440382	mg/kg	40/ 40	100			11.4	5.7	20.5	12.5	12.5	15.4
Barium	7440393	mg/kg	40/ 40	100			65.8	21.9	144	76.8	76.8	88.4
Beryllium	7440417	mg/kg	36/ 36	100			0.66	0.42	1	0.704	0.704	0.88
Cadmium	7440439	mg/kg	20/ 40	50	0.018	0.074	0.129	0.057	0.87	0.178	0.178	0
Calcium	7440702	mg/kg	40/ 40	100			1150	153	9250	1620	1620	15800
Chromium	7440473	mg/kg	40/ 40	100			26.5	7.5	429	43.9	43.9	17.4
Chromium, hexavalent	18540299	mg/kg	0/ 4	0	2.9	5.9	1.9			2.73	2.73	
Cobalt	7440484	mg/kg	40/ 40	100			8.83	4.4	13	9.46	9.46	10.4
Copper	7440508	mg/kg	40/ 40	100			17.3	6	68.6	20.2	20.2	17.7
Iron	7439896	mg/kg	40/ 40	100			23400	15200	34700	24600	24600	23100
Lead	7439921	mg/kg	40/ 40	100			16.9	11.6	49.5	18.5	18.5	26.1
Magnesium	7439954	mg/kg	40/ 40	100			2160	575	4290	2390	2390	3030
Manganese	7439965	mg/kg	40/ 40	100			546	204	1300	632	632	1450
Mercury	7439976	mg/kg	0/ 40	0	0.014	0.061	0.0123			0.0136	0.0136	0.036
Nickel	7440020	mg/kg	40/ 40	100			16.5	9.2	28.2	17.7	17.7	21.1
Potassium	7440097	mg/kg	40/ 40	100			1080	578	2010	1170	1170	927
Selenium	7782492	mg/kg	0/ 40	0	0.27	0.93	0.246			0.27	0.27	1.4
Silver	7440224	mg/kg	0/ 40	0	0.039	0.17	0.0329			0.0367	0.0367	0
Sodium	7440235	mg/kg	36/ 40	90	47.7	52.3	66	30.4	118	72.1	72.1	123
Thallium	7440280	mg/kg	6/ 40	15	0.36	1.8	0.611	2	2.6	0.804	0.804	0
Vanadium	7440622	mg/kg	40/ 40	100			20.7	9.2	34.1	22.7	22.7	31.1
Zinc	7440666	mg/kg	40/ 40	100			60.6	44.2	114	63.9	63.9	61.8
Organics-Explosives												
1,3,5-Trinitrobenzene	99354	mg/kg	0/ 30	0	0.1	0.1	0.05			0.05	0.05	
1,3-Dinitrobenzene	99650	mg/kg	0/ 40	0	0.1	0.1	0.05			0.05	0.05	
2,4,6-Trinitrotoluene	118967	mg/kg	1/ 40	2.5	0.1	0.1	0.0515	0.11	0.11	0.054	0.054	
2,4-Dinitrotoluene	121142	mg/kg	1/ 40	2.5	0.1	0.1	0.0512	0.096	0.096	0.0531	0.0531	
2,6-Dinitrotoluene	606202	mg/kg	0/ 40	0	0.1	0.1	0.05			0.05	0.05	
2-Amino-4,6-dinitrotoluene	35572782	mg/kg	0/ 40	0	0.1	0.1	0.05			0.05	0.05	
2-Nitrotoluene	88722	mg/kg	0/ 40	0	0.2	0.2	0.1			0.1	0.1	
3-Nitrotoluene	99081	mg/kg	1/ 40	2.5	0.2	0.2	0.1	0.1	0.1	0.1	0.1	
4-Amino-2,6-dinitrotoluene	19406510	mg/kg	0/ 40	0	0.1	0.1	0.05			0.05	0.05	
4-Nitrotoluene	99990	mg/kg	0/ 40	0	0.2	0.2	0.1			0.1	0.1	
HMX	2691410	mg/kg	1/ 40	2.5	0.2	0.2	0.105	0.28	0.28	0.112	0.112	
Nitrobenzene	98953	mg/kg	4/ 40	10	0.037	0.1	0.0483	0.033	0.066	0.0506	0.0506	
Nitrocellulose	9004700	mg/kg	4/ 4	100			43	20	64	65	64	
Nitroglycerin	55630	mg/kg	0/ 4	0	10	10	5			5	5	
Nitroguanidine	556887	mg/kg	0/ 4	0	0.13	0.13	0.065			0.065	0.065	
RDX	121824	mg/kg	0/ 40	0	0.2	0.2	0.1			0.1	0.1	
Tetryl	479458	mg/kg	1/ 30	3.33	0.2	0.2	0.102	0.17	0.17	0.106	0.106	
Organics-Pesticide/PCB												
4,4'-DDD	72548	mg/kg	0/ 4	0	0.002	0.0024	0.00105			0.00117	0.00117	
4,4'-DDE	72559	mg/kg	1/ 4	25	0.002	0.0024	0.000883	0.00033	0.00033	0.00133	0.00033	
4,4'-DDT	50293	mg/kg	0/ 4	0	0.002	0.0024	0.0011			0.00124	0.0012	

Appendix Table C-3. Soil Screening in Shallow Surface Soil (0-1 ft) at 40 mm Range at RVAAP (cont'd)

Analyte	CAS Registry Number	Justification	Soil ESV	Max Exceeds ESV?	PBT: PBT Compound?	PBT: Detected?	Max. > Bkg.?	SRC?	COPEC*?	Dist
Metals										
Aluminum	7429905	Above Background	600	Yes	no	Not PBT	Yes	Yes	**Yes**	X
Antimony	7440360	No Detects	5	No	no	Not PBT	No	Yes	No	O
Arsenic	7440382	Above Background	9.9	Yes	no	Not PBT	Yes	Yes	**Yes**	L
Barium	7440393	Above Background	283	No	no	Not PBT	Yes	Yes	No	L
Beryllium	7440417	Above Background	10	No	no	Not PBT	Yes	Yes	No	L
Cadmium	7440439	Above Background	4	No	yes	Yes	Yes	Yes	**Yes**	X
Calcium	7440702	Below Background	No ESV	No ESV	no	Not PBT	No	Yes	No	X
Chromium	7440473	Above Background	0.4	Yes	no	Not PBT	Yes	Yes	**Yes**	X
Chromium, hexavalent	18540299	No Background Data Available	0.4	Yes	no	Not PBT		Yes	**Yes**	O
Cobalt	7440484	Above Background	20	No	no	Not PBT	Yes	Yes	No	N
Copper	7440508	Above Background	13.9	Yes	no	Not PBT	Yes	Yes	**Yes**	L
Iron	7439896	Above Background	200	Yes	no	Not PBT	Yes	No	No	L
Lead	7439921	Above Background	40.5	Yes	yes	Yes	Yes	Yes	**Yes**	X
Magnesium	7439954	Essential Element	No ESV	No ESV	no	Not PBT	Yes	Yes	No	N
Manganese	7439965	Below Background	100	Yes	no	Not PBT	No	Yes	No	L
Mercury	7439976	No Detects	0.00051	Yes	yes	no	Yes	Yes	**Yes**	O
Nickel	7440020	Above Background	30	No	no	Not PBT	Yes	Yes	No	N
Potassium	7440097	Above Background	No ESV	No ESV	no	Not PBT	Yes	Yes	No	L
Selenium	7782492	No Detects	0.21	Yes	no	Not PBT	No	Yes	No	O
Silver	7440224	No Background Data Available	2	No	no	Not PBT		Yes	No	O
Sodium	7440235	Below Background	No ESV	No ESV	no	Not PBT	No	Yes	No	N
Thallium	7440280	Above Background	1	Yes	no	Not PBT	Yes	Yes	**Yes**	D
Vanadium	7440622	Above Background	2	Yes	no	Not PBT	Yes	Yes	**Yes**	X
Zinc	7440666	Above Background	8.5	Yes	yes	Yes	Yes	Yes	**Yes**	X
Organics-Explosives										
1,3,5-Trinitrobenzene	99354	No Detects	0.86	No	no	Not PBT		Yes	No	O
1,3-Dinitrobenzene	99650	No Detects	0.655	No	no	Not PBT		Yes	No	O
2,4,6-Trinitrotoluene	118967	No Background Data Available	71	No	no	Not PBT		Yes	No	D
2,4-Dinitrotoluene	121142	No Background Data Available	1.28	No	no	Not PBT		Yes	No	D
2,6-Dinitrotoluene	606202	No Detects	0.0328	Yes	no	Not PBT		Yes	**Yes**	O
2-Amino-4,6-dinitrotoluene	35572782	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
2-Nitrotoluene	88722	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
3-Nitrotoluene	99081	No Background Data Available	No ESV	No ESV	no	Not PBT		Yes	No	D
4-Amino-2,6-dinitrotoluene	19406510	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Nitrotoluene	99990	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
HMX	2691410	No Background Data Available	No ESV	No ESV	No Kow	Not PBT		Yes	No	D
Nitrobenzene	98953	No Background Data Available	40	No	no	Not PBT		Yes	No	D
Nitrocellulose	9004700	No Background Data Available	No ESV	No ESV	No Kow	Not PBT		Yes	No	N
Nitroglycerin	55630	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Nitroguanidine	556887	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
RDX	121824	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Tetryl	479458	No Background Data Available	No ESV	No ESV	No Kow	Not PBT		Yes	No	D
Organics-Pesticide/PCB										
4,4'-DDD	72548	No Detects	0.758	No	yes	no		Yes	No	O
4,4'-DDE	72559	No Background Data Available	0.596	No	yes	Yes		Yes	**Yes**	D
4,4'-DDT	50293	No Detects	0.0035	No	yes	no		Yes	No	O

Appendix Table C-3. Soil Screening in Shallow Surface Soil (0-1 ft) at 40 mm Range at RVAAP
DRAFT

Analyte	CAS Registry Number	Units	Results >Detection Limit	% Results >Detection Limit	Minimum Nondetect	Maximum Nondetect	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background Criteria
Aldrin	309002	mg/kg	1/ 4	25	0.002	0.0024	0.0011	0.0012	0.0012	0.00124	0.0012	
Chlordane	57749	mg/kg	0/ 4	0	0.039	0.047	0.021			0.023	0.023	
Dieldrin	60571	mg/kg	0/ 4	0	0.002	0.0024	0.00106			0.00117	0.00117	
Endosulfan I	959988	mg/kg	0/ 4	0	0.002	0.0024	0.00105			0.00117	0.00117	
Endosulfan II	33213659	mg/kg	0/ 4	0	0.002	0.0024	0.00105			0.00117	0.00117	
Endosulfan sulfate	1031078	mg/kg	0/ 4	0	0.002	0.0024	0.00105			0.00117	0.00117	
Endrin	72208	mg/kg	0/ 4	0	0.002	0.0026	0.00113			0.0013	0.0013	
Endrin aldehyde	7421934	mg/kg	1/ 4	25	0.002	0.0024	0.00101	0.00085	0.00085	0.00118	0.00085	
Endrin ketone	53494705	mg/kg	1/ 4	25	0.002	0.0024	0.000885	0.00034	0.00034	0.00133	0.00034	
Heptachlor	76448	mg/kg	1/ 4	25	0.002	0.0024	0.000998	0.00079	0.00079	0.00119	0.00079	
Heptachlor epoxide	1024573	mg/kg	0/ 4	0	0.002	0.0024	0.00105			0.00117	0.00117	
Lindane	58899	mg/kg	1/ 4	25	0.002	0.0024	0.00103	0.00093	0.00093	0.00117	0.00093	
Methoxychlor	72435	mg/kg	0/ 4	0	0.002	0.0024	0.00105			0.00117	0.00117	
PCB-1016	12674112	mg/kg	0/ 4	0	0.039	0.047	0.021			0.023	0.023	
PCB-1221	11104282	mg/kg	0/ 4	0	0.039	0.047	0.021			0.023	0.023	
PCB-1232	11141165	mg/kg	0/ 4	0	0.039	0.047	0.021			0.023	0.023	
PCB-1242	53469219	mg/kg	0/ 4	0	0.039	0.047	0.021			0.023	0.023	
PCB-1248	12672296	mg/kg	0/ 4	0	0.039	0.047	0.021			0.023	0.023	
PCB-1254	11097691	mg/kg	0/ 4	0	0.039	0.047	0.021			0.023	0.023	
PCB-1260	11096825	mg/kg	0/ 4	0	0.039	0.047	0.021			0.023	0.023	
Toxaphene	8001352	mg/kg	0/ 4	0	0.039	0.047	0.021			0.023	0.023	
alpha-BHC	319846	mg/kg	0/ 4	0	0.002	0.0024	0.00105			0.00117	0.00117	
alpha-Chlordane	5103719	mg/kg	0/ 4	0	0.002	0.0024	0.00105			0.00117	0.00117	
beta-BHC	319857	mg/kg	0/ 4	0	0.002	0.0024	0.00105			0.00117	0.00117	
delta-BHC	319868	mg/kg	0/ 4	0	0.002	0.0024	0.00105			0.00117	0.00117	
gamma-Chlordane	5103742	mg/kg	0/ 4	0	0.002	0.0024	0.00105			0.00117	0.00117	
Organics-Semivolatile												
1,1-Biphenyl	92524	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
2,4,5-Trichlorophenol	95954	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
2,4,6-Trichlorophenol	88062	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
2,4-Dichlorophenol	120832	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
2,4-Dimethylphenol	105679	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
2-Chloronaphthalene	91587	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
2-Chlorophenol	95578	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
2-Methyl-4,6-dinitrophenol	534521	mg/kg	0/ 4	0	0.78	0.94	0.419			0.46	0.46	
2-Methylnaphthalene	91576	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
2-Methylphenol	95487	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
2-Nitrobenzenamine	88744	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
2-Nitrophenol	88755	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
3-Nitrobenzenamine	99092	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
4-Bromophenyl phenyl ether	101553	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
4-Chloro-3-methylphenol	59507	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
4-Chlorobenzenamine	106478	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
4-Chlorophenyl phenyl ether	7005723	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
4-Methylphenol	106445	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
4-Nitrobenzenamine	100016	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
4-Nitrophenol	100027	mg/kg	0/ 4	0	0.78	0.94	0.419			0.46	0.46	
Acenaphthene	83329	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Acetophenone	98862	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Anthracene	120127	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Atrazine	1912249	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Benzo(a)anthracene	56553	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	

Appendix Table C-3. Soil Screening in Shallow Surface Soil (0-1 ft) at 40 mm Range at RVAAP (cont'd)

Analyte	CAS Registry Number	Justification	Soil ESV	Max Exceeds ESV?	PBT: PBT Compound?	PBT: Detected?	Max. > Bkg.?	SRC?	COPEC*?	Dist
Aldrin	309002	No Background Data Available	0.00332	No	yes	Yes		Yes	Yes	D
Chlordane	57749	No Detects	0.224	No	yes	no		Yes	No	O
Dieldrin	60571	No Detects	0.00238	Yes	yes	no		Yes	Yes	O
Endosulfan I	959988	No Detects	No ESV	No ESV	yes	no		Yes	No	O
Endosulfan II	33213659	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Endosulfan sulfate	1031078	No Detects	0.0358	No	yes	no		Yes	No	O
Endrin	72208	No Detects	0.0101	No	yes	no		Yes	No	O
Endrin aldehyde	7421934	No Background Data Available	0.0105	No	yes	Yes		Yes	Yes	D
Endrin ketone	53494705	No Background Data Available	No ESV	No ESV	No Kow	Not PBT		Yes	No	D
Heptachlor	76448	No Background Data Available	0.00598	No	yes	Yes		Yes	Yes	D
Heptachlor epoxide	1024573	No Detects	0.152	No	yes	no		Yes	No	O
Lindane	58899	No Background Data Available	0.005	No	yes	Yes		Yes	Yes	D
Methoxychlor	72435	No Detects	0.0199	No	yes	no		Yes	No	O
PCB-1016	12674112	No Detects	No ESV	No ESV	yes	no		Yes	No	O
PCB-1221	11104282	No Detects	No ESV	No ESV	yes	no		Yes	No	O
PCB-1232	11141165	No Detects	No ESV	No ESV	yes	no		Yes	No	O
PCB-1242	53469219	No Detects	No ESV	No ESV	yes	no		Yes	No	O
PCB-1248	12672296	No Detects	No ESV	No ESV	yes	no		Yes	No	O
PCB-1254	11097691	No Detects	No ESV	No ESV	yes	no		Yes	No	O
PCB-1260	11096825	No Detects	No ESV	No ESV	yes	no		Yes	No	O
Toxaphene	8001352	No Detects	0.119	No	yes	no		Yes	No	O
alpha-BHC	319846	No Detects	No ESV	No ESV	yes	no		Yes	No	O
alpha-Chlordane	5103719	No Detects	0.224	No	No Kow	Not PBT		Yes	No	O
beta-BHC	319857	No Detects	0.00398	No	yes	no		Yes	No	O
delta-BHC	319868	No Detects	No ESV	No ESV	yes	no		Yes	No	O
gamma-Chlordane	5103742	No Detects	0.224	No	No Kow	Not PBT		Yes	No	O
Organics-Semivolatile										
1,1-Biphenyl	92524	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
2,4,5-Trichlorophenol	95954	No Detects	9	No	No Kow	Not PBT		Yes	No	O
2,4,6-Trichlorophenol	88062	No Detects	4	No	yes	no		Yes	No	O
2,4-Dichlorophenol	120832	No Detects	20	No	yes	no		Yes	No	O
2,4-Dimethylphenol	105679	No Detects	0.01	No	no	Not PBT		No	No	O
2-Chloronaphthalene	91587	No Detects	0.0122	Yes	yes	no		No	No	O
2-Chlorophenol	95578	No Detects	60	No	no	Not PBT		Yes	No	O
2-Methyl-4,6-dinitrophenol	534521	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
2-Methylnaphthalene	91576	No Detects	3.24	No	no	Not PBT		Yes	No	O
2-Methylphenol	95487	No Detects	No ESV	No	no	Not PBT		Yes	No	O
2-Nitrobenzenamine	88744	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
2-Nitrophenol	88755	No Detects	1.6	No	no	Not PBT		Yes	No	O
3-Nitrobenzenamine	99092	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Bromophenyl phenyl ether	101553	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Chloro-3-methylphenol	59507	No Detects	No ESV	No ESV	yes	no		Yes	No	O
4-Chlorobenzenamine	106478	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Chlorophenyl phenyl ether	7005723	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Methylphenol	106445	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
4-Nitrobenzenamine	100016	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Nitrophenol	100027	No Detects	5.12	No	no	Not PBT		Yes	No	O
Acenaphthene	83329	No Detects	20	No	yes	no		Yes	No	O
Acetophenone	98862	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Anthracene	120127	No Detects	1480	No	yes	no		Yes	No	O
Atrazine	1912249	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Benzo(a)anthracene	56553	No Detects	5.21	No	yes	no		Yes	No	O

Appendix Table C-3. Soil Screening in Shallow Surface Soil (0-1 ft) at 40 mm Range at RVAAP
DRAFT

Analyte	CAS Registry Number	Units	Results >Detection Limit	% Results >Detection Limit	Minimum Nondetect	Maximum Nondetect	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background Criteria
Benzo(a)pyrene	50328	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Benzo(b)fluoranthene	205992	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Benzo(g,h,i)perylene	191242	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Benzo(k)fluoranthene	207089	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Bis(2-chloroethoxy)methane	111911	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Bis(2-chloroisopropyl) ether	108601	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Bis(2-ethylhexyl)phthalate	117817	mg/kg	1/ 4	25	0.39	0.47	0.196	0.15	0.15	0.238	0.15	
Butylbenzylphthalate	85687	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Caprolactam	105602	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Carbazole	86748	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Chrysene	218019	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Di-n-butylphthalate	84742	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Dibenzo(a,h)anthracene	53703	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Dibenzofuran	132649	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Diethylphthalate	84662	mg/kg	1/ 4	25	0.39	0.47	1.56	5.6	5.6	4.73	4.73	
Dimethylphthalate	131113	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Fluoranthene	206440	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Fluorene	86737	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Hexachlorobenzene	118741	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Hexachlorocyclopentadiene	77474	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Hexachloroethane	67721	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Indeno(1,2,3-cd)pyrene	193395	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Isophorone	78591	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
N-Nitroso-di-n-propylamine	621647	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
N-Nitrosodiphenylamine	86306	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Naphthalene	91203	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Pentachlorophenol	87865	mg/kg	0/ 4	0	0.78	0.94	0.419			0.46	0.46	
Phenanthrene	85018	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Phenol	108952	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Pyrene	129000	mg/kg	0/ 4	0	0.39	0.47	0.21			0.23	0.23	
Organics-Volatile												
1,1,1-Trichloroethane	71556	mg/kg	1/ 4	25	0.0059	0.0069	0.00561	0.013	0.013	0.0114	0.0114	
1,1,2,2-Tetrachloroethane	79345	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	mg/kg	0/ 2	0	0.0059	0.0069	0.003			0.00332	0.00305	
1,1,2-Trichloroethane	79005	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
1,1-Dichloroethane	75343	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
1,1-Dichloroethene	75354	mg/kg	1/ 3	33.3	0.0059	0.0069	0.00463	0.0074	0.0074	0.00869	0.0074	
1,2,4-Trichlorobenzene	120821	mg/kg	0/ 2	0	0.0059	0.0069	0.003			0.00332	0.00305	
1,2-Dibromo-3-chloropropane	96128	mg/kg	0/ 2	0	0.0059	0.0069	0.003			0.00332	0.00305	
1,2-Dibromoethane	106934	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	

Appendix Table C-3. Soil Screening in Shallow Surface Soil (0-1 ft) at 40 mm Range at RVAAP (cont'd)

Analyte	CAS Registry Number	Justification	Soil ESV	Max Exceeds ESV?	PBT: PBT Compound?	PBT: Detected?	Max. > Bkg.?	SRC?	COPEC^a?	Dist
Benzo(a)pyrene	50328	No Detects	1.52	No	yes	no		No	No	O
Benzo(b)fluoranthene	205992	No Detects	59.8	No	yes	no		Yes	No	O
Benzo(g,h,i)perylene	191242	No Detects	119	No	yes	no		Yes	No	O
Benzo(k)fluoranthene	207089	No Detects	148	No	yes	no		Yes	No	O
Bis(2-chloroethoxy)methane	111911	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Bis(2-chloroisopropyl) ether	108601	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Bis(2-ethylhexyl)phthalate	117817	No Background Data Available	0.92594	No	yes	Yes		Yes	Yes	D
Butylbenzylphthalate	85687	No Detects	No ESV	No ESV	yes	no		Yes	No	O
Caprolactam	105602	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Carbazole	86748	No Detects	No ESV	No ESV	yes	no		Yes	No	O
Chrysene	218019	No Detects	4.73	No	yes	no		Yes	No	O
Di-n-butylphthalate	84742	No Detects	200	No	yes	no		Yes	No	O
Dibenzo(a,h)anthracene	53703	No Detects	18.4	No	yes	no		No	No	O
Dibenzofuran	132649	No Detects	No ESV	No ESV	yes	no		Yes	No	O
Diethylphthalate	84662	No Background Data Available	100	No	no	Not PBT		Yes	No	D
Dimethylphthalate	131113	No Detects	200	No	no	Not PBT		Yes	No	O
Fluoranthene	206440	No Detects	122	No	yes	no		Yes	No	O
Fluorene	86737	No Detects	30	No	yes	no		Yes	No	O
Hexachlorobenzene	118741	No Detects	1000	No	yes	no		Yes	No	O
Hexachlorocyclopentadiene	77474	No Detects	10	No	yes	no		Yes	No	O
Hexachloroethane	67721	No Detects	0.596	No	yes	no		Yes	No	O
Indeno(1,2,3-cd)pyrene	193395	No Detects	109	No	yes	no		Yes	No	O
Isophorone	78591	No Detects	139	No	no	Not PBT		Yes	No	O
N-Nitroso-di-n-propylamine	621647	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
N-Nitrosodiphenylamine	86306	No Detects	20	No	yes	no		Yes	No	O
Naphthalene	91203	No Detects	10	No	yes	no		Yes	No	O
Pentachlorophenol	87865	No Detects	3	No	yes	no		Yes	No	O
Phenanthrene	85018	No Detects	45.7	No	yes	no		Yes	No	O
Phenol	108952	No Detects	30	No	no	Not PBT		Yes	No	O
Pyrene	129000	No Detects	78.5	No	yes	no		Yes	No	O
Organics-Volatile										
1,1,1-Trichloroethane	71556	No Background Data Available	29.8	No	no	Not PBT		Yes	No	D
1,1,2,2-Tetrachloroethane	79345	No Detects	0.127	No	no	Not PBT		Yes	No	O
1,1,2-Trichloro-1,2,2-trifluoroethane	76131	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
1,1,2-Trichloroethane	79005	No Detects	28.6	No	no	Not PBT		Yes	No	O
1,1-Dichloroethane	75343	No Detects	20.1	No	yes	no		Yes	No	O
1,1-Dichloroethene	75354	No Background Data Available	8.28	No	no	Not PBT		Yes	No	D
1,2,4-Trichlorobenzene	120821	No Detects	20	No	yes	no		Yes	No	O
1,2-Dibromo-3-chloropropane	96128	No Detects	0.0352	No	no	Not PBT		Yes	No	O
1,2-Dibromoethane	106934	No Detects	No ESV	No ESV	No Kow	no		Yes	No	O

Appendix Table C-3. Soil Screening in Shallow Surface Soil (0-1 ft) at 40 mm Range at RVAAP

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Analyte	CAS Registry Number	Units	Results >Detection Limit	% Results >Detection Limit	Minimum Nondetect	Maximum Nondetect	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background Criteria
1,2-Dichlorobenzene	95501	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
1,2-Dichloroethane	107062	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
1,2-Dichloropropane	78875	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
1,2-Dimethylbenzene	95476	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
1,3-Dichlorobenzene	541731	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
1,4-Dichlorobenzene	106467	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
2-Butanone	78933	mg/kg	0/ 2	0	0.012	0.014	0.006			0.006	0.006	
2-Hexanone	591786	mg/kg	0/ 2	0	0.012	0.014	0.006			0.006	0.006	
2-Methoxy-2-methylpropane	1634044	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
4-Methyl-2-pentanone	108101	mg/kg	0/ 4	0	0.012	0.014	0.00625			0.00684	0.00684	
Acetone	67641	mg/kg	0/ 2	0	0.0066	0.015	0.00445			0.00698	0.00485	
Benzene	71432	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
Bromodichloromethane	75274	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
Bromomethane	74839	mg/kg	0/ 2	0	0.012	0.014	0.006			0.006	0.006	
Carbon disulfide	75150	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
Carbon tetrachloride	56235	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
Chlorobenzene	108907	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
Chloroethane	75003	mg/kg	0/ 4	0	0.012	0.014	0.00625			0.00684	0.00684	
Chloroform	67663	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
Chloromethane	74873	mg/kg	0/ 4	0	0.012	0.014	0.00625			0.00684	0.00684	
Cumene	98828	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
Cyclohexane	110827	mg/kg	0/ 2	0	0.0059	0.0069	0.003			0.00332	0.00305	
Dibromochloromethane	124481	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
Dichlorodifluoromethane	75718	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
Ethylbenzene	100414	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
M + P Xylene	136777612	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
Methylcyclohexane	108872	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
Methylene chloride	75092	mg/kg	0/ 2	0	0.0085	0.012	0.006			0.006	0.006	
Styrene	100425	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
Tetrachloroethene	127184	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
Toluene	108883	mg/kg	1/ 4	25	0.0059	0.0069	0.00286	0.002	0.002	0.00359	0.002	
Trichloroethene	79016	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
Trichlorofluoromethane	75694	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
Vinyl chloride	75014	mg/kg	0/ 4	0	0.012	0.014	0.00625			0.00684	0.00684	
cis-1,2-Dichloroethene	156592	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
cis-1,3-Dichloropropene	10061015	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	
trans-1,2-Dichloroethene	156605	mg/kg	0/ 4	0	0.0059	0.0069	0.00313			0.00339	0.00339	

RVAAP = Ravenna Army Ammunition Plant

CAS = Chemical Abstract Service

UCL = upper confidence limit

ESV = ecological screening value

Max = maximum concentration (maximum detect if at least one detect, otherwise maximum non detect)

PBT = persistant, bioaccumulative, and toxic compound (inorganics include cadmium, lead, merucy, and zinc; organics are chemicals with log Kow >= 3)

Bkg = background concentration

SRC = Site related chemical (from Army's usage records)

Non-SRCs based on knowledge of the historical processes at the 40 mm range are: metals -- iron; organics-semivolatiles -- 2,4-Dimethylphenol, 2-Chloronaphthalene, Benzo(a)pyrene, Dibenzo(a,h) anthracene, and Hexachlorobutadiene

*COPEC = chemical of potential ecological concern ["Yes" = 1) maximum concentration (detect if at least one detection, or, non detect if no detections) > ESV, or if detected and below ESV or "No ESV and is a PBT compound, and 2) maximum concentration is above background (inorganics) or there is no background data (inorganics and organics), and 3) analyte is a SRC; else, "No"

Dist = data distribution (X = neither normal nor lognormal; O = no detected concentrations; L = lognormal; N = normal; D = fewer than 50% detected or fewer than 8 detected - distribution not determined)

PCBs = polychlorinated biphenyls

Note that 10 analytes were eliminated per 0/ 0 detects, including 2,4-dinitrophenol; 3,3'-dichlorobenzidine; acenaphthylene; benzaldehyde; bis(2-chloroethyl) ether; di-n-octylphthalate; hexachlorobutadiene; bromoform; methyl acetate; and trans-1,3-dichloropropane

Appendix Table C-3. Soil Screening in Shallow Surface Soil (0-1 ft) at 40 mm Range at RVAAP (cont'd)

Analyte	CAS Registry Number	Justification	Soil ESV	Max Exceeds ESV?	PBT: PBT Compound?	PBT: Detected?	Max. > Bkg.?	SRC?	COPEC*?	Dist
1,2-Dichlorobenzene	95501	No Detects	2.96	No	yes	no		Yes	No	O
1,2-Dichloroethane	107062	No Detects	21.2	No	no	Not PBT		Yes	No	O
1,2-Dichloropropane	78875	No Detects	700	No	No Kow	Not PBT		Yes	No	O
1,2-Dimethylbenzene	95476	No Detects	No ESV	No ESV	yes	no		Yes	No	O
1,3-Dichlorobenzene	541731	No Detects	37.7	No	yes	no		Yes	No	O
1,4-Dichlorobenzene	106467	No Detects	20	No	yes	no		Yes	No	O
2-Butanone	78933	No Detects	89.6	No	no	Not PBT		Yes	No	O
2-Hexanone	591786	No Detects	12.6	No	no	Not PBT		Yes	No	O
2-Methoxy-2-methylpropane	1634044	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Methyl-2-pentanone	108101	No Detects	443	No	No Kow	Not PBT		Yes	No	O
Acetone	67641	No Detects	2.5	No	no	Not PBT		Yes	No	O
Benzene	71432	No Detects	0.25462	No	no	Not PBT		Yes	No	O
Bromodichloromethane	75274	No Detects	0.54	No	no	Not PBT		Yes	No	O
Bromomethane	74839	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Carbon disulfide	75150	No Detects	0.09412	No	no	Not PBT		Yes	No	O
Carbon tetrachloride	56235	No Detects	1000	No	no	Not PBT		Yes	No	O
Chlorobenzene	108907	No Detects	40	No	no	Not PBT		Yes	No	O
Chloroethane	75003	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Chloroform	67663	No Detects	1.19	No	no	Not PBT		Yes	No	O
Chloromethane	74873	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Cumene	98828	No Detects	No ESV	No ESV	yes	no		Yes	No	O
Cyclohexane	110827	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Dibromochloromethane	124481	No Detects	2.05	No	no	Not PBT		Yes	No	O
Dichlorodifluoromethane	75718	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Ethylbenzene	100414	No Detects	5.16	No	yes	no		Yes	No	O
M + P Xylene	136777612	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Methylcyclohexane	108872	No Detects	No ESV	No ESV	yes	no		Yes	No	O
Methylene chloride	75092	No Detects	1.05	No	no	Not PBT		Yes	No	O
Styrene	100425	No Detects	300	No	no	Not PBT		Yes	No	O
Tetrachloroethene	127184	No Detects	10	No	no	Not PBT		Yes	No	O
Toluene	108883	No Background Data Available	200	No	no	Not PBT		Yes	No	D
Trichloroethene	79016	No Detects	100	No	no	Not PBT		Yes	No	O
Trichlorofluoromethane	75694	No Detects	16.4	No	no	Not PBT		Yes	No	O
Vinyl chloride	75014	No Detects	0.646	No	no	Not PBT		Yes	No	O
cis-1,2-Dichloroethene	156592	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
cis-1,3-Dichloropropene	10061015	No Detects	0.398	No	no	Not PBT		Yes	No	O
trans-1,2-Dichloroethene	156605	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O

Appendix Table C-4. Soil Screening in Subsurface Soil (1-3 ft) at 40 mm Range at RVAAP

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Analyte	CAS Registry Number	Units	Results >Detection Limit	% Results >Detection Limit	Minimum Nondetect	Maximum Nondetect	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background Criteria
Metals												
Aluminum	7429905	mg/kg	26/ 26	100			12600	6850	19600	13600	13600	19500
Antimony	7440360	mg/kg	0/ 26	0	0.18	0.45	0.154			0.166	0.166	0.96
Arsenic	7440382	mg/kg	26/ 26	100			17.5	8.1	30.3	19	19	19.8
Barium	7440393	mg/kg	26/ 26	100			62	30.5	121	71	71	124
Beryllium	7440417	mg/kg	23/ 23	100			0.709	0.32	1.2	0.796	0.796	0.88
Cadmium	7440439	mg/kg	3/ 26	11.5	0.016	0.061	0.0279	0.077	0.22	0.0424	0.0424	0
Calcium	7440702	mg/kg	26/ 26	100			589	144	1570	774	774	35500
Chromium, hexavalent	18540299	mg/kg	0/ 3	0	2.7	6.3	1.98			3.69	3.15	
Chromium	7440473	mg/kg	26/ 26	100			17.9	10.5	27.7	19.2	19.2	27.2
Cobalt	7440484	mg/kg	26/ 26	100			10.9	4.7	23.8	12.5	12.5	23.2
Copper	7440508	mg/kg	26/ 26	100			21.6	9.4	36.5	23.2	23.2	32.3
Iron	7439896	mg/kg	26/ 26	100			26800	13300	36900	28400	28400	35200
Lead	7439921	mg/kg	26/ 26	100			14.7	8.7	36.1	16.3	16.3	19.1
Magnesium	7439954	mg/kg	26/ 26	100			2770	1430	4700	3120	3120	8790
Manganese	7439965	mg/kg	26/ 26	100			333	152	840	375	375	3030
Mercury	7439976	mg/kg	0/ 26	0	0.013	0.023	0.00906			0.00948	0.00948	0.044
Nickel	7440020	mg/kg	26/ 26	100			22.2	10.2	38.5	24.7	24.7	60.7
Potassium	7440097	mg/kg	26/ 26	100			1310	769	2400	1440	1440	3350
Selenium	7782492	mg/kg	0/ 26	0	0.22	0.69	0.188			0.21	0.21	1.5
Silver	7440224	mg/kg	0/ 26	0	0.037	0.079	0.0277			0.0297	0.0297	0
Sodium	7440235	mg/kg	26/ 26	100			81	46.3	288	96.4	96.4	145
Thallium	7440280	mg/kg	6/ 26	23.1	0.31	0.9	0.759	1.9	2.8	1.08	1.08	0.91
Vanadium	7440622	mg/kg	26/ 26	100			22	13.1	34	23.6	23.6	37.6
Zinc	7440666	mg/kg	26/ 26	100			60.5	29.2	77.4	64.1	64.1	93.3
Organics-Explosives												
1,3,5-Trinitrobenzene	99354	mg/kg	0/ 23	0	0.1	0.1	0.05			0.05	0.05	
1,3-Dinitrobenzene	99650	mg/kg	0/ 26	0	0.1	0.1	0.05			0.05	0.05	
2,4,6-Trinitrotoluene	118967	mg/kg	0/ 26	0	0.1	0.1	0.05			0.05	0.05	
2,4-Dinitrotoluene	121142	mg/kg	0/ 26	0	0.1	0.1	0.05			0.05	0.05	
2,6-Dinitrotoluene	606202	mg/kg	0/ 26	0	0.1	0.1	0.05			0.05	0.05	
2-Amino-4,6-dinitrotoluene	35572782	mg/kg	0/ 26	0	0.1	0.1	0.05			0.05	0.05	
2-Nitrotoluene	88722	mg/kg	0/ 26	0	0.2	0.2	0.1			0.1	0.1	
3-Nitrotoluene	99081	mg/kg	1/ 26	3.85	0.2	0.2	0.0999	0.098	0.098	0.1	0.098	
4-Amino-2,6-dinitrotoluene	19406510	mg/kg	0/ 26	0	0.1	0.1	0.05			0.05	0.05	
4-Nitrotoluene	99990	mg/kg	0/ 26	0	0.2	0.2	0.1			0.1	0.1	
HMX	2691410	mg/kg	0/ 26	0	0.2	0.2	0.1			0.1	0.1	
Nitrobenzene	98953	mg/kg	3/ 26	11.5	0.035	0.1	0.0473	0.042	0.07	0.0506	0.0506	
Nitrocellulose	9004700	mg/kg	3/ 3	100			43	24	59	72.8	59	
Nitroglycerin	55630	mg/kg	0/ 3	0	10	10	5			5	5	
Nitroguanidine	556887	mg/kg	0/ 3	0	0.13	0.13	0.065			0.065	0.065	
RDX	121824	mg/kg	0/ 26	0	0.2	0.2	0.1			0.1	0.1	
Tetryl	479458	mg/kg	0/ 23	0	0.2	0.2	0.1			0.1	0.1	
Organics-Pesticide/PCB												
4,4'-DDD	72548	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
4,4'-DDE	72559	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
4,4'-DDT	50293	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
Aldrin	309002	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
Chlordane	57749	mg/kg	0/ 3	0	0.039	0.042	0.0202			0.0215	0.021	
Dieldrin	60571	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
Endosulfan I	959988	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
Endosulfan II	33213659	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
Endosulfan sulfate	1031078	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
Endrin	72208	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
Endrin aldehyde	7421934	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
Endrin ketone	53494705	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
Heptachlor	76448	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
Heptachlor epoxide	1024573	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	

Appendix Table C-4. Soil Screening in Subsurface Soil (1-3 ft) at 40 mm Range at RVAAP (cont'd)

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Analyte	CAS Registry Number	Justification	Soil ESV	Max Exceeds ESV?	PBT: PBT Compound?	PBT: Detected?	Max. > Bkg.?	SRC?	COPEC*?	Dist
Metals										
Aluminum	7429905	Above Background	6.00E+02	Yes	No	Not PBT	Yes	Yes	**Yes**	N
Antimony	7440360	No Detects	5.00E+00	No	No	Not PBT	No	Yes	No	O
Arsenic	7440382	Above Background	9.90E+00	Yes	No	Not PBT	Yes	Yes	**Yes**	N
Barium	7440393	Below Background	2.83E+02	No	No	Not PBT	No	Yes	No	L
Beryllium	7440417	Above Background	1.00E+01	No	No	Not PBT	Yes	Yes	No	L
Cadmium	7440439	Above Background	4.00E+00	No	Yes	Yes	Yes	Yes	**Yes**	D
Calcium	7440702	Essential Element	No ESV	No ESV	No	Not PBT	No	Yes	No	L
Chromium, hexavalent	18540299	No Detects	4.00E-01	Yes	No	Not PBT		Yes	**Yes**	O
Chromium	7440473	Above Background	4.00E-01	Yes	No	Not PBT	Yes	Yes	**Yes**	L
Cobalt	7440484	Above Background	2.00E+01	Yes	No	Not PBT	Yes	Yes	**Yes**	L
Copper	7440508	Above Background	1.39E+01	Yes	No	Not PBT	Yes	Yes	**Yes**	X
Iron	7439896	Essential Element	2.00E+02	Yes	No	Not PBT	Yes	No	No	X
Lead	7439921	Above Background	4.05E+01	No	Yes	Yes	Yes	Yes	**Yes**	X
Magnesium	7439954	Essential Element	No ESV	No ESV	No	Not PBT	No	Yes	No	L
Manganese	7439965	Below Background	1.00E+02	Yes	No	Not PBT	No	Yes	No	L
Mercury	7439976	No Detects	5.10E-04	Yes	Yes	No	No	Yes	No	O
Nickel	7440020	Below Background	3.00E+01	Yes	No	Not PBT	No	Yes	No	L
Potassium	7440097	Essential Element	No ESV	No ESV	No	Not PBT	No	Yes	No	L
Selenium	7782492	No Detects	2.10E-01	Yes	No	Not PBT	No	Yes	No	O
Silver	7440224	No Detects	2.00E+00	No	No	Not PBT		Yes	No	O
Sodium	7440235	Essential Element	No ESV	No ESV	No	Not PBT	Yes	Yes	No	X
Thallium	7440280	Above Background	1.00E+00	Yes	No	Not PBT	Yes	Yes	**Yes**	D
Vanadium	7440622	Below Background	2.00E+00	Yes	No	Not PBT	No	Yes	**No**	N
Zinc	7440666	Below Background	8.50E+00	Yes	Yes	Yes	No	Yes	No	N
Organics-Explosives										
1,3,5-Trinitrobenzene	99354	No Detects	8.60E-01	No	no	Not PBT		Yes	No	O
1,3-Dinitrobenzene	99650	No Detects	6.55E-01	No	no	Not PBT		Yes	No	O
2,4,6-Trinitrotoluene	118967	No Detects	7.10E+01	No	no	Not PBT		Yes	No	O
2,4-Dinitrotoluene	121142	No Detects	1.28E+00	No	no	Not PBT		Yes	No	O
2,6-Dinitrotoluene	606202	No Detects	3.28E-02	Yes	no	Not PBT		Yes	**Yes**	O
2-Amino-4,6-dinitrotoluene	35572782	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
2-Nitrotoluene	88722	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
3-Nitrotoluene	99081	No Background Data Available	No ESV	No ESV	no	Not PBT		Yes	No	D
4-Amino-2,6-dinitrotoluene	19406510	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Nitrotoluene	99990	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
HMX	2691410	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Nitrobenzene	98953	No Background Data Available	4.00E+01	No	no	Not PBT		Yes	No	D
Nitrocellulose	9004700	No Background Data Available	No ESV	No ESV	No Kow	Not PBT		Yes	No	N
Nitroglycerin	55630	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Nitroguanidine	556887	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
RDX	121824	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Tetryl	479458	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Organics-Pesticide/PCB										
4,4'-DDD	72548	No Detects	7.58E-01	No	yes	No		Yes	No	O
4,4'-DDE	72559	No Detects	5.96E-01	No	yes	No		Yes	No	O
4,4'-DDT	50293	No Detects	3.50E-03	No	yes	No		Yes	No	O
Aldrin	309002	No Detects	3.32E-03	No	yes	No		Yes	No	O
Chlordane	57749	No Detects	2.24E-01	No	yes	No		Yes	No	O
Dieldrin	60571	No Detects	2.38E-03	No	yes	No		Yes	No	O
Endosulfan I	959988	No Detects	No ESV	No ESV	yes	No		Yes	No	O
Endosulfan II	33213659	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Endosulfan sulfate	1031078	No Detects	3.58E-02	No	yes	No		Yes	No	O
Endrin	72208	No Detects	1.01E-02	No	yes	No		Yes	No	O
Endrin aldehyde	7421934	No Detects	1.05E-02	No	yes	No		Yes	No	O
Endrin ketone	53494705	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Heptachlor	76448	No Detects	5.98E-03	No	yes	No		Yes	No	O
Heptachlor epoxide	1024573	No Detects	1.52E-01	No	yes	No		Yes	No	O

Appendix Table C-4. Soil Screening in Subsurface Soil (1-3 ft) at 40 mm Range at RVAAP

DRAFT

Analyte	CAS Registry Number	Units	Results >Detection Limit	% Results >Detection Limit	Minimum Nondetect	Maximum Nondetect	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background Criteria
Lindane	58899	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
Methoxychlor	72435	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
PCB-1016	12674112	mg/kg	0/ 3	0	0.039	0.042	0.0202			0.0215	0.021	
PCB-1221	11104282	mg/kg	0/ 3	0	0.039	0.042	0.0202			0.0215	0.021	
PCB-1232	11141165	mg/kg	0/ 3	0	0.039	0.042	0.0202			0.0215	0.021	
PCB-1242	53469219	mg/kg	0/ 3	0	0.039	0.042	0.0202			0.0215	0.021	
PCB-1248	12672296	mg/kg	0/ 3	0	0.039	0.042	0.0202			0.0215	0.021	
PCB-1254	11097691	mg/kg	0/ 3	0	0.039	0.042	0.0202			0.0215	0.021	
PCB-1260	11096825	mg/kg	0/ 3	0	0.039	0.042	0.0202			0.0215	0.021	
Toxaphene	8001352	mg/kg	0/ 3	0	0.039	0.042	0.0202			0.0215	0.021	
alpha-BHC	319846	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
alpha-Chlordane	5103719	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
beta-BHC	319857	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
delta-BHC	319868	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
gamma-Chlordane	5103742	mg/kg	0/ 3	0	0.0019	0.0021	0.001			0.00108	0.00105	
Organics-Semivolatile												
1,1-Biphenyl	92524	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
2,4,5-Trichlorophenol	95954	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
2,4,6-Trichlorophenol	88062	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
2,4-Dichlorophenol	120832	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
2,4-Dimethylphenol	105679	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
2,4-Dinitrophenol	51285	mg/kg	0/ 1	0	0.78	0.85	0.4				0.4	
2-Chloronaphthalene	91587	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
2-Chlorophenol	95578	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
2-Methyl-4,6-dinitrophenol	534521	mg/kg	0/ 3	0	0.78	0.85	0.405			0.435	0.425	
2-Methylnaphthalene	91576	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
2-Methylphenol	95487	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
2-Nitrobenzenamine	88744	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
2-Nitrophenol	88755	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
3,3'-Dichlorobenzidine	91941	mg/kg	0/ 1	0	0.78	0.85	0.4				0.4	
3-Nitrobenzenamine	99092	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
4-Bromophenyl phenyl ether	101553	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
4-Chloro-3-methylphenol	59507	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
4-Chlorobenzenamine	106478	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
4-Chlorophenyl phenyl ether	7005723	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
4-Methylphenol	106445	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
4-Nitrobenzenamine	100016	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
4-Nitrophenol	100027	mg/kg	0/ 3	0	0.78	0.85	0.405			0.435	0.425	

Appendix Table C-4. Soil Screening in Subsurface Soil (1-3 ft) at 40 mm Range at RVAAP (cont'd)

DRAFT

Analyte	CAS Registry Number	Justification	Soil ESV	Max Exceeds ESV?	PBT: PBT Compound?	PBT: Detected?	Max. > Bkg.?	SRC?	COPEC[a]?	Dist
Lindane	58899	No Detects	5.00E-03	No	yes	No		Yes	No	O
Methoxychlor	72435	No Detects	1.99E-02	No	yes	No		Yes	No	O
PCB-1016	12674112	No Detects	No ESV	No ESV	yes	No		Yes	No	O
PCB-1221	11104282	No Detects	No ESV	No ESV	yes	No		Yes	No	O
PCB-1232	11141165	No Detects	No ESV	No ESV	yes	No		Yes	No	O
PCB-1242	53469219	No Detects	No ESV	No ESV	yes	No		Yes	No	O
PCB-1248	12672296	No Detects	No ESV	No ESV	yes	No		Yes	No	O
PCB-1254	11097691	No Detects	No ESV	No ESV	yes	No		Yes	No	O
PCB-1260	11096825	No Detects	No ESV	No ESV	yes	No		Yes	No	O
Toxaphene	8001352	No Detects	1.19E-01	No	yes	No		Yes	No	O
alpha-BHC	319846	No Detects	No ESV	No ESV	yes	No		Yes	No	O
alpha-Chlordane	5103719	No Detects	2.24E-01	No	No Kow	Not PBT		Yes	No	O
beta-BHC	319857	No Detects	3.98E-03	No	yes	No		Yes	No	O
delta-BHC	319868	No Detects	No ESV	No ESV	yes	No		Yes	No	O
gamma-Chlordane	5103742	No Detects	2.24E-01	No	No Kow	Not PBT		Yes	No	O
Organics-Semivolatile										
1,1-Biphenyl	92524	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
2,4,5-Trichlorophenol	95954	No Detects	9.00E+00	No	No Kow	Not PBT		Yes	No	O
2,4,6-Trichlorophenol	88062	No Detects	4.00E+00	No	yes	No		Yes	No	O
2,4-Dichlorophenol	120832	No Detects	2.00E+01	No	yes	No		Yes	No	O
2,4-Dimethylphenol	105679	No Detects	1.00E-02	Yes	no	Not PBT		No	No	O
2,4-Dinitrophenol	51285	No Detects	2.00E+01	No	no	Not PBT		Yes	No	O
2-Chloronaphthalene	91587	No Detects	1.22E-02	Yes	yes	No		No	No	O
2-Chlorophenol	95578	No Detects	6.00E+01	No	no	Not PBT		Yes	No	O
2-Methyl-4,6-dinitrophenol	534521	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
2-Methylnaphthalene	91576	No Detects	3.24E+00	No	no	Not PBT		Yes	No	O
2-Methylphenol	95487	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
2-Nitrobenzenamine	88744	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
2-Nitrophenol	88755	No Detects	1.60E+00	No	no	Not PBT		Yes	No	O
3,3'-Dichlorobenzidine	91941	No Detects	6.46E-01	Yes	yes	No		Yes	**Yes**	O
3-Nitrobenzenamine	99092	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Bromophenyl phenyl ether	101553	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Chloro-3-methylphenol	59507	No Detects	No ESV	No ESV	yes	No		Yes	No	O
4-Chlorobenzenamine	106478	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Chlorophenyl phenyl ether	7005723	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Methylphenol	106445	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
4-Nitrobenzenamine	100016	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Nitrophenol	100027	No Detects	5.12E+00	No	no	Not PBT		Yes	No	O

Appendix Table C-4. Soil Screening in Subsurface Soil (1-3 ft) at 40 mm Range at RVAAP

DRAFT

Analyte	CAS Registry Number	Units	Results >Detection Limit	% Results >Detection Limit	Minimum Nondetect	Maximum Nondetect	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background Criteria
Acenaphthene	83329	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Acenaphthylene	208968	mg/kg	0/ 1	0	0.39	0.42	0.2				0.2	
Acetophenone	98862	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Anthracene	120127	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Atrazine	1912249	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Benz(a)anthracene	56553	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Benzaldehyde	100527	mg/kg	0/ 1	0	0.39	0.42	0.2				0.2	
Benzo(a)pyrene	50328	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Benzo(b)fluoranthene	205992	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Benzo(ghi)perylene	191242	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Benzo(k)fluoranthene	207089	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Bis(2-chloroethoxy)methane	111911	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Bis(2-chloroethyl) ether	111444	mg/kg	0/ 1	0	0.39	0.42	0.2				0.2	
Bis(2-chloroisopropyl) ether	108601	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Bis(2-ethylhexyl)phthalate	117817	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Butyl benzyl phthalate	85687	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Caprolactam	105602	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Carbazole	86748	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Chrysene	218019	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Di-n-butyl phthalate	84742	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Di-n-octylphthalate	117840	mg/kg	0/ 1	0	0.39	0.42	0.2				0.2	
Dibenz(a,h)anthracene	53703	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Dibenzofuran	132649	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Diethyl phthalate	84662	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Dimethyl phthalate	131113	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Fluoranthene	206440	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Fluorene	86737	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Hexachlorobenzene	118741	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Hexachlorobutadiene	87683	mg/kg	0/ 1	0	0.39	0.42	0.2				0.2	
Hexachlorocyclopentadiene	77474	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Hexachloroethane	67721	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Indeno(1,2,3-cd)pyrene	193395	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Isophorone	78591	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
N-Nitroso-di-n-propylamine	621647	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
N-Nitrosodiphenylamine	86306	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Naphthalene	91203	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Pentachlorophenol	87865	mg/kg	0/ 3	0	0.78	0.85	0.405			0.435	0.425	
Phenanthrene	85018	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Phenol	108952	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Pyrene	129000	mg/kg	0/ 3	0	0.39	0.42	0.202			0.215	0.21	
Organics-Volatile												
1,1,1-Trichloroethane	71556	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
1,1,2,2-Tetrachloroethane	79345	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
1,1,2-Trichloro-1,2,2-trifluoroethar	76131	mg/kg	0/ 1	0	0.0058	0.0065	0.0029				0.0029	
1,1,2-Trichloroethane	79005	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
1,1-Dichloroethane	75343	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
1,1-Dichloroethene	75354	mg/kg	0/ 2	0	0.0058	0.0065	0.00318			0.00365	0.00325	
1,2,4-Trichlorobenzene	120821	mg/kg	0/ 1	0	0.0058	0.0065	0.0029				0.0029	
1,2-Dibromo-3-chloropropane	96128	mg/kg	0/ 1	0	0.0058	0.0065	0.0029				0.0029	
1,2-Dibromoethane	106934	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	

Appendix Table C-4. Soil Screening in Subsurface Soil (1-3 ft) at 40 mm Range at RVAAP (cont'd)

DRAFT

Analyte	CAS Registry Number	Justification	Soil ESV	Max Exceeds ESV?	PBT: PBT Compound?	PBT: Detected?	Max. > Bkg.?	SRC?	COPEC*?	Dist
Acenaphthene	83329	No Detects	2.00E+01	No	yes	No		Yes	No	O
Acenaphthylene	208968	No Detects	6.82E+02	No	yes	No		Yes	No	O
Acetophenone	98862	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Anthracene	120127	No Detects	1.48E+03	No	yes	No		Yes	No	O
Atrazine	1912249	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Benz(a)anthracene	56553	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Benzaldehyde	100527	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Benzo(a)pyrene	50328	No Detects	1.52E+00	No	yes	No		No	No	O
Benzo(b)fluoranthene	205992	No Detects	5.98E+01	No	yes	No		Yes	No	O
Benzo(ghi)perylene	191242	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Benzo(k)fluoranthene	207089	No Detects	1.48E+02	No	yes	No		Yes	No	O
Bis(2-chloroethoxy)methane	111911	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Bis(2-chloroethyl) ether	111444	No Detects	2.37E+01	No	No Kow	Not PBT		Yes	No	O
Bis(2-chloroisopropyl) ether	108601	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Bis(2-ethylhexyl)phthalate	117817	No Detects	9.26E-01	No	yes	No		Yes	No	O
Butyl benzyl phthalate	85687	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Caprolactam	105602	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Carbazole	86748	No Detects	No ESV	No ESV	yes	No		Yes	No	O
Chrysene	218019	No Detects	4.73E+00	No	yes	No		Yes	No	O
Di-n-butyl phthalate	84742	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Di-n-octylphthalate	117840	No Detects	7.09E+02	No	yes	No		No	No	O
Dibenz(a,h)anthracene	53703	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Dibenzofuran	132649	No Detects	No ESV	No ESV	yes	No		Yes	No	O
Diethyl phthalate	84662	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Dimethyl phthalate	131113	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Fluoranthene	206440	No Detects	1.22E+02	No	yes	No		Yes	No	O
Fluorene	86737	No Detects	3.00E+01	No	yes	No		Yes	No	O
Hexachlorobenzene	118741	No Detects	1.00E+03	No	yes	No		No	No	O
Hexachlorobutadiene	87683	No Detects	3.98E-02	Yes	yes	No		Yes	No	O
Hexachlorocyclopentadiene	77474	No Detects	1.00E+01	No	yes	No		Yes	No	O
Hexachloroethane	67721	No Detects	5.96E-01	No	yes	No		Yes	No	O
Indeno(1,2,3-cd)pyrene	193395	No Detects	1.09E+02	No	yes	No		Yes	No	O
Isophorone	78591	No Detects	1.39E+02	No	no	Not PBT		Yes	No	O
N-Nitroso-di-n-propylamine	621647	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
N-Nitrosodiphenylamine	86306	No Detects	2.00E+01	No	yes	No		Yes	No	O
Naphthalene	91203	No Detects	1.00E+01	No	yes	No		Yes	No	O
Pentachlorophenol	87865	No Detects	3.00E+00	No	yes	No		Yes	No	O
Phenanthrene	85018	No Detects	4.57E+01	No	yes	No		Yes	No	O
Phenol	108952	No Detects	3.00E+01	No	no	Not PBT		Yes	No	O
Pyrene	129000	No Detects	7.85E+01	No	yes	No		Yes	No	O
Organics-Volatile										
1,1,1-Trichloroethane	71556	No Detects	2.98E+01	No	no	Not PBT		Yes	No	O
1,1,2,2-Tetrachloroethane	79345	No Detects	1.27E-01	No	no	Not PBT		Yes	No	O
1,1,2-Trichloro-1,2,2-trifluoroethan	76131	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
1,1,2-Trichloroethane	79005	No Detects	2.86E+01	No	no	Not PBT		Yes	No	O
1,1-Dichloroethane	75343	No Detects	2.01E+01	No	yes	No		Yes	No	O
1,1-Dichloroethene	75354	No Detects	8.28E+00	No	no	Not PBT		Yes	No	O
1,2,4-Trichlorobenzene	120821	No Detects	2.00E+01	No	yes	No		Yes	No	O
1,2-Dibromo-3-chloropropane	96128	No Detects	3.52E-02	No	no	Not PBT		Yes	No	O
1,2-Dibromoethane	106934	No Detects	No ESV	No ESV	No Kow	No		Yes	No	O

Appendix Table C-4. Soil Screening in Subsurface Soil (1-3 ft) at 40 mm Range at RVAAP

DRAFT

Analyte	CAS Registry Number	Units	Results >Detection Limit	% Results >Detection Limit	Minimum Nondetect	Maximum Nondetect	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background Criteria
1,2-Dichlorobenzene	95501	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
1,2-Dichloroethane	107062	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
1,2-Dichloropropane	78875	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
1,2-Dimethylbenzene	95476	mg/kg	1/ 3	33.3	0.0062	0.0065	0.00278	0.002	0.002	0.00393	0.002	
1,3-Dichlorobenzene	541731	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
1,4-Dichlorobenzene	106467	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
2-Butanone	78933	mg/kg	0/ 1	0	0.012	0.013	0.006				0.006	
2-Hexanone	591786	mg/kg	0/ 1	0	0.012	0.013	0.006				0.006	
2-Methoxy-2-methylpropane	1634044	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
4-Methyl-2-pentanone	108101	mg/kg	0/ 3	0	0.012	0.013	0.00617			0.00665	0.0065	
Acetone	67641	mg/kg	0/ 1	0	0.012	0.013	0.0065				0.0065	
Benzene	71432	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
Bromodichloromethane	75274	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
Bromomethane	74839	mg/kg	0/ 1	0	0.012	0.013	0.006				0.006	
Carbon disulfide	75150	mg/kg	2/ 3	66.7	0.0065	0.0065	0.00745	0.0031	0.016	0.0199	0.016	
Carbon tetrachloride	56235	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
Chlorobenzene	108907	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
Chloroethane	75003	mg/kg	0/ 3	0	0.012	0.013	0.00617			0.00665	0.0065	
Chloroform	67663	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
Chloromethane	74873	mg/kg	0/ 3	0	0.012	0.013	0.00617			0.00665	0.0065	
Cumene	98828	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
Cyclohexane	110827	mg/kg	0/ 1	0	0.0058	0.0065	0.0029				0.0029	
Dibromochloromethane	124481	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
Dichlorodifluoromethane	75718	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
Ethylbenzene	100414	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
M + P Xylene	136777612	mg/kg	1/ 3	33.3	0.0062	0.0065	0.00382	0.0051	0.0051	0.00569	0.0051	
Methylcyclohexane	108872	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
Methylene chloride	75092	mg/kg	0/ 1	0	0.007	0.014	0.0035				0.0035	
Styrene	100425	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
Tetrachloroethene	127184	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
Toluene	108883	mg/kg	1/ 3	33.3	0.0062	0.0065	0.00332	0.0036	0.0036	0.00375	0.0036	
Trichloroethene	79016	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
Trichlorofluoromethane	75694	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
Vinyl chloride	75014	mg/kg	0/ 3	0	0.012	0.013	0.00617			0.00665	0.0065	
cis-1,2-Dichloroethene	156592	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
cis-1,3-Dichloropropene	10061015	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	
trans-1,2-Dichloroethene	156605	mg/kg	0/ 3	0	0.0058	0.0065	0.00308			0.00338	0.00325	

RVAAP = Ravenna Army Ammunition Plant
CAS = Chemical Abstract Service
UCL = upper confidence limit
ESV = ecological screening value
Max = maximum concentration (maximum detect if at least one detect, otherwise maximum non detect)
PBT = persistant, bioaccumulative, and toxic compound (inorganics include cadmium, lead, merucy, and zinc; organics are chemicals with log Kow >= 3)
Bkg = background concentration
SRC = Site related chemical (from Army's usage records)
Non-SRCs based on knowledge of the historical processes at the 40 mm range are: metals -- iron; organics-semivolatiles -- 2,4-Dimethylphenol, 2-Chloronaphthalene, Benzo(a)pyrene, Dibenzo(a,h) anthracene, and Hexachlorobutadiene

[a]COPEC = chemical of potential ecological concern ["Yes" = 1) maximum concentration (detect if at least one detection, or, non detect if no detections) > ESV, or if detected and below ESV or "No ESV and is a PBT compound, and 2) maximum concentration is above background (inorganics) or there is no background data (inorganics and organics), and 3) analyte is a SRC; else, "No"
Dist = data distribution (X = neither normal nor lognormal; O = no detected concentrations; L = lognormal; N = normal; D = fewer than 50% detected or fewer than 8 detected - distribution not determined)
PCBs = polychlorinated biphenyls
Note that 3 analytes were eliminated per 0/ 0 detects, including bromoform; methyl acetate; and trans-1,3-dichloropropene;

Appendix Table C-4. Soil Screening in Subsurface Soil (1-3 ft) at 40 mm Range at RVAAP (cont'd)

DRAFT

Analyte	CAS Registry Number	Justification	Soil ESV	Max Exceeds ESV?	PBT		Max. > Bkg.?	SRC?	COPEC[a]?	Dist
					PBT Compound?	Detected?				
1,2-Dichlorobenzene	95501	No Detects	2.96E+00	No	yes	No		Yes	No	O
1,2-Dichloroethane	107062	No Detects	2.12E+01	No	no	Not PBT		Yes	No	O
1,2-Dichloropropane	78875	No Detects	7.00E+02	No	No Kow	No		Yes	No	O
1,2-Dimethylbenzene	95476	No Background Data Available	No ESV	No ESV	yes	Yes		Yes	Yes	D
1,3-Dichlorobenzene	541731	No Detects	3.77E+01	No	yes	No		Yes	No	O
1,4-Dichlorobenzene	106467	No Detects	2.00E+01	No	yes	No		Yes	No	O
2-Butanone	78933	No Detects	8.96E+01	No	no	Not PBT		Yes	No	O
2-Hexanone	591786	No Detects	1.26E+01	No	no	Not PBT		Yes	No	O
2-Methoxy-2-methylpropane	1634044	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Methyl-2-pentanone	108101	No Detects	4.43E+02	No	No Kow	Not PBT		Yes	No	O
Acetone	67641	No Detects	2.50E+00	No	no	Not PBT		Yes	No	O
Benzene	71432	No Detects	2.55E-01	No	no	Not PBT		Yes	No	O
Bromodichloromethane	75274	No Detects	5.40E-01	No	no	Not PBT		Yes	No	O
Bromomethane	74839	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Carbon disulfide	75150	No Background Data Available	9.41E-02	No	no	Not PBT		Yes	No	X
Carbon tetrachloride	56235	No Detects	1.00E+03	No	no	Not PBT		Yes	No	O
Chlorobenzene	108907	No Detects	4.00E+01	No	no	Not PBT		Yes	No	O
Chloroethane	75003	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Chloroform	67663	No Detects	1.19E+00	No	no	Not PBT		Yes	No	O
Chloromethane	74873	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Cumene	98828	No Detects	No ESV	No ESV	yes	No		Yes	No	O
Cyclohexane	110827	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Dibromochloromethane	124481	No Detects	2.05E+00	No	no	Not PBT		Yes	No	O
Dichlorodifluoromethane	75718	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Ethylbenzene	100414	No Detects	5.16E+00	No	yes	No		Yes	No	O
M + P Xylene	136777612	No Background Data Available	No ESV	No ESV	No Kow	Not PBT		Yes	No	D
Methylcyclohexane	108872	No Detects	No ESV	No ESV	yes	No		Yes	No	O
Methylene chloride	75092	No Detects	1.05E+00	No	no	Not PBT		Yes	No	O
Styrene	100425	No Detects	3.00E+02	No	no	Not PBT		Yes	No	O
Tetrachloroethene	127184	No Detects	1.00E+01	No	no	Not PBT		Yes	No	O
Toluene	108883	No Background Data Available	2.00E+02	No	no	Not PBT		Yes	No	D
Trichloroethene	79016	No Detects	1.00E+02	No	no	Not PBT		Yes	No	O
Trichlorofluoromethane	75694	No Detects	1.64E+01	No	no	Not PBT		Yes	No	O
Vinyl chloride	75014	No Detects	6.46E-01	No	no	Not PBT		Yes	No	O
cis-1,2-Dichloroethene	156592	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
cis-1,3-Dichloropropene	10061015	No Detects	3.98E-01	No	no	Not PBT		Yes	No	O
trans-1,2-Dichloroethene	156605	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O

Appendix Table C-5. Soil Screening in Deep Surface Soil (0-3 ft) at 40 mm Range at RVAAP

Analyte	CAS Registry Number	Units	Results >Detection Limit	% Results >Detection Limit	Minimum Nondetect	Maximum Nondetect	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background Criteria
Metals												
Aluminum	7429905	mg/kg	66/ 66	100			11700	3470	21000	12600	12600	17700
Antimony	7440360	mg/kg	0/ 66	0	0.18	0.52	0.156			0.164	0.164	0.96
Arsenic	7440382	mg/kg	66/ 66	100			13.8	5.7	30.3	15	15	15.4
Barium	7440393	mg/kg	66/ 66	100			64.3	21.9	144	71.3	71.3	88.4
Beryllium	7440417	mg/kg	59/ 59	100			0.679	0.32	1.2	0.719	0.719	0.88
Cadmium	7440439	mg/kg	23/ 66	34.8	0.016	0.074	0.0889	0.057	0.87	0.121	0.121	0
Calcium	7440702	mg/kg	66/ 66	100			931	144	9250	1220	1220	15800
Chromium, hexavalent	18540299	mg/kg	0/ 7	0	2.7	6.3	1.94			2.5	2.5	
Chromium	7440473	mg/kg	66/ 66	100			23.1	7.5	429	33.6	33.6	17.4
Cobalt	7440484	mg/kg	66/ 66	100			9.65	4.4	23.8	10.4	10.4	10.4
Copper	7440508	mg/kg	66/ 66	100			19	6	68.6	21	21	17.7
Iron	7439896	mg/kg	66/ 66	100			24700	13300	36900	25700	25700	23100
Lead	7439921	mg/kg	66/ 66	100			16	8.7	49.5	17.2	17.2	26.1
Magnesium	7439954	mg/kg	66/ 66	100			2400	575	4700	2590	2590	3030
Manganese	7439965	mg/kg	66/ 66	100			462	152	1300	512	512	1450
Mercury	7439976	mg/kg	0/ 66	0	0.013	0.061	0.011			0.0119	0.0119	0.036
Nickel	7440020	mg/kg	66/ 66	100			18.8	9.2	38.5	20.1	20.1	21.1
Potassium	7440097	mg/kg	66/ 66	100			1170	578	2400	1250	1250	927
Selenium	7782492	mg/kg	0/ 66	0	0.22	0.93	0.223			0.24	0.24	1.4
Silver	7440224	mg/kg	0/ 66	0	0.037	0.17	0.0309			0.0333	0.0333	0
Sodium	7440235	mg/kg	62/ 66	93.9	47.7	52.3	71.9	30.4	288	79	79	123
Thallium	7440280	mg/kg	12/ 66	18.2	0.31	1.8	0.669	1.9	2.8	0.838	0.838	0
Vanadium	7440622	mg/kg	66/ 66	100			21.2	9.2	34.1	22.5	22.5	31.1
Zinc	7440666	mg/kg	66/ 66	100			60.5	29.2	114	62.9	62.9	61.8
Organics-Explosives												
1,3,5-Trinitrobenzene	99354	mg/kg	0/ 53	0	0.1	0.1	0.05			0.05	0.05	
1,3-Dinitrobenzene	99650	mg/kg	0/ 66	0	0.1	0.1	0.05			0.05	0.05	
2,4,6-Trinitrotoluene	118967	mg/kg	1/ 66	1.52	0.1	0.1	0.0509	0.11	0.11	0.0524	0.0524	
2,4-Dinitrotoluene	121142	mg/kg	1/ 66	1.52	0.1	0.1	0.0507	0.096	0.096	0.0519	0.0519	
2,6-Dinitrotoluene	606202	mg/kg	0/ 66	0	0.1	0.1	0.05			0.05	0.05	
2-Amino-4,6-dinitrotoluene	35572782	mg/kg	0/ 66	0	0.1	0.1	0.05			0.05	0.05	
2-Nitrotoluene	88722	mg/kg	0/ 66	0	0.2	0.2	0.1			0.1	0.1	
3-Nitrotoluene	99081	mg/kg	2/ 66	3.03	0.2	0.2	0.1	0.098	0.1	0.1	0.1	
4-Amino-2,6-dinitrotoluene	19406510	mg/kg	0/ 66	0	0.1	0.1	0.05			0.05	0.05	
4-Nitrotoluene	99990	mg/kg	0/ 66	0	0.2	0.2	0.1			0.1	0.1	
HMX	2691410	mg/kg	1/ 66	1.52	0.2	0.2	0.103	0.28	0.28	0.107	0.107	
Nitrobenzene	98953	mg/kg	7/ 66	10.6	0.035	0.1	0.0479	0.033	0.07	0.0498	0.0498	
Nitrocellulose	9004700	mg/kg	7/ 7	100			43	20	64	55.3	55.3	
Nitroglycerin	55630	mg/kg	0/ 7	0	10	10	5			5	5	
Nitroguanidine	556887	mg/kg	0/ 7	0	0.13	0.13	0.065			0.065	0.065	
RDX	121824	mg/kg	0/ 66	0	0.2	0.2	0.1			0.1	0.1	
Tetryl	479458	mg/kg	1/ 53	1.89	0.2	0.2	0.101	0.17	0.17	0.104	0.104	
Organics-Pesticide/PCB												
4,4'-DDD	72548	mg/kg	0/ 7	0	0.0019	0.0024	0.00103			0.00109	0.00109	
4,4'-DDE	72559	mg/kg	1/ 7	14.3	0.0019	0.0024	0.000933	0.00033	0.00033	0.00114	0.00033	
4,4'-DDT	50293	mg/kg	0/ 7	0	0.0019	0.0024	0.00106			0.00113	0.00113	
Aldrin	309002	mg/kg	1/ 7	14.3	0.0019	0.0024	0.00106	0.0012	0.0012	0.00113	0.00113	
Chlordane	57749	mg/kg	0/ 7	0	0.039	0.047	0.0206			0.0217	0.0217	
Dieldrin	60571	mg/kg	0/ 7	0	0.0019	0.0024	0.00104			0.00109	0.00109	
Endosulfan I	959988	mg/kg	0/ 7	0	0.0019	0.0024	0.00103			0.00109	0.00109	
Endosulfan II	33213659	mg/kg	0/ 7	0	0.0019	0.0024	0.00103			0.00109	0.00109	
Endosulfan sulfate	1031078	mg/kg	0/ 7	0	0.0019	0.0024	0.00103			0.00109	0.00109	
Endrin	72208	mg/kg	0/ 7	0	0.0019	0.0026	0.00107			0.00117	0.00117	
Endrin aldehyde	7421934	mg/kg	1/ 7	14.3	0.0019	0.0024	0.00101	0.00085	0.00085	0.00108	0.00085	

Appendix Table C-5. Soil Screening in Deep Surface Soil (0-3 ft) at 40 mm Range at RVAAP (cont'd)

Analyte	CAS Registry Number	Justification	Soil ESV	Max Exceeds ESV?	PBT: PBT Compound?	PBT: Detected?	Max. > Bkg.?	SRC?	COPEC[a]?	Dist
Metals										
Aluminum	7429905	Above Background	6.00E+02	Yes	No	Not PBT	Yes	Yes	**Yes**	X
Antimony	7440360	No Detects	5.00E+00	No	No	Not PBT	No	Yes	No	O
Arsenic	7440382	Above Background	9.90E+00	Yes	No	Not PBT	Yes	Yes	**Yes**	L
Barium	7440393	Above Background	2.83E+02	No	No	Not PBT	Yes	Yes	No	L
Beryllium	7440417	Above Background	1.00E+01	No	No	Not PBT	Yes	Yes	No	L
Cadmium	7440439	Above Background	4.00E+00	No	Yes	Yes	Yes	Yes	**Yes**	D
Calcium	7440702	Essential Element	No ESV	No ESV	No	Not PBT	No	Yes	No	X
Chromium, hexavalent	18540299	No Detects	4.00E-01	Yes	No	Not PBT		Yes	**Yes**	O
Chromium	7440473	Above Background	4.00E-01	Yes	No	Not PBT	Yes	Yes	**Yes**	X
Cobalt	7440484	Above Background	2.00E+01	Yes	No	Not PBT	Yes	Yes	**Yes**	X
Copper	7440508	Above Background	1.39E+01	Yes	No	Not PBT	Yes	Yes	**Yes**	X
Iron	7439896	Essential Element	2.00E+02	Yes	No	Not PBT	Yes	No	No	N
Lead	7439921	Above Background	4.05E+01	Yes	Yes	Yes	Yes	Yes	**Yes**	X
Magnesium	7439954	Essential Element	No ESV	No ESV	No	Not PBT	Yes	Yes	No	N
Manganese	7439965	Below Background	1.00E+02	Yes	No	Not PBT	No	Yes	No	L
Mercury	7439976	No Detects	5.10E-04	Yes	Yes	No	No	Yes	No	O
Nickel	7440020	Above Background	3.00E+01	Yes	No	Not PBT	Yes	Yes	**Yes**	L
Potassium	7440097	Essential Element	No ESV	No ESV	No	Not PBT	Yes	Yes	No	L
Selenium	7782492	No Detects	2.10E-01	Yes	No	Not PBT	No	Yes	No	O
Silver	7440224	No Detects	2.00E+00	No	No	Not PBT		Yes	No	O
Sodium	7440235	Essential Element	No ESV	No ESV	No	Not PBT	Yes	Yes	No	X
Thallium	7440280	Above Background	1.00E+00	Yes	No	Not PBT	Yes	Yes	**Yes**	D
Vanadium	7440622	Above Background	2.00E+00	Yes	No	Not PBT	Yes	Yes	**Yes**	N
Zinc	7440666	Above Background	8.50E+00	Yes	Yes	Yes	Yes	Yes	**Yes**	X
Organics-Explosives										
1,3,5-Trinitrobenzene	99354	No Detects	8.60E-01	No	no	Not PBT		Yes	No	O
1,3-Dinitrobenzene	99650	No Detects	6.55E-01	No	no	Not PBT		Yes	No	O
2,4,6-Trinitrotoluene	118967	No Background Data Available	7.10E+01	No	no	Not PBT		Yes	No	D
2,4-Dinitrotoluene	121142	No Background Data Available	1.28E+00	No	no	Not PBT		Yes	No	D
2,6-Dinitrotoluene	606202	No Detects	3.28E-02	Yes	no	Not PBT		Yes	**Yes**	O
2-Amino-4,6-dinitrotoluene	35572782	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
2-Nitrotoluene	88722	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
3-Nitrotoluene	99081	No Background Data Available	No ESV	No ESV	no	Not PBT		Yes	No	D
4-Amino-2,6-dinitrotoluene	19406510	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Nitrotoluene	99990	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
HMX	2691410	No Background Data Available	No ESV	No ESV	No Kow	Not PBT		Yes	No	D
Nitrobenzene	98953	No Background Data Available	4.00E+01	No	no	Not PBT		Yes	No	D
Nitrocellulose	9004700	No Background Data Available	No ESV	No ESV	No Kow	Not PBT		Yes	No	N
Nitroglycerin	55630	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Nitroguanidine	556887	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
RDX	121824	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Tetryl	479458	No Background Data Available	No ESV	No ESV	No Kow	Not PBT		Yes	No	D
Organics-Pesticide/PCB										
4,4'-DDD	72548	No Detects	7.58E-01	No	yes	No		Yes	No	O
4,4'-DDE	72559	No Background Data Available	5.96E-01	No	yes	Yes		Yes	**Yes**	D
4,4'-DDT	50293	No Detects	3.50E-03	No	yes	No		Yes	No	O
Aldrin	309002	No Background Data Available	3.32E-03	No	yes	Yes		Yes	**Yes**	D
Chlordane	57749	No Detects	2.24E-01	No	yes	No		Yes	No	O
Dieldrin	60571	No Detects	2.38E-03	Yes	yes	No		Yes	**Yes**	O
Endosulfan I	959988	No Detects	No ESV	No ESV	yes	No		Yes	No	O
Endosulfan II	33213659	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Endosulfan sulfate	1031078	No Detects	3.58E-02	No	yes	No		Yes	No	O
Endrin	72208	No Detects	1.01E-02	No	yes	No		Yes	No	O
Endrin aldehyde	7421934	No Background Data Available	1.05E-02	No	yes	[illegible]		Yes	**Yes**	D

Appendix Table C-5. Soil Screening in Deep Surface Soil (0-3 ft) at 40 mm Range at RVAAP

Analyte	CAS Registry Number	Units	Results >Detection Limit	% Results >Detection Limit	Minimum Nondetect	Maximum Nondetect	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background Criteria
Endrin ketone	53494705	mg/kg	1/ 7	14.3	0.0019	0.0024	0.000934	0.00034	0.00034	0.00114	0.00034	
Heptachlor	76448	mg/kg	1/ 7	14.3	0.0019	0.0024	0.000999	0.00079	0.00079	0.00109	0.00079	
Heptachlor epoxide	1024573	mg/kg	0/ 7	0	0.0019	0.0024	0.00103			0.00109	0.00109	
Lindane	58899	mg/kg	1/ 7	14.3	0.0019	0.0024	0.00102	0.00093	0.00093	0.00108	0.00093	
Methoxychlor	72435	mg/kg	0/ 7	0	0.0019	0.0024	0.00103			0.00109	0.00109	
PCB-1016	12674112	mg/kg	0/ 7	0	0.039	0.047	0.0206			0.0217	0.0217	
PCB-1221	11104282	mg/kg	0/ 7	0	0.039	0.047	0.0206			0.0217	0.0217	
PCB-1232	11141165	mg/kg	0/ 7	0	0.039	0.047	0.0206			0.0217	0.0217	
PCB-1242	53469219	mg/kg	0/ 7	0	0.039	0.047	0.0206			0.0217	0.0217	
PCB-1248	12672296	mg/kg	0/ 7	0	0.039	0.047	0.0206			0.0217	0.0217	
PCB-1254	11097691	mg/kg	0/ 7	0	0.039	0.047	0.0206			0.0217	0.0217	
PCB-1260	11096825	mg/kg	0/ 7	0	0.039	0.047	0.0206			0.0217	0.0217	
Toxaphene	8001352	mg/kg	0/ 7	0	0.039	0.047	0.0206			0.0217	0.0217	
alpha-BHC	319846	mg/kg	0/ 7	0	0.0019	0.0024	0.00103			0.00109	0.00109	
alpha-Chlordane	5103719	mg/kg	0/ 7	0	0.0019	0.0024	0.00103			0.00109	0.00109	
beta-BHC	319857	mg/kg	0/ 7	0	0.0019	0.0024	0.00103			0.00109	0.00109	
delta-BHC	319868	mg/kg	0/ 7	0	0.0019	0.0024	0.00103			0.00109	0.00109	
gamma-Chlordane	5103742	mg/kg	0/ 7	0	0.0019	0.0024	0.00103			0.00109	0.00109	
Organics-Semivolatile												
1,1-Biphenyl	92524	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
2,4,5-Trichlorophenol	95954	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
2,4,6-Trichlorophenol	88062	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
2,4-Dichlorophenol	120832	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
2,4-Dimethylphenol	105679	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
2,4-Dinitrophenol	51285	mg/kg	0/ 1	0	0.78	0.94	0.4				0.4	
2-Chloronaphthalene	91587	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
2-Chlorophenol	95578	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
2-Methyl-4,6-dinitrophenol	534521	mg/kg	0/ 7	0	0.78	0.94	0.413			0.433	0.433	
2-Methylnaphthalene	91576	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
2-Methylphenol	95487	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
2-Nitrobenzenamine	88744	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
2-Nitrophenol	88755	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
3,3'-Dichlorobenzidine	91941	mg/kg	0/ 1	0	0.78	0.94	0.4				0.4	
3-Nitrobenzenamine	99092	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
4-Bromophenyl phenyl ether	101553	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
4-Chloro-3-methylphenol	59507	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
4-Chlorobenzenamine	106478	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
4-Chlorophenyl phenyl ether	7005723	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
4-Methylphenol	106445	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
4-Nitrobenzenamine	100016	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
4-Nitrophenol	100027	mg/kg	0/ 7	0	0.78	0.94	0.413			0.433	0.433	
Acenaphthene	83329	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Acenaphthylene	208968	mg/kg	0/ 1	0	0.39	0.47	0.2				0.2	
Acetophenone	98862	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Anthracene	120127	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Atrazine	1912249	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Benz(a)anthracene	56553	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Benzaldehyde	100527	mg/kg	0/ 1	0	0.39	0.47	0.2				0.2	
Benzo(a)pyrene	50328	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Benzo(b)fluoranthene	205992	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Benzo(ghi)perylene	191242	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Benzo(k)fluoranthene	207089	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Bis(2-chloroethoxy)methane	111911	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Bis(2-chloroethyl) ether	111444	mg/kg	0/ 1	0	0.39	0.47	0.2				0.2	
Bis(2-chloroisopropyl) ether	108601	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	

Appendix Table C-5. Soil Screening in Deep Surface Soil (0-3 ft) at 40 mm Range at RVAAP (cont'd)

Analyte	CAS Registry Number	Justification	Soil ESV	Max Exceeds ESV?	PBT: PBT Compound?	PBT: Detected?	Max. > Bkg.?	SRC?	COPEC[a]?	Dist
Endrin ketone	53494705	No Background Data Available	No ESV	No ESV	No Kow	Not PBT		Yes	No	D
Heptachlor	76448	No Background Data Available	5.98E-03	No	yes	Yes		Yes	**Yes**	D
Heptachlor epoxide	1024573	No Detects	1.52E-01	No	yes	No		Yes	No	O
Lindane	58899	No Background Data Available	5.00E-03	No	yes	Yes		Yes	**Yes**	D
Methoxychlor	72435	No Detects	1.99E-02	No	yes	No		Yes	No	O
PCB-1016	12674112	No Detects	No ESV	No ESV	yes	No		Yes	No	O
PCB-1221	11104282	No Detects	No ESV	No ESV	yes	No		Yes	No	O
PCB-1232	11141165	No Detects	No ESV	No ESV	yes	No		Yes	No	O
PCB-1242	53469219	No Detects	No ESV	No ESV	yes	No		Yes	No	O
PCB-1248	12672296	No Detects	No ESV	No ESV	yes	No		Yes	No	O
PCB-1254	11097691	No Detects	No ESV	No ESV	yes	No		Yes	No	O
PCB-1260	11096825	No Detects	No ESV	No ESV	yes	No		Yes	No	O
Toxaphene	8001352	No Detects	1.19E-01	No	yes	No		Yes	No	O
alpha-BHC	319846	No Detects	No ESV	No ESV	yes	No		Yes	No	O
alpha-Chlordane	5103719	No Detects	2.24E-01	No	No Kow	Not PBT		Yes	No	O
beta-BHC	319857	No Detects	3.98E-03	No	yes	No		Yes	No	O
delta-BHC	319868	No Detects	No ESV	No ESV	yes	No		Yes	No	O
gamma-Chlordane	5103742	No Detects	2.24E-01	No	No Kow	Not PBT		Yes	No	O
Organics-Semivolatile										
1,1-Biphenyl	92524	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
2,4,5-Trichlorophenol	95954	No Detects	9.00E+00	No	No Kow	Not PBT		Yes	No	O
2,4,6-Trichlorophenol	88062	No Detects	4.00E+00	No	yes	No		Yes	No	O
2,4-Dichlorophenol	120832	No Detects	2.00E+01	No	yes	No		Yes	No	O
2,4-Dimethylphenol	105679	No Detects	1.00E-02	Yes	no	Not PBT		No	No	O
2,4-Dinitrophenol	51285	No Detects	2.00E+01	No	no	Not PBT		Yes	No	O
2-Chloronaphthalene	91587	No Detects	1.22E-02	Yes	yes	No		No	No	O
2-Chlorophenol	95578	No Detects	6.00E+01	No	no	Not PBT		Yes	No	O
2-Methyl-4,6-dinitrophenol	534521	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
2-Methylnaphthalene	91576	No Detects	3.24E+00	No	no	Not PBT		Yes	No	O
2-Methylphenol	95487	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
2-Nitrobenzenamine	88744	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
2-Nitrophenol	88755	No Detects	1.60E+00	No	no	Not PBT		Yes	No	O
3,3'-Dichlorobenzidine	91941	No Detects	6.46E-01	Yes	yes	No		Yes	**Yes**	O
3-Nitrobenzenamine	99092	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Bromophenyl phenyl ether	101553	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Chloro-3-methylphenol	59507	No Detects	No ESV	No ESV	yes	No		Yes	No	O
4-Chlorobenzenamine	106478	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Chlorophenyl phenyl ether	7005723	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Methylphenol	106445	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
4-Nitrobenzenamine	100016	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Nitrophenol	100027	No Detects	5.12E+00	No	no	Not PBT		Yes	No	O
Acenaphthene	83329	No Detects	2.00E+01	No	yes	No		Yes	No	O
Acenaphthylene	208968	No Detects	6.82E+02	No	yes	No		Yes	No	O
Acetophenone	98862	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Anthracene	120127	No Detects	1.48E+03	No	yes	No		Yes	No	O
Atrazine	1912249	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Benz(a)anthracene	56553	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Benzaldehyde	100527	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Benzo(a)pyrene	50328	No Detects	1.52E+00	No	yes	No		No	No	O
Benzo(b)fluoranthene	205992	No Detects	5.98E+01	No	yes	No		Yes	No	O
Benzo(ghi)perylene	191242	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Benzo(k)fluoranthene	207089	No Detects	1.48E+02	No	yes	No		Yes	No	O
Bis(2-chloroethoxy)methane	111911	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Bis(2-chloroethyl) ether	111444	No Detects	2.37E+01	No	No Kow	Not PBT		Yes	No	O
Bis(2-chloroisoprop[illegible]	108601	No Detects	No ESV	No ESV	No Kow	N[illegible]		Yes	No	O

Appendix Table C-5. Soil Screening in Deep Surface Soil (0-3 ft) at 40 mm Range at RVAAP

Analyte	CAS Registry Number	Units	Results >Detection Limit	% Results >Detection Limit	Minimum Nondetect	Maximum Nondetect	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background Criteria
Bis(2-ethylhexyl)phthalate	117817	mg/kg	1/ 7	14.3	0.39	0.47	0.199	0.15	0.15	0.217	0.15	
Butyl benzyl phthalate	85687	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Caprolactam	105602	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Carbazole	86748	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Chrysene	218019	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Di-n-butyl phthalate	84742	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Di-n-octylphthalate	117840	mg/kg	0/ 1	0	0.39	0.47	0.2				0.2	
Dibenz(a,h)anthracene	53703	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Dibenzofuran	132649	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Diethyl phthalate	84662	mg/kg	1/ 7	14.3	0.39	0.47	0.977	5.6	5.6	2.47	2.47	
Dimethyl phthalate	131113	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Fluoranthene	206440	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Fluorene	86737	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Hexachlorobenzene	118741	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Hexachlorobutadiene	87683	mg/kg	0/ 1	0	0.39	0.47	0.2				0.2	
Hexachlorocyclopentadiene	77474	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Hexachloroethane	67721	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Indeno(1,2,3-cd)pyrene	193395	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Isophorone	78591	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
N-Nitroso-di-n-propylamine	621647	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
N-Nitrosodiphenylamine	86306	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Naphthalene	91203	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Pentachlorophenol	87865	mg/kg	0/ 7	0	0.78	0.94	0.413			0.433	0.433	
Phenanthrene	85018	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Phenol	108952	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Pyrene	129000	mg/kg	0/ 7	0	0.39	0.47	0.206			0.217	0.217	
Organics-Volatile												
1,1,1-Trichloroethane	71556	mg/kg	1/ 7	14.3	0.0058	0.0069	0.00453	0.013	0.013	0.00728	0.00728	
1,1,2,2-Tetrachloroethane	79345	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
1,1,2-Trichloro-1,2,2-trifluoroetha	76131	mg/kg	0/ 3	0	0.0058	0.0069	0.00297			0.0031	0.00305	
1,1,2-Trichloroethane	79005	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
1,1-Dichloroethane	75343	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
1,1-Dichloroethene	75354	mg/kg	1/ 5	20	0.0058	0.0069	0.00405	0.0074	0.0074	0.00584	0.00584	
1,2,4-Trichlorobenzene	120821	mg/kg	0/ 3	0	0.0058	0.0069	0.00297			0.0031	0.00305	
1,2-Dibromo-3-chloropropane	96128	mg/kg	0/ 3	0	0.0058	0.0069	0.00297			0.0031	0.00305	
1,2-Dibromoethane	106934	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
1,2-Dichlorobenzene	95501	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
1,2-Dichloroethane	107062	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
1,2-Dichloropropane	78875	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
1,2-Dimethylbenzene	95476	mg/kg	1/ 7	14.3	0.0059	0.0069	0.00298	0.002	0.002	0.00332	0.002	
1,3-Dichlorobenzene	541731	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
1,4-Dichlorobenzene	106467	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
2-Butanone	78933	mg/kg	0/ 3	0	0.012	0.014	0.006			0.006	0.006	
2-Hexanone	591786	mg/kg	0/ 3	0	0.012	0.014	0.006			0.006	0.006	
2-Methoxy-2-methylpropane	1634044	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
4-Methyl-2-pentanone	108101	mg/kg	0/ 7	0	0.012	0.014	0.00621			0.0065	0.0065	
Acetone	67641	mg/kg	0/ 3	0	0.0066	0.015	0.00513			0.00724	0.0065	
Benzene	71432	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
Bromodichloromethane	75274	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
Bromomethane	74839	mg/kg	0/ 3	0	0.012	0.014	0.006			0.006	0.006	
Carbon disulfide	75150	mg/kg	2/ 7	28.6	0.0059	0.0069	0.00498	0.0031	0.016	0.00855	0.00855	
Carbon tetrachloride	56235	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
Chlorobenzene	108907	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
Chloroethane	75003	mg/kg	0/ 7	0	0.012	0.014	0.00621			0.0065	0.0065	
Chloroform	67663	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	

Appendix Table C-5. Soil Screening in Deep Surface Soil (0-3 ft) at 40 mm Range at RVAAP (cont'd)

Analyte	CAS Registry Number	Justification	Soil ESV	Max Exceeds ESV?	PBT: PBT Compound?	PBT: Detected?	Max. > Bkg.?	SRC?	COPEC^a?	Dist
Bis(2-ethylhexyl)phthalate	117817	No Background Data Available	9.26E-01	No	yes	Yes		Yes	**Yes**	D
Butyl benzyl phthalate	85687	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Caprolactam	105602	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Carbazole	86748	No Detects	No ESV	No ESV	yes	No		Yes	No	O
Chrysene	218019	No Detects	4.73E+00	No	yes	No		Yes	No	O
Di-n-butyl phthalate	84742	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Di-n-octylphthalate	117840	No Detects	7.09E+02	No	yes	No		Yes	No	O
Dibenz(a,h)anthracene	53703	No Detects	No ESV	No ESV	No Kow	Not PBT		No	No	O
Dibenzofuran	132649	No Detects	No ESV	No ESV	yes	No		Yes	No	O
Diethyl phthalate	84662	No Background Data Available	No ESV	No ESV	No Kow	Not PBT		Yes	No	D
Dimethyl phthalate	131113	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Fluoranthene	206440	No Detects	1.22E+02	No	yes	No		Yes	No	O
Fluorene	86737	No Detects	3.00E+01	No	yes	No		Yes	No	O
Hexachlorobenzene	118741	No Detects	1.00E+03	No	yes	No		Yes	No	O
Hexachlorobutadiene	87683	No Detects	3.98E-02	Yes	yes	No		No	No	O
Hexachlorocyclopentadiene	77474	No Detects	1.00E+01	No	yes	No		Yes	No	O
Hexachloroethane	67721	No Detects	5.96E-01	No	yes	No		Yes	No	O
Indeno(1,2,3-cd)pyrene	193395	No Detects	1.09E+02	No	yes	No		Yes	No	O
Isophorone	78591	No Detects	1.39E+02	No	no	Not PBT		Yes	No	O
N-Nitroso-di-n-propylamine	621647	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
N-Nitrosodiphenylamine	86306	No Detects	2.00E+01	No	yes	No		Yes	No	O
Naphthalene	91203	No Detects	1.00E+01	No	yes	No		Yes	No	O
Pentachlorophenol	87865	No Detects	3.00E+00	No	yes	No		Yes	No	O
Phenanthrene	85018	No Detects	4.57E+01	No	yes	No		Yes	No	O
Phenol	108952	No Detects	3.00E+01	No	no	Not PBT		Yes	No	O
Pyrene	129000	No Detects	7.85E+01	No	yes	No		Yes	No	O
Organics-Volatile										
1,1,1-Trichloroethane	71556	No Background Data Available	2.98E+01	No	no	Not PBT		Yes	No	D
1,1,2,2-Tetrachloroethane	79345	No Detects	1.27E-01	No	no	Not PBT		Yes	No	O
1,1,2-Trichloro-1,2,2-trifluoro	76131	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
1,1,2-Trichloroethane	79005	No Detects	2.86E+01	No	no	Not PBT		Yes	No	O
1,1-Dichloroethane	75343	No Detects	2.01E+01	No	yes	No		Yes	No	O
1,1-Dichloroethene	75354	No Background Data Available	8.28E+00	No	no	Not PBT		Yes	No	D
1,2,4-Trichlorobenzene	120821	No Detects	2.00E+01	No	yes	No		Yes	No	O
1,2-Dibromo-3-chloropropane	96128	No Detects	3.52E-02	No	no	Not PBT		Yes	No	O
1,2-Dibromoethane	106934	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
1,2-Dichlorobenzene	95501	No Detects	2.96E+00	No	yes	No		Yes	No	O
1,2-Dichloroethane	107062	No Detects	2.12E+01	No	no	Not PBT		Yes	No	O
1,2-Dichloropropane	78875	No Detects	7.00E+02	No	No Kow	Not PBT		Yes	No	O
1,2-Dimethylbenzene	95476	No Background Data Available	No ESV	No ESV	yes	Yes		Yes	**Yes**	D
1,3-Dichlorobenzene	541731	No Detects	3.77E+01	No	yes	No		Yes	No	O
1,4-Dichlorobenzene	106467	No Detects	2.00E+01	No	yes	No		Yes	No	O
2-Butanone	78933	No Detects	8.96E+01	No	no	Not PBT		Yes	No	O
2-Hexanone	591786	No Detects	1.26E+01	No	no	Not PBT		Yes	No	O
2-Methoxy-2-methylpropane	1634044	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
4-Methyl-2-pentanone	108101	No Detects	4.43E+02	No	No Kow	Not PBT		Yes	No	O
Acetone	67641	No Detects	2.50E+00	No	no	Not PBT		Yes	No	O
Benzene	71432	No Detects	2.55E-01	No	no	Not PBT		Yes	No	O
Bromodichloromethane	75274	No Detects	5.40E-01	No	no	Not PBT		Yes	No	O
Bromomethane	74839	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Carbon disulfide	75150	No Background Data Available	9.41E-02	No	no	Not PBT		Yes	No	D
Carbon tetrachloride	56235	No Detects	1.00E+03	No	no	Not PBT		Yes	No	O
Chlorobenzene	108907	No Detects	4.00E+01	No	no	Not PBT		Yes	No	O
Chloroethane	75003	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Chloroform	67663	No Detects	1.19E+00	No	no	[illegible]		Yes	No	O

Appendix Table C-5. Soil Screening in Deep Surface Soil (0-3 ft) at 40 mm Range at RVAAP

Analyte	CAS Registry Number	Units	Results >Detection Limit	% Results >Detection Limit	Minimum Nondetect	Maximum Nondetect	Average Result	Minimum Detect	Maximum Detect	95% UCL of Mean	Exposure Concentration	Background Criteria
Chloromethane	74873	mg/kg	0/ 7	0	0.012	0.014	0.00621			0.0065	0.0065	
Cumene	98828	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
Cyclohexane	110827	mg/kg	0/ 3	0	0.0058	0.0069	0.00297			0.0031	0.00305	
Dibromochloromethane	124481	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
Dichlorodifluoromethane	75718	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
Ethylbenzene	100414	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
M + P Xylene	136777612	mg/kg	1/ 7	14.3	0.0059	0.0069	0.00342	0.0051	0.0051	0.00398	0.00398	
Methylcyclohexane	108872	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
Methylene chloride	75092	mg/kg	0/ 3	0	0.007	0.014	0.00517			0.0076	0.006	
Styrene	100425	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
Tetrachloroethene	127184	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
Toluene	108883	mg/kg	2/ 7	28.6	0.0059	0.0069	0.00306	0.002	0.0036	0.00344	0.00344	
Trichloroethene	79016	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
Trichlorofluoromethane	75694	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
Vinyl chloride	75014	mg/kg	0/ 7	0	0.012	0.014	0.00621			0.0065	0.0065	
cis-1,2-Dichloroethene	156592	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
cis-1,3-Dichloropropene	10061015	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	
trans-1,2-Dichloroethene	156605	mg/kg	0/ 7	0	0.0058	0.0069	0.00311			0.00325	0.00325	

RVAAP = Ravenna Army Ammunition Plant
CAS = Chemical Abstract Service
UCL = upper confidence limit
ESV = ecological screening value
Max = maximum concentration (maximum detect if at least one detect, otherwise maximum non detect)
PBT = persistant, bioaccumulative, and toxic compound (inorganics include cadmium, lead, merucy, and zinc; organics are chemicals with log Kow >= 3)
Bkg = background concentration
SRC = Site related chemical (from Army's usage records)
Non-SRCs based on knowledge of the historical processes at the 40 mm range are: metals -- iron; organics-semivolatiles -- 2,4-Dimethylphenol, 2-Chloronaphthalene, Benzo(a)pyrene, Dibenzo(a,h) anthracene, and Hexachlorobutadiene
[a]COPEC = chemical of potential ecological concern ["**Yes**" = 1) maximum concentration (detect if at least one detection, or, non detect if no detections) > ESV, or if detected and below ESV or "No ESV and is a PBT compound, and 2) maximum concentration is above background (inorganics) or there is no background data (inorganics and organics), and 3) analyte is a SRC; else, "No"
Dist = data distribution (X = neither normal nor lognormal; O = no detected concentrations; L = lognormal; N = normal; D = fewer than 50% detected or fewer than 8 detected - distribution not determined)
PCBs = polychlorinated biphenyls
Note that 3 analytes were eliminated per 0/ 0 detects, including bromoform; methyl acetate; and trans-1,3-dichloropropene;

Appendix Table C-5. Soil Screening in Deep Surface Soil (0-3 ft) at 40 mm Range at RVAAP (cont'd)

Analyte	CAS Registry Number	Justification	Soil ESV	Max Exceeds ESV?	PBT: PBT Compound?	PBT: Detected?	Max. > Bkg.?	SRC?	COPEC[a]?	Dist
Chloromethane	74873	No Detects	No ESV	No ESV	no	Not PBT		Yes	No	O
Cumene	98828	No Detects	No ESV	No ESV	yes	No		Yes	No	O
Cyclohexane	110827	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Dibromochloromethane	124481	No Detects	2.05E+00	No	no	Not PBT		Yes	No	O
Dichlorodifluoromethane	75718	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
Ethylbenzene	100414	No Detects	5.16E+00	No	yes	No		Yes	No	O
M + P Xylene	136777612	No Background Data Available	No ESV	No ESV	No Kow	Not PBT		Yes	No	D
Methylcyclohexane	108872	No Detects	No ESV	No ESV	yes	No		Yes	No	O
Methylene chloride	75092	No Detects	1.05E+00	No	no	Not PBT		Yes	No	O
Styrene	100425	No Detects	3.00E+02	No	no	Not PBT		Yes	No	O
Tetrachloroethene	127184	No Detects	1.00E+01	No	no	Not PBT		Yes	No	O
Toluene	108883	No Background Data Available	2.00E+02	No	no	Not PBT		Yes	No	D
Trichloroethene	79016	No Detects	1.00E+02	No	no	Not PBT		Yes	No	O
Trichlorofluoromethane	75694	No Detects	1.64E+01	No	no	Not PBT		Yes	No	O
Vinyl chloride	75014	No Detects	6.46E-01	No	no	Not PBT		Yes	No	O
cis-1,2-Dichloroethene	156592	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O
cis-1,3-Dichloropropene	10061015	No Detects	3.98E-01	No	no	Not PBT		Yes	No	O
trans-1,2-Dichloroethene	156605	No Detects	No ESV	No ESV	No Kow	Not PBT		Yes	No	O

Appendix Table C-6. Receptor Parameters for Cottontail Rabbits

Parameter	Definition	Receptor: Eastern Cottontail *(Sylvilagus floridanus)* Value	Reference / Notes
BW	Body weight (kg)	1.22	Arithmetic mean of means, both sexes, all seasons (EPA 1993)
HR	Home range (ha)	3.1	(EPA 1993)
TUF	Temporal use factor	1	Will be 1 unless a specific value exists for a receptor
IR_F	Food ingestion rate (g/g-d = kg/kgBW/d)[a]	0.2	Dalke and Slime (1941)
PF	Plant fraction	0.94	Exclusively herbivorous, assumed to be vegetative parts (EPA 1993)
AF	Animal fraction	0	Not stated in EPA (1993), assumed to be 0
SF	Soil fraction	0.063	Assumed comparable to that for black-tailed jackrabbit (6.3%) (Arthur and Gates 1988)
IR_w	Water ingestion rate (g/g-d = L/kgBW/d)	0.097	(EPA 1993)

[a] Food ingestion rate (g/g-d) reexpressed as kg/kgBW/d is assumed not to include ingested soil; therefore, PF+AF = 1.0

Appendix Table C-7. Receptor Parameters for Short-tailed shrew

Parameter	Definition	Receptor: Short-tailed shrew *(Blarina brevicauda)* Value	Reference / Notes
BW	Body weight (kg)	0.017	Arithmetic mean of means, both sexes, fall and summer, western Pennsylvania (EPA 1993)
HR	Home range (ha)	0.1	Minimum, adult and juveniles, Michigan and New York (EPA 1993)
TUF	Temporal use factor	1	Will be 1 unless a specific value exists for a receptor
IR_F	Food ingestion rate (g/g-d = kg/kgBW/d)[a]	0.56	Arithmetic mean of adults, both sexes, 25oC, Wisconsin (EPA 1993)
PF	Plant fraction	0.13	June through October, New York (EPA 1993); assuming vegetative parts and fungi
AF	Animal fraction	0.87	June through October, New York (EPA 1993); assuming 100% earthworms
SF	Soil fraction	0.06	EPA (1999)
IR_w	Water ingestion rate (g/g-d = L/kgBW/d)	0.223	Adult, both sexes, Illinois, lab (EPA 1993)

[a] Food ingestion rate (g/g-d) reexpressed as kg/kgBW/d is assumed not to include ingested soil; therefore, PF+AF = 1.0

Appendix Table C-8 Receptor Parameters for Red Fox

Parameter	Definition	Receptor: Red fox *(Vulpes vulpes)* Value	Reference / Notes
BW	Body weight (kg)	4.535	Arithmetic average of means, both sexes, (EPA 1993)
HR	Home range (ha)	504	Arithmetic mean, adult, both sexes, Minnesota and Wisconsin (EPA 1993)
TUF	Temporal use factor	1	Will be 1 unless a specific value exists for a receptor
IR_F	Food ingestion rate (g/g-d = kg/kgBW/d)[a]	0.095	Adult, non-breeding, North Dakota (EPA 1993)
PF	Plant fraction	0.046	Illinois farm/woods, spring, % wet weight (EPA 1993); assumed to be reproductive parts
AF	Animal fraction	0.954	Illinois farm/woods, spring, % wet weight, including unspecified/other (EPA 1993)
SF	Soil fraction	0.028	Estimated percent soil in diet, dry weight (EPA 1993)
IR_w	Water ingestion rate (g/g-d = L/kgBW/d)	0.085	Arithmetic mean, adult, both sexes (EPA 1993)

[a] Food ingestion rate (g/g-d) reexpressed as kg/kgBW/d is assumed not to include ingested soil; therefore, PF+AF = 1.0

Appendix Table C-9. Receptor Parameters for Red-tailed Hawk

Parameter	Definition	Receptor: Red-tailed hawk *(Buteo jamaicensis)* Value	Reference / Notes
BW	Body weight (kg)	1.134	Arithmetic mean, female and male, Michigan (EPA 1993)
HR	Home range (ha)	876	Mean, adults, both sexes, (EPA 1993)
TUF	Temporal use factor	1	Will be 1 unless a specific value exists for a receptor
IR_F	Food ingestion rate (g/g-d = kg/kgBW/d)[a]	0.11	Adult female, winter, Michigan, captive outdoors (EPA 1993)
PF	Plant fraction	0	Not stated in EPA (1993); assumed to be negligible
AF	Animal fraction	1	Prey brought to nests (EPA 1993)
SF	Soil fraction	0	Not stated in EPA (1993) and Beyer et al. (1994); assumed to be negligible.
IR_w	Water ingestion rate (g/g-d = L/kgBW/d)	0.057	Arithmetic mean, both sexes, estimated (EPA 1993)

[a] Food ingestion rate (g/g/-d) reexpressed as kg/kgBW/d is assumed not to include ingested soil; therefore, PF+AF = 1.0

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
Organic Compounds							
Aromatic Halogenated Hydrocarbons							
2,3,4,6-Tetrachlorophenol	58-90-2	4.30	2.40	1.26E-01	Equation 1	3.0E-04	Equation 2[b]
4-Chloro-3-methylphenol	59-50-7	3.10	2.57	6.25E-01	Equation 1	2.5E-04	Equation 2
Aromatic Nonhalogenated Hydrocarbons							
2-Nitrotoluene	88-72-2	2.30	2.63	1.81E+00	Equation 1	2.2E-04	Equation 2
4-Nitrobiphenyl	92-93-3	3.77	3.09	2.56E-01	Equation 1	2.8E-04	Equation 2
Benzaldehyde	100-52-7	1.48	1.30	5.42E+00	Equation 1	1.9E-04	Equation 2
Benzene	71-43-2	2.14	1.79	2.25E+00	Equation 1	2.1E-04	Equation 2
Benzyl alcohol	100-51-6	1.10	1.01	8.95E+00	Equation 1	1.8E-04	Equation 2
Ethyl benzene	100-41-4	3.12	2.31	6.06E-01	Equation 1	2.5E-04	Equation 2
m-Xylene	108-38-3	3.20	2.29	5.47E-01	Equation 1	2.5E-04	Equation 2
o-Xylene	95-47-6	3.13	2.38	6.01E-01	Equation 1	2.5E-04	Equation 2
1,2-Dimethylbenzene	95-47-6	3.13	2.38	6.01E-01	Equation 1	2.5E-04	Equation 2
p-Xylene	106-42-3	3.17	2.49	5.70E-01	Equation 1	2.5E-04	Equation 2
Styrene	100-42-5	2.93	2.96	7.85E-01	Equation 1	2.4E-04	Equation 2
Toluene	108-88-3	2.67	2.15	1.11E+00	Equation 1	2.3E-04	Equation 2
Non-aromatic Nonhalogenated Hydrocarbons							
1,2-Epoxybutane	106-88-7	0.86	0.65	1.23E+01	Equation 1	1.7E-04	Equation 2
1,3-Butadiene	106-99-0	1.99	1.64	2.74E+00	Equation 1	2.1E-04	Equation 2
1,4-Dioxane	123-91-1	-0.27	-0.06	5.53E+01	EPA (1999a)	1.5E-04	EPA (1999a)
1-Methylpropyl alcohol	78-92-2	0.61	0.63	1.72E+01	Equation 1	1.7E-04	Equation 2
1-Nitropropane	108-03-2	0.87	0.83	1.22E+01	Equation 1	1.7E-04	Equation 2
2,2,4-Trimethylpentane	540-84-1	5.02	4.07	4.86E-02	Equation 1	3.4E-04	Equation 2
2-Butanone	78-93-3	0.28	0.37	2.66E+01	Equation 1	1.6E-04	Equation 2
2-Butenaldehyde (2-Butenal)	4170-30-3	0.55	0.58	1.86E+01	EPA (1999a)	1.7E-04	EPA (1999a)

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
Organic Compounds							
Aromatic Halogenated Hydrocarbons							
2,3,4,6-Tetrachlorophenol	58-90-2	5.02E-04	Equation 3	2.38E+02	Equation 2	1.26E-01	Equation 1
4-Chloro-3-methylphenol	59-50-7	3.16E-05	Equation 3	2.47E+01	Equation 2	6.25E-01	Equation 1
Aromatic Nonhalogenated Hydrocarbons							
2-Nitrotoluene	88-72-2	5.01E-06	Equation 3	5.47E+00	Equation 2	1.81E+00	Equation 1
4-Nitrobiphenyl	92-93-3	1.48E-04	Equation 3	8.74E+01	Equation 2	2.56E-01	Equation 1
Benzaldehyde	100-52-7	7.54E-07	Equation 3	1.16E+00	Equation 2	5.42E+00	Equation 1
Benzene	71-43-2	3.44E-06	Equation 3	4.02E+00	Equation 2	2.25E+00	Equation 1
Benzyl alcohol	100-51-6	3.16E-07	Equation 3	5.69E-01	Equation 2	8.95E+00	Equation 1
Ethyl benzene	100-41-4	3.34E-05	Equation 3	2.58E+01	Equation 2	6.06E-01	Equation 1
m-Xylene	108-38-3	3.99E-05	Equation 3	2.99E+01	Equation 2	5.47E-01	Equation 1
o-Xylene	95-47-6	3.39E-05	Equation 3	2.62E+01	Equation 2	6.01E-01	Equation 1
1,2-Dimethylbenzene	95-47-6	3.39E-05	Equation 3	2.62E+01	Equation 2	6.01E-01	Equation 1
p-Xylene	106-42-3	3.72E-05	Equation 3	2.82E+01	Equation 2	5.70E-01	Equation 1
Styrene	100-42-5	2.13E-05	Equation 3	1.79E+01	Equation 2	7.85E-01	Equation 1
Toluene	108-88-3	1.17E-05	Equation 3	1.09E+01	Equation 2	1.11E+00	Equation 1
Non-aromatic Nonhalogenated Hydrocarbons							
1,2-Epoxybutane	106-88-7	1.82E-07	Equation 3	1.74E-04	Equation 2	1.23E+01	Equation 1
1,3-Butadiene	106-99-0	2.45E-06	Equation 3	2.09E-04	Equation 2	2.74E+00	Equation 1
1,4-Dioxane	123-91-1	1.36E-08	Equation 3	4.00E-02	EPA (1999a)	5.53E+01	EPA (1999a)
1-Methylpropyl alcohol	78-92-2	1.02E-07	Equation 3	2.26E-01	Equation 2	1.72E+01	Equation 1
1-Nitropropane	108-03-2	1.86E-07	Equation 3	3.69E-01	Equation 2	1.22E+01	Equation 1
2,2,4-Trimethylpentane	540-84-1	2.63E-03	Equation 3	9.23E+02	Equation 2	4.86E-02	Equation 1
2-Butanone	78-93-3	4.80E-08	Equation 3	1.21E-01	Equation 2	2.66E+01	Equation 1
2-Butenaldehyde (2-Butenal)	4170-30-3	8.91E-08	EPA (1999a)	2.00E-01	EPA (1999a)	1.86E+01	EPA (1999a)

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
2-Ethoxyethanol	110-80-5	-0.10	1.32	4.42E+01	Equation 1	1.5E-04	Equation 2
2-Heptanone	110-43-0	1.98	1.70	2.78E+00	Equation 1	2.1E-04	Equation 2
2-Hexanone	591-78-6	1.38	2.13	6.17E+00	Equation 1	1.9E-04	Equation 2
2-Methoxyethanol	109-86-4	-0.77	0.00	1.08E+02	Equation 1	1.3E-04	Equation 2
2-Methyl-2-propanol	75-65-0	0.35	1.57	2.43E+01	Equation 1	1.6E-04	Equation 2
2-Methyl-2-propenenitrile	126-98-7	0.54	0.57	1.89E+01	Equation 1	1.7E-04	Equation 2
2-Methylaziridine	75-55-8	-0.60	-0.32	8.61E+01	Equation 1	1.4E-04	Equation 2
2-Methylpropyl alcohol	78-83-1	0.76	0.74	1.41E+01	Equation 1	1.7E-04	Equation 2
2-Pentanone	107-87-9	0.91	1.87	1.15E+01	Equation 1	1.8E-04	Equation 2
2-Propanone (Acetone)	67-64-1	-0.22	-0.02	5.20E+01	EPA (1999a)	1.5E-04	EPA (1999a)
2-Propene-1-ol	107-18-6	0.17	0.28	3.09E+01	Equation 1	1.6E-04	Equation 2
2-Propyl alcohol	67-63-0	0.05	0.19	3.62E+01	Equation 1	1.5E-04	Equation 2
3-Heptanone	106-35-4	NA	NA	No data	No data	No data	No data
3-Methyl-1-butanol	123-51-3	NA	NA	No data	No data	No data	No data
3-Methyl-2-butanone	563-80-4	NA	NA	No data	No data	No data	No data
3-Pentanone	96-22-0	0.99	1.08	1.04E+01	Equation 1	1.8E-04	Equation 2
4-Heptanone	123-19-3	NA	NA	No data	No data	No data	No data
4-Methyl-2-pentanone	108-10-1	1.19	1.08	7.94E+00	Equation 1	1.8E-04	Equation 2
4-Methyl-3-penten-2-one	141-79-7	NA	NA	No data	No data	No data	No data
5-Methyl-2-hexanone	110-12-3	1.72	1.59	3.93E+00	Equation 1	2.0E-04	Equation 2
Acetaldehyde	75-07-0	-0.22	-0.02	5.19E+01	Equation 1	1.5E-04	Equation 2
Acetamide	60-35-5	-1.26	-1.55	2.07E+02	Equation 1	1.2E-04	Equation 2
Acetic acid	64-19-7	-0.17	0.00	4.86E+01	Equation 1	1.5E-04	Equation 2
Acetic acid ethyl ester	141-78-6	0.73	0.36	1.47E+01	Equation 1	1.7E-04	Equation 2
Acetic acid n-butyl ester	123-86-4	1.73	1.50	3.87E+00	Equation 1	2.0E-04	Equation 2
Acetonitrile	75-05-8	-0.34	-0.11	6.09E+01	Equation 1	1.4E-04	Equation 2

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
2-Ethoxyethanol	110-80-5	2.00E-08	Equation 3	5.92E-02	Equation 2	4.42E+01	Equation 1
2-Heptanone	110-43-0	2.40E-06	Equation 3	2.99E+00	Equation 2	2.78E+00	Equation 1
2-Hexanone	591-78-6	6.03E-07	Equation 3	9.64E-01	Equation 2	6.17E+00	Equation 1
2-Methoxyethanol	109-86-4	4.27E-09	Equation 3	1.34E-04	Equation 2	1.08E+02	Equation 1
2-Methyl-2-propanol	75-65-0	5.62E-08	Equation 3	1.38E-01	Equation 2	2.43E+01	Equation 1
2-Methyl-2-propenenitrile	126-98-7	8.72E-08	Equation 3	1.98E-01	Equation 2	1.89E+01	Equation 1
2-Methylaziridine	75-55-8	6.31E-09	Equation 3	2.30E-02	Equation 2	8.61E+01	Equation 1
2-Methylpropyl alcohol	78-83-1	1.45E-07	Equation 3	3.00E-01	Equation 2	1.41E+01	Equation 1
2-Pentanone	107-87-9	2.04E-07	Equation 3	3.97E-01	Equation 2	1.15E+01	Equation 1
2-Propanone (Acetone)	67-64-1	1.51E-08	Equation 3	5.00E-02	EPA (1999a)	5.20E+01	EPA (1999a)
2-Propene-1-ol	107-18-6	3.72E-08	Equation 3	9.85E-02	Equation 2	3.09E+01	Equation 1
2-Propyl alcohol	67-63-0	2.82E-08	Equation 3	7.85E-02	Equation 2	3.62E+01	Equation 1
3-Heptanone	106-35-4	No data	No data	No data	No data	No data	No data
3-Methyl-1-butanol	123-51-3	No data	No data	No data	No data	No data	No data
3-Methyl-2-butanone	563-80-4	No data	No data	No data	No data	No data	No data
3-Pentanone	96-22-0	2.45E-07	Equation 3	4.62E-01	Equation 2	1.04E+01	Equation 1
4-Heptanone	123-19-3	No data	No data	No data	No data	No data	No data
4-Methyl-2-pentanone	108-10-1	3.89E-07	Equation 3	6.74E-01	Equation 2	7.94E+00	Equation 1
4-Methyl-3-penten-2-one	141-79-7	No data	No data	No data	No data	No data	No data
5-Methyl-2-hexanone	110-12-3	1.32E-06	Equation 3	2.00E-04	Equation 2	3.93E+00	Equation 1
Acetaldehyde	75-07-0	1.51E-08	Equation 3	4.72E-02	Equation 2	5.19E+01	Equation 1
Acetamide	60-35-5	1.38E-09	Equation 3	6.64E-03	Equation 2	2.07E+02	Equation 1
Acetic acid	64-19-7	1.70E-08	Equation 3	5.19E-02	Equation 2	4.86E+01	Equation 1
Acetic acid ethyl ester	141-78-6	1.35E-07	Equation 3	2.83E-01	Equation 2	1.47E+01	Equation 1
Acetic acid n-butyl ester	123-86-4	1.35E-06	Equation 3	1.87E+00	Equation 2	3.87E+00	Equation 1
Acetonitrile	75-05-8	1.15E-08	Equation 3	3.76E-02	Equation 2	6.09E+01	Equation 1

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
Acrolein	107-02-8	-0.01	0.14	3.92E+01	Equation 1	1.5E-04	Equation 2
Acrylonitrile	107-13-1	0.25	0.35	2.78E+01	EPA (1999a)	1.6E-04	EPA (1999a)
Bis(isopropyl)ether	108-20-3	1.56	2.23	4.86E+00	Equation 1	1.9E-04	Equation 2
Butane	106-97-8	2.89	2.41	8.27E-01	Equation 1	2.4E-04	Equation 2
Carbon disulfide	75-15-0	2.00	1.71	2.70E+00	Equation 1	2.1E-04	Equation 2
Cyanogen	460-19-5	0.07	0.92	3.53E+01	Equation 1	1.5E-04	Equation 2
Cyclohexane	110-82-7	3.44	2.68	3.98E-01	Equation 1	2.6E-04	Equation 2
Cyclohexanone	108-94-1	0.81	0.78	1.32E+01	Equation 1	1.7E-04	Equation 2
Cyclohexene	110-83-8	2.86	2.38	8.61E-01	Equation 1	2.4E-04	Equation 2
Cyclopentane	287-92-3	3.00	2.49	7.14E-01	Equation 1	2.5E-04	Equation 2
Ethyl alcohol	64-17-5	-0.31	-0.09	5.85E+01	Equation 1	1.4E-04	Equation 2
Ethyl ether	60-29-7	0.89	0.85	1.18E+01	Equation 1	1.7E-04	Equation 2
Ethyl methacrylate	97-63-2	1.59	1.39	4.67E+00	Equation 1	2.0E-04	Equation 2
Formaldehyde	50-00-0	0.34	0.42	2.46E+01	EPA (1999a)	1.6E-04	EPA (1999a)
Formamide	75-12-7	-1.51	-1.03	2.89E+02	Equation 1	1.2E-04	Equation 2
Formic acid	64-18-6	-0.54	-0.27	7.92E+01	Equation 1	1.4E-04	Equation 2
Formic acid, methyl ester	107-31-3	-0.26	-0.05	5.50E+01	Equation 1	1.5E-04	Equation 2
Glycidylaldehyde	765-34-4	-0.12	0.00	4.54E+01	Equation 1	1.5E-04	Equation 2
Methyl acetate	79-20-9	0.46	0.51	2.10E+01	Equation 1	1.6E-04	Equation 2
Methyl alcohol	67-56-1	-0.71	-0.40	9.96E+01	Equation 1	1.4E-04	Equation 2
Methyl isocyanate	624-83-9	NA	NA	No data	No data	No data	No data
Methyl methacrylate	80-62-6	0.79	1.80	1.35E+01	Equation 1	1.7E-04	Equation 2
Methyl tert-butyl ether	1634-04-4	0.94	0.88	1.11E+01	Equation 1	1.8E-04	Equation 2
Methylacetylene	74-99-7	0.94	0.88	1.11E+01	Equation 1	1.8E-04	Equation 2
Methylcyclohexane	108-87-2	4.10	3.35	1.65E-01	Equation 1	2.9E-04	Equation 2
N,N-Dimethylacetamide	127-19-5	NA	NA	No data	No data	No data	No data

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
Acrolein	107-02-8	2.46E-08	Equation 3	7.03E-02	Equation 2	3.92E+01	Equation 1
Acrylonitrile	107-13-1	4.47E-08	Equation 3	1.10E-01	EPA (1999a)	2.78E+01	EPA (1999a)
Bis(isopropyl)ether	108-20-3	9.12E-07	Equation 3	1.95E-04	Equation 2	4.86E+00	Equation 1
Butane	106-97-8	1.95E-05	Equation 3	1.66E+01	Equation 2	8.27E-01	Equation 1
Carbon disulfide	75-15-0	2.51E-06	Equation 3	3.10E+00	Equation 2	2.70E+00	Equation 1
Cyanogen	460-19-5	2.95E-08	Equation 3	1.53E-04	Equation 2	3.53E+01	Equation 1
Cyclohexane	110-82-7	6.92E-05	Equation 3	4.69E+01	Equation 2	3.98E-01	Equation 1
Cyclohexanone	108-94-1	1.62E-07	Equation 3	3.29E-01	Equation 2	1.32E+01	Equation 1
Cyclohexene	110-83-8	1.82E-05	Equation 3	1.57E+01	Equation 2	8.61E-01	Equation 1
Cyclopentane	287-92-3	2.51E-05	Equation 3	2.05E+01	Equation 2	7.14E-01	Equation 1
Ethyl alcohol	64-17-5	1.23E-08	Equation 3	3.98E-02	Equation 2	5.85E+01	Equation 1
Ethyl ether	60-29-7	1.95E-07	Equation 3	3.83E-01	Equation 2	1.18E+01	Equation 1
Ethyl methacrylate	97-63-2	9.77E-07	Equation 3	1.43E+00	Equation 2	4.67E+00	Equation 1
Formaldehyde	50-00-0	5.56E-08	Equation 3	1.40E-01	EPA (1999a)	2.46E+01	EPA (1999a)
Formamide	75-12-7	7.76E-10	Equation 3	4.14E-03	Equation 2	2.89E+02	Equation 1
Formic acid	64-18-6	7.28E-09	Equation 3	2.59E-02	Equation 2	7.92E+01	Equation 1
Formic acid, methyl ester	107-31-3	1.37E-08	Equation 3	4.34E-02	Equation 2	5.50E+01	Equation 1
Glycidylaldehyde	765-34-4	1.91E-08	Equation 3	1.49E-04	Equation 2	4.54E+01	Equation 1
Methyl acetate	79-20-9	7.24E-08	Equation 3	1.70E-01	Equation 2	2.10E+01	Equation 1
Methyl alcohol	67-56-1	4.90E-09	Equation 3	1.87E-02	Equation 2	9.96E+01	Equation 1
Methyl isocyanate	624-83-9	No data	No data	No data	No data	No data	No data
Methyl methacrylate	80-62-6	1.55E-07	Equation 3	3.17E-01	Equation 2	1.35E+01	Equation 1
Methyl tert-butyl ether	1634-04-4	2.19E-07	Equation 3	4.21E-01	Equation 2	1.11E+01	Equation 1
Methylacetylene	74-99-7	2.19E-07	Equation 3	4.21E-01	Equation 2	1.11E+01	Equation 1
Methylcyclohexane	108-87-2	3.16E-04	Equation 3	1.63E+02	Equation 2	1.65E-01	Equation 1
N,N-Dimethylacetamide	127-19-5	No data	No data	No data	No data	No data	No data

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
n-Butyl alcohol	71-36-3	0.88	0.84	1.20E+01	Equation 1	1.7E-04	Equation 2
n-Heptane	142-82-5	4.66	3.79	7.84E-02	Equation 1	3.2E-04	Equation 2
n-Hexane	110-54-3	4.11	3.36	1.63E-01	Equation 1	2.9E-04	Equation 2
Nitromethane	75-52-5	-0.35	-0.12	6.17E+01	Equation 1	1.4E-04	Equation 2
n-Nonane	111-84-2	5.65	4.56	2.10E-02	Equation 1	3.8E-04	Equation 2
n-Octane	111-65-9	4.00	3.27	1.89E-01	Equation 1	2.9E-04	Equation 2
n-Pentane	109-66-0	3.21	2.65	5.40E-01	Equation 1	2.5E-04	Equation 2
n-Propionaldehyde	123-38-6	0.59	0.61	1.77E+01	Equation 1	1.7E-04	Equation 2
n-Propyl alcohol	71-23-8	0.25	0.35	2.78E+01	Equation 1	1.6E-04	Equation 2
n-Valeraldehyde	110-62-3	NA	NA	No data	No data	No data	No data
Oxirane	75-21-8	-0.30	-0.08	5.77E+01	Equation 1	1.4E-04	Equation 2
p-Cymene	99-87-6	4.10	3.35	1.65E-01	Equation 1	2.9E-04	Equation 2
Phosgene	75-44-5	NA	NA	No data	No data	No data	No data
Propargyl alcohol	107-19-7	-0.38	0.12	6.42E+01	Equation 1	1.4E-04	Equation 2
Propionic acid	79-09-4	0.33	0.41	2.50E+01	Equation 1	1.6E-04	Equation 2
Propionitrile	107-12-0	0.16	0.28	3.13E+01	Equation 1	1.6E-04	Equation 2
Propylene glycol monomethyl ether	107-98-2	-0.49	0.00	7.43E+01	Equation 1	1.4E-04	Equation 2
p-tert-Butyltoluene	98-51-1	NA	NA	No data	No data	No data	No data
Triethylamine	121-44-8	1.45	2.03	5.62E+00	Equation 1	1.9E-04	Equation 2
Trimethylamine	75-50-3	0.16	0.60	3.13E+01	Equation 1	1.6E-04	Equation 2
Vinyl acetate	108-05-4	0.70	0.70	1.53E+01	Equation 1	1.7E-04	Equation 2
Non-aromatic Halogenated Hydrocarbons							
1,1,1,2-Tetrachloro-2,2-difluoroethane	76-11-9	3.41	2.54	4.14E-01	Equation 1	2.6E-04	Equation 2
1,1,1,2-Tetrachloroethane	630-20-6	2.63	2.20	1.17E+00	Equation 1	2.3E-04	Equation 2
1,1,1-Trichloroethane	71-55-6	2.42	5.13	1.54E+00	Equation 1	2.2E-04	Equation 2
1,1,2,2-Tetrachloro-1,2-difluoroethane	76-12-0	3.73	2.50	2.70E-01	Equation 1	2.8E-04	Equation 2

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
n-Butyl alcohol	71-36-3	1.91E-07	Equation 3	3.76E-01	Equation 2	1.20E+01	Equation 1
n-Heptane	142-82-5	1.15E-03	Equation 3	4.68E+02	Equation 2	7.84E-02	Equation 1
n-Hexane	110-54-3	3.24E-04	Equation 3	1.66E+02	Equation 2	1.63E-01	Equation 1
Nitromethane	75-52-5	1.12E-08	Equation 3	3.69E-02	Equation 2	6.17E+01	Equation 1
n-Nonane	111-84-2	1.12E-02	Equation 3	3.03E+03	Equation 2	2.10E-02	Equation 1
n-Octane	111-65-9	2.51E-04	Equation 3	1.35E+02	Equation 2	1.89E-01	Equation 1
n-Pentane	109-66-0	4.07E-05	Equation 3	3.04E+01	Equation 2	5.40E-01	Equation 1
n-Propionaldehyde	123-38-6	9.77E-08	Equation 3	2.17E-01	Equation 2	1.77E+01	Equation 1
n-Propyl alcohol	71-23-8	4.47E-08	Equation 3	1.14E-01	Equation 2	2.78E+01	Equation 1
n-Valeraldehyde	110-62-3	No data	No data	No data	No data	No data	No data
Oxirane	75-21-8	1.26E-08	Equation 3	4.06E-02	Equation 2	5.77E+01	Equation 1
p-Cymene	99-87-6	3.16E-04	Equation 3	1.63E+02	Equation 2	1.65E-01	Equation 1
Phosgene	75-44-5	No data	No data	No data	No data	No data	No data
Propargyl alcohol	107-19-7	1.05E-08	Equation 3	1.43E-04	Equation 2	6.42E+01	Equation 1
Propionic acid	79-09-4	5.37E-08	Equation 3	1.33E-01	Equation 2	2.50E+01	Equation 1
Propionitrile	107-12-0	3.63E-08	Equation 3	9.66E-02	Equation 2	3.13E+01	Equation 1
Propylene glycol monomethyl ether	107-98-2	8.13E-09	Equation 3	1.40E-04	Equation 2	7.43E+01	Equation 1
p-tert-Butyltoluene	98-51-1	No data	No data	No data	No data	No data	No data
Triethylamine	121-44-8	7.08E-07	Equation 3	1.91E-04	Equation 2	5.62E+00	Equation 1
Trimethylamine	75-50-3	3.63E-08	Equation 3	9.66E-02	Equation 2	3.13E+01	Equation 1
Vinyl acetate	108-05-4	1.26E-07	Equation 3	2.67E-01	Equation 2	1.53E+01	Equation 1
Non-aromatic Halogenated Hydrocarbons							
1,1,1,2-Tetrachloro-2,2-difluoroethane	76-11-9	6.46E-05	Equation 3	2.63E-04	Equation 2	4.14E-01	Equation 1
1,1,1,2-Tetrachloroethane	630-20-6	1.07E-05	Equation 3	1.02E+01	Equation 2	1.17E+00	Equation 1
1,1,1-Trichloroethane	71-55-6	6.63E-06	Equation 3	6.88E+00	Equation 2	1.54E+00	Equation 1
1,1,2,2-Tetrachloro-1,2-difluoroethane	76-12-0	1.35E-04	Equation 3	8.11E+01	Equation 2	2.70E-01	Equation 1

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
1,1,2,2-Tetrachloroethane	79-34-5	4.64	1.90	8.02E-02	Equation 1	3.2E-04	Equation 2
1,1,2,2-Tetrachloroethene	127-18-4	2.55	2.42	1.31E+00	Equation 1	2.3E-04	Equation 2
1,1,2-Trichloroethane	79-00-5	2.10	1.88	2.38E+00	Equation 1	2.1E-04	Equation 2
1,1,2-Trichloroethylene	79-01-6	2.43	1.97	1.52E+00	Equation 1	2.2E-04	Equation 2
1,1-Dichloroethane	75-34-3	1.79	1.72	3.56E+00	Equation 1	2.0E-04	Equation 2
1,1-Dichloroethene	75-35-4	2.12	1.81	2.30E+00	Equation 1	2.1E-04	Equation 2
1,2,2-Trichloro-1,1,2-trifluoroethane	76-13-1	3.16	2.41	5.77E-01	Equation 1	2.5E-04	Equation 2
1,2,3-Trichloropropane	96-18-4	2.25	1.91	1.94E+00	Equation 1	2.2E-04	Equation 2
1,2-Dibromo-3-chloropropane	96-12-8	2.34	1.98	1.72E+00	Equation 1	2.2E-04	Equation 2
1,2-Dichloro-1,1,2,2-tetrafluoroethane	76-14-2	2.82	2.35	9.08E-01	Equation 1	2.4E-04	Equation 2
1,2-Dichloroethane	107-06-2	1.46	1.29	5.53E+00	Equation 1	1.9E-04	Equation 2
1,2-Dichloroethylene	540-59-0	2.09	1.64	2.40E+00	Equation 1	2.1E-04	Equation 2
1,2-Dichloropropane	78-87-5	2.25	1.67	1.94E+00	Equation 1	2.2E-04	Equation 2
1,3-Dichloropropene	542-75-6	1.75	1.43	3.78E+00	Equation 1	2.0E-04	Equation 2
1,4-Dichloro-2-butene	764-41-0	2.60	2.17	1.21E+01	Equation 1	2.3E-04	Equation 2
1-Chloroethene	75-01-4	1.15	1.05	8.43E+00	EPA (1999a)	1.8E-04	EPA (1999a)
2,2-Dichloropropionic acid	75-99-0	1.68	0.44	4.14E+00	Equation 1	2.0E-04	Equation 2
2-Chloropropane	75-29-6	1.90	1.63	3.09E+00	Equation 1	2.1E-04	Equation 2
3-Chloropropene (Allyl chloride)	107-05-1	1.93	1.64	2.97E+00	Equation 1	2.1E-04	Equation 2
Bromochloromethane	74-97-5	1.41	1.25	5.93E+00	Equation 1	1.9E-04	Equation 2
Bromodichloromethane	75-27-4	2.03	1.73	2.61E+00	Equation 1	2.1E-04	Equation 2
Bromoethene	593-60-2	1.57	1.38	9.37E+00	Equation 1	2.0E-04	Equation 2
Bromoform	75-25-2	2.35	2.10	1.70E+00	Equation 1	2.2E-04	Equation 2
Bromomethane	74-83-9	1.11	0.95	8.79E+00	Equation 1	1.8E-04	Equation 2
Carbon tetrachloride	56-23-5	2.72	2.18	1.04E+00	EPA (1999a)	2.3E-04	EPA (1999a)
Chlorodibromomethane	124-48-1	2.18	1.85	2.14E+00	Equation 1	2.2E-04	Equation 2

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
1,1,2,2-Tetrachloroethane	79-34-5	1.11E-03	Equation 3	4.54E+02	Equation 2	8.02E-02	Equation 1
1,1,2,2-Tetrachloroethene	127-18-4	8.82E-06	Equation 3	8.68E+00	Equation 2	1.31E+00	Equation 1
1,1,2-Trichloroethane	79-00-5	3.14E-06	Equation 3	3.73E+00	Equation 2	2.38E+00	Equation 1
1,1,2-Trichloroethylene	79-01-6	6.81E-06	Equation 3	7.02E+00	Equation 2	1.52E+00	Equation 1
1,1-Dichloroethane	75-34-3	1.56E-06	Equation 3	2.10E+00	Equation 2	3.56E+00	Equation 1
1,1-Dichloroethene	75-35-4	3.32E-06	Equation 3	3.90E+00	Equation 2	2.30E+00	Equation 1
1,2,2-Trichloro-1,1,2-trifluoroethane	76-13-1	3.63E-05	Equation 3	2.77E+01	Equation 2	5.77E-01	Equation 1
1,2,3-Trichloropropane	96-18-4	4.47E-06	Equation 3	4.98E+00	Equation 2	1.94E+00	Equation 1
1,2-Dibromo-3-chloropropane	96-12-8	5.50E-06	Equation 3	5.90E+00	Equation 2	1.72E+00	Equation 1
1,2-Dichloro-1,1,2,2-tetrafluoroethane	76-14-2	1.66E-05	Equation 3	1.46E+01	Equation 2	9.08E-01	Equation 1
1,2-Dichloroethane	107-06-2	7.28E-07	Equation 3	1.13E+00	Equation 2	5.53E+00	Equation 1
1,2-Dichloroethylene	540-59-0	3.09E-06	Equation 3	2.12E-04	Equation 2	2.40E+00	Equation 1
1,2-Dichloropropane	78-87-5	4.47E-06	Equation 3	4.98E+00	Equation 2	1.94E+00	Equation 1
1,3-Dichloropropene	542-75-6	1.41E-06	Equation 3	1.93E+00	Equation 2	3.78E+00	Equation 1
1,4-Dichloro-2-butene	764-41-0	1.87E-07	Equation 3	3.70E-01	Equation 2	1.21E+01	Equation 1
1-Chloroethene	75-01-4	3.52E-07	Equation 3	6.20E-01	EPA (1999a)	8.43E+00	EPA (1999a)
2,2-Dichloropropionic acid	75-99-0	1.20E-06	Equation 3	1.99E-04	Equation 2	4.14E+00	Equation 1
2-Chloropropane	75-29-6	2.00E-06	Equation 3	2.06E-04	Equation 2	3.09E+00	Equation 1
3-Chloropropene (Allyl chloride)	107-05-1	2.14E-06	Equation 3	2.07E-04	Equation 2	2.97E+00	Equation 1
Bromochloromethane	74-97-5	6.46E-07	Equation 3	1.02E+00	Equation 2	5.93E+00	Equation 1
Bromodichloromethane	75-27-4	2.66E-06	Equation 3	3.26E+00	Equation 2	2.61E+00	Equation 1
Bromoethene	593-60-2	2.93E-07	Equation 3	5.34E-01	Equation 2	9.37E+00	Equation 1
Bromoform	75-25-2	5.63E-06	Equation 3	6.01E+00	Equation 2	1.70E+00	Equation 1
Bromomethane	74-83-9	3.27E-07	Equation 3	5.84E-01	Equation 2	8.79E+00	Equation 1
Carbon tetrachloride	56-23-5	1.31E-05	Equation 3	3.00E+02	EPA (1999a)	1.04E+00	EPA (1999a)
Chlorodibromomethane	124-48-1	3.77E-06	Equation 3	4.33E+00	Equation 2	2.14E+00	Equation 1

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
Chlorodifluoromethane	75-45-6	1.08	0.99	9.21E+00	Equation 1	1.8E-04	Equation 2
Chloroethane	75-00-3	3.10	2.57	6.25E-01	Equation 1	2.5E-04	Equation 2
Chloroform	67-66-3	1.95	1.72	2.90E+00	EPA (1999a)	2.1E-04	EPA (1999a)
Chloromethane	74-87-3	0.90	0.78	1.16E+01	Equation 1	1.8E-04	Equation 2
Chloropentafluoroethane	76-15-3	2.10	2.85	2.37E+00	Equation 1	2.1E-04	Equation 2
cis-1,2-Dichloroethene	156-59-2	1.98	1.70	2.77E+00	Equation 1	2.1E-04	Equation 2
cis-1,3-Dichloropropene	10061-01-5	NA	NA	No data	No data	No data	No data
Cyanogen bromide	506-68-3	-0.29	-0.08	5.70E+01	Equation 1	1.4E-04	Equation 2
Cyanogen chloride	506-77-4	-0.38	0.65	6.42E+01	Equation 1	1.4E-04	Equation 2
Dichlorodifluoromethane	75-71-8	2.16	0.84	2.19E+00	Equation 1	2.1E-04	Equation 2
Dichlorofluoromethane	75-43-4	1.55	1.54	4.92E+00	Equation 1	1.9E-04	Equation 2
Dichloromethane	75-09-2	1.26	1.00	7.29E+00	Equation 1	1.9E-04	Equation 2
Difluorodibromomethane	75-61-6	NA	NA	No data	No data	No data	No data
Hexafluoroacetone	684-16-2	NA	NA	No data	No data	No data	No data
Iodomethane	74-88-4	1.69	1.47	4.08E+00	Equation 1	2.0E-04	Equation 2
Methylene bromide	74-95-3	1.62	1.41	4.48E+00	Equation 1	2.0E-04	Equation 2
Pentachloroethane	76-01-7	3.05	2.53	6.68E-01	Equation 1	2.5E-04	Equation 2
trans-1,2-Dichloroethylene	156-60-5	1.98	1.58	2.77E+00	Equation 1	2.1E-04	Equation 2
trans-1,3-Dichloropropene	10061-02-6	2.06	1.76	2.50E+00	Equation 1	2.1E-04	Equation 2
Trichloroacetic acid	76-03-9	1.33	1.19	6.60E+00	Equation 1	1.9E-04	Equation 2
Trichlorofluoroethane	27154-33-2	NA	NA	No data	No data	No data	No data
Trichlorofluoromethane	75-69-4	2.53	2.13	1.33E+00	Equation 1	2.3E-04	Equation 2
Trifluorobromomethane	75-63-8	1.86	1.60	3.26E+00	Equation 1	2.0E-04	Equation 2
Dioxin and Furan Compounds (PCDDs/PCDFs)							
1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	35822-46-9	8.20	7.99	2.90E-04	EPA (1999a)	8.10E-02	EPA (1999a)
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	7.92	7.71	6.20E-05	EPA (1999a)	1.70E-02	EPA (1999a)

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
Chlorodifluoromethane	75-45-6	3.01E-07	Equation 3	5.47E-01	Equation 2	9.21E+00	Equation 1
Chloroethane	75-00-3	3.16E-05	Equation 3	2.47E+01	Equation 2	6.25E-01	Equation 1
Chloroform	67-66-3	2.24E-06	Equation 3	2.82E+00	EPA (1999a)	2.90E+00	EPA (1999a)
Chloromethane	74-87-3	2.01E-07	Equation 3	3.92E-01	Equation 2	1.16E+01	Equation 1
Chloropentafluoroethane	76-15-3	3.16E-06	Equation 3	2.13E-04	Equation 2	2.37E+00	Equation 1
cis-1,2-Dichloroethene	156-59-2	2.41E-06	Equation 3	2.09E-04	Equation 2	2.77E+00	Equation 1
cis-1,3-Dichloropropene	10061-01-5	No data	No data	No data	No data	No data	No data
Cyanogen bromide	506-68-3	1.29E-08	Equation 3	1.45E-04	Equation 2	5.70E+01	Equation 1
Cyanogen chloride	506-77-4	1.05E-08	Equation 3	1.43E-04	Equation 2	6.42E+01	Equation 1
Dichlorodifluoromethane	75-71-8	3.62E-06	Equation 3	2.15E-04	Equation 2	2.19E+00	Equation 1
Dichlorofluoromethane	75-43-4	8.91E-07	Equation 3	1.95E-04	Equation 2	4.92E+00	Equation 1
Dichloromethane	75-09-2	4.52E-07	Equation 3	7.62E-01	Equation 2	7.29E+00	Equation 1
Difluorodibromomethane	75-61-6	No data	No data	No data	No data	No data	No data
Hexafluoroacetone	684-16-2	No data	No data	No data	No data	No data	No data
Iodomethane	74-88-4	1.23E-06	Equation 3	1.73E+00	Equation 2	4.08E+00	Equation 1
Methylene bromide	74-95-3	1.05E-06	Equation 3	1.52E+00	Equation 2	4.48E+00	Equation 1
Pentachloroethane	76-01-7	2.82E-05	Equation 3	2.25E+01	Equation 2	6.68E-01	Equation 1
trans-1,2-Dichloroethylene	156-60-5	2.41E-06	Equation 3	3.00E+00	Equation 2	2.77E+00	Equation 1
trans-1,3-Dichloropropene	10061-02-6	2.88E-06	Equation 3	3.48E+00	Equation 2	2.50E+00	Equation 1
Trichloroacetic acid	76-03-9	5.37E-07	Equation 3	8.78E-01	Equation 2	6.60E+00	Equation 1
Trichlorofluoroethane	27154-33-2	No data	No data	No data	No data	No data	No data
Trichlorofluoromethane	75-69-4	8.54E-06	Equation 3	8.46E+00	Equation 2	1.33E+00	Equation 1
Trifluorobromomethane	75-63-8	1.82E-06	Equation 3	2.38E+00	Equation 2	3.26E+00	Equation 1
Dioxin and Furan Compounds (PCDDs/PCDFs)							
1,2,3,4,6,7,8-Heptachlorodibenzo(p)dioxin	35822-46-9	2.77E-03	TCDD x BEF	1.68E+02	EPA (1999a)	2.90E-04	EPA (1999a)
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562-39-4	5.98E-04	TCDD x BEF	3.63E+01	EPA (1999a)	6.20E-05	EPA (1999a)

Appendix Table C-10. Ecological Transfer Factors for COPCs
for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	7.92	7.71	2.20E-03	EPA (1999a)	6.20E-01	EPA (1999a)
1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	39227-28-6	7.79	7.58	1.70E-03	EPA (1999a)	4.90E-01	EPA (1999a)
1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9	7.25	7.04	4.30E-04	EPA (1999a)	1.21E-01	EPA (1999a)
1,2,3,6,7,8-Hexachlorodibenzo(p)dioxin	57653-85-7	7.25	7.04	6.70E-04	EPA (1999a)	1.90E-01	EPA (1999a)
1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9	7.25	7.04	1.10E-03	EPA (1999a)	3.00E-01	EPA (1999a)
1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	19408-74-3	7.25	7.04	7.80E-04	EPA (1999a)	2.20E-01	EPA (1999a)
1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9	7.25	7.04	3.50E-03	EPA (1999a)	1.00E+00	EPA (1999a)
1,2,3,7,8-Pentachlorodibenzo(p)dioxin	40321-76-4	6.64	6.43	5.20E-03	EPA (1999a)	1.46E+00	EPA (1999a)
1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6	6.79	6.58	1.10E-03	EPA (1999a)	3.20E-01	EPA (1999a)
2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5	7.25	7.04	3.80E-03	EPA (1999a)	1.07E+00	EPA (1999a)
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	6.92	6.71	9.00E-03	EPA (1999a)	2.54E+00	EPA (1999a)
2,3,7,8-Tetrachlorodibenzo(p)dioxin	1746-01-6	6.64	6.43	5.60E-03	EPA (1999a)	1.17E+01	Sample et al. 1999
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	6.53	6.32	4.50E-03	EPA (1999a)	1.27E+00	EPA (1999a)
Dibenzofuran	132-64-9	4.33	4.12	1.22E-01	Equation 1	3.0E-04	Equation 2
Octachlorodibenzo(p)dioxin	3268-87-9	7.59	7.38	6.70E-05	EPA (1999a)	1.90E-02	EPA (1999a)
Octachlorodibenzofuran	39001-02-0	8.78	8.57	9.00E-05	EPA (1999a)	2.50E-02	EPA (1999a)
Total dioxins and dibenzofurans	No CAS #	NA	NA	No data	No data	No data	No data
Polychlorinated Biphenyls (PCBs)							
2,2',3,3',4,4',5-Heptachlorobiphenyl	35065-30-6	7.08	6.85	3.13E-03	Equation 1	4.7E-04	Mass-limited
2,2',3,4,4',5,5'-Heptachlorobiphenyl	35065-29-3	7.12	6.92	2.97E-03	Equation 1	4.8E-04	Mass-limited
2,3,3',4,4',5,5'-Heptachlorobiphenyl	39635-31-9	NA	NA	No data	No data	No data	No data
2,3,3',4,4',5'-Hexachlorobiphenyl	69782-90-7	NA	NA	No data	No data	No data	No data
2,3,3',4,4',5-Hexachlorobiphenyl	38380-08-4	NA	NA	No data	No data	No data	No data
2,3,3',4,4'-Pentachlorobiphenyl	32598-14-4	NA	NA	No data	No data	No data	No data
2,3',4,4',5,5'-Hexachlorobiphenyl	52663-72-6	NA	NA	No data	No data	No data	No data
2,3,4,4',5-Pentachlorobiphenyl	74472-37-0	NA	NA	No data	No data	No data	No data

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
1,2,3,4,7,8,9-Heptachlorodibenzofuran	55673-89-7	2.12E-02	TCDD x BEF	1.29E+03	EPA (1999a)	2.20E-03	EPA (1999a)
1,2,3,4,7,8-Hexachlorodibenzo(p)dioxin	39227-28-6	1.68E-02	TCDD x BEF	1.02E+03	EPA (1999a)	1.70E-03	EPA (1999a)
1,2,3,4,7,8-Hexachlorodibenzofuran	70648-26-9	4.13E-03	TCDD x BEF	2.51E+02	EPA (1999a)	4.30E-04	EPA (1999a)
1,2,3,6,7,8-Hexachlorodibenzo(p)dioxin	57653-85-7	6.52E-03	TCDD x BEF	3.96E+02	EPA (1999a)	6.70E-04	EPA (1999a)
1,2,3,6,7,8-Hexachlorodibenzofuran	57117-44-9	1.03E-02	TCDD x BEF	6.27E+02	EPA (1999a)	1.10E-03	EPA (1999a)
1,2,3,7,8,9-Hexachlorodibenzo(p)dioxin	19408-74-3	7.61E-03	TCDD x BEF	4.62E+02	EPA (1999a)	7.80E-04	EPA (1999a)
1,2,3,7,8,9-Hexachlorodibenzofuran	72918-21-9	3.42E-02	TCDD x BEF	2.08E+03	EPA (1999a)	3.50E-03	EPA (1999a)
1,2,3,7,8-Pentachlorodibenzo(p)dioxin	40321-76-4	5.00E-02	TCDD x BEF	3.04E+03	EPA (1999a)	5.20E-03	EPA (1999a)
1,2,3,7,8-Pentachlorodibenzofuran	57117-41-6	1.20E-02	TCDD x BEF	7.26E+02	EPA (1999a)	1.10E-03	EPA (1999a)
2,3,4,6,7,8-Hexachlorodibenzofuran	60851-34-5	3.64E-02	TCDD x BEF	2.21E+03	EPA (1999a)	3.80E-03	EPA (1999a)
2,3,4,7,8-Pentachlorodibenzofuran	57117-31-4	8.70E-02	TCDD x BEF	5.28E+03	EPA (1999a)	9.00E-03	EPA (1999a)
2,3,7,8-Tetrachlorodibenzo(p)dioxin	1746-01-6	5.43E-02	EPA (1999a)	3.30E+03	EPA (1999a)	5.60E-03	EPA (1999a)
2,3,7,8-Tetrachlorodibenzofuran	51207-31-9	4.34E-02	TCDD x BEF	2.64E+03	EPA (1999a)	4.50E-03	EPA (1999a)
Dibenzofuran	132-64-9	5.37E-04	Equation 3	2.51E+02	Equation 2	1.22E-01	Equation 1
Octachlorodibenzo(p)dioxin	3268-87-9	6.52E-04	TCDD x BEF	3.96E+01	EPA (1999a)	6.70E-05	EPA (1999a)
Octachlorodibenzofuran	39001-02-0	8.70E-04	TCDD x BEF	5.28E+01	EPA (1999a)	9.00E-05	EPA (1999a)
Total dioxins and dibenzofurans	No CAS #	No data	No data	No data	No data	No data	No data
Polychlorinated Biphenyls (PCBs)							
2,2',3,3',4,4',5-Heptachlorobiphenyl	35065-30-6	3.02E-01	Equation 3	4.49E+04	Equation 2	3.13E-03	Equation 1
2,2',3,4,4',5,5'-Heptachlorobiphenyl	35065-29-3	3.31E-01	Equation 3	4.84E+04	Equation 2	2.97E-03	Equation 1
2,3,3',4,4',5,5'-Heptachlorobiphenyl	39635-31-9	No data	No data	No data	No data	No data	No data
2,3,3',4,4',5'-Hexachlorobiphenyl	69782-90-7	No data	No data	No data	No data	No data	No data
2,3,3',4,4',5-Hexachlorobiphenyl	38380-08-4	No data	No data	No data	No data	No data	No data
2,3,3',4,4'-Pentachlorobiphenyl	32598-14-4	No data	No data	No data	No data	No data	No data
2,3',4,4',5,5'-Hexachlorobiphenyl	52663-72-6	No data	No data	No data	No data	No data	No data
2,3,4,4',5-Pentachlorobiphenyl	74472-37-0	No data	No data	No data	No data	No data	No data

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
2',3,4,4',5-Pentachlorobiphenyl	65510-44-3	NA	NA	No data	No data	No data	No data
2,3',4,4',5-Pentachlorobiphenyl	31508-00-6	7.12	7.00	2.97E-03	Equation 1	4.8E-04	Mass-limited
3,3',4,4',5,5'-Hexachlorobiphenyl	32774-16-6	7.41	6.60	2.02E-03	Equation 1	5.0E-04	Mass-limited
3,3',4,4',5-Pentachlorobiphenyl	57465-28-8	NA	NA	No data	No data	No data	No data
3,3',4,4'-Tetrachlorobiphenyl	32598-13-3	NA	NA	No data	No data	No data	No data
Aroclor-1254		6.29	4.65	8.96E-03	Equation 1	8.91E+00	Sample et al. 1999
3,4,4',5-Tetrachlorobiphenyl	70362-50-4	NA	NA	No data	No data	No data	No data
Polychlorinated biphenyls (PCBs)[c]	1336-36-3	6.29	4.65	8.96E-03	Equation 1	1.13E+00	EPA (1999a)
Phthalates							
Bis(2-ethylhexyl)phthalate	117-81-7	5.20	5.05	3.80E-02	EPA (1999a)	3.5E-04	EPA (1999a)
Butylbenzyl phthalate	85-68-7	4.41	4.14	1.09E-01	Equation 1	3.1E-04	Equation 2
Dibutyl phthalate	84-74-2	4.72	3.20	7.24E-02	Equation 1	3.2E-04	Equation 2
Diethyl phthalate	84-66-2	4.44	1.91	1.06E-01	Equation 1	3.1E-04	Equation 2
Dimethyl phthalate	131-11-3	1.63	1.49	4.40E+00	Equation 1	2.0E-04	Equation 2
n-Dioctyl phthalate	117-84-0	9.33	8.96	1.57E-04	EPA (1999a)	6.8E-04	Mass-limited
Light Polycyclic Aromatic Hydrocarbons (molecular weight <200 g/mole)							
2-Chloronaphthalene	91-58-7	4.07	3.85	1.72E-01	Equation 1	2.9E-04	Equation 2
2-Methyl naphthalene	91-57-6	3.86	3.65	2.27E-01	Equation 1	2.8E-04	Equation 2
5-Nitroacenaphthene	602-87-9	NA	NA	No data	No data	No data	No data
Acenaphthene	83-32-9	3.96	3.69	1.98E-01	Equation 1	2.9E-04	Equation 2
Acenaphthylene	208-96-8	4.07	3.83	1.72E-01	Equation 1	2.9E-04	Equation 2
Anthracene	120-12-7	4.47	4.37	1.01E-01	Equation 1	3.1E-04	Equation 2
Fluorene	86-73-7	4.17	3.89	1.51E-01	Equation 1	3.0E-04	Equation 2
Indene	95-13-6	NA	NA	No data	No data	No data	No data
Naphthalene	91-20-3	3.37	3.08	4.35E-01	Equation 1	2.6E-04	Equation 2
Phenanthrene	85-01-8	4.55	4.32	9.08E-02	Equation 1	3.2E-04	Equation 2

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
2',3,4,4',5-Pentachlorobiphenyl	65510-44-3	No data	No data	No data	No data	No data	No data
2,3',4,4',5-Pentachlorobiphenyl	31508-00-6	3.31E-01	Equation 3	4.84E+04	Equation 2	2.97E-03	Equation 1
3,3',4,4',5,5'-Hexachlorobiphenyl	32774-16-6	6.43E-01	Equation 3	8.34E+04	Equation 2	2.02E-03	Equation 1
3,3',4,4',5-Pentachlorobiphenyl	57465-28-8	No data	No data	No data	No data	No data	No data
3,3',4,4'-Tetrachlorobiphenyl	32598-13-3	No data	No data	No data	No data	No data	No data
Aroclor-1254		4.90E-02	Equation 3	8.91E+00	Sample et al. 1999	8.96E-03	Equation 1
3,4,4',5-Tetrachlorobiphenyl	70362-50-4	No data	No data	No data	No data	No data	No data
Polychlorinated biphenyls (PCBs)[b]	1336-36-3	4.90E-02	Equation 3	1.13E+00	EPA (1999a)	8.96E-03	Equation 1
Phthalates							
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	4.02E-03	Equation 3	9.93E+03	EPA (1999a)	3.80E-02	EPA (1999a)
Butylbenzyl phthalate	85-68-7	6.51E-04	Equation 3	2.94E+02	Equation 2	1.09E-01	Equation 1
Dibutyl phthalate	84-74-2	1.32E-03	Equation 3	5.25E+02	Equation 2	7.24E-02	Equation 1
Diethyl phthalate	84-66-2	6.86E-04	Equation 3	3.07E+02	Equation 2	1.06E-01	Equation 1
Dimethyl phthalate	131-11-3	1.08E-06	Equation 3	1.56E+00	Equation 2	4.40E+00	Equation 1
n-Dioctyl phthalate	117-84-0	5.37E+01	Equation 3	2.85E+04	EPA (1999a)	1.57E-04	EPA (1999a)
Light Polycyclic Aromatic Hydrocarbons (molecular weight <200 g/mole)							
2-Chloronaphthalene	91-58-7	2.94E-04	Equation 3	1.53E+02	Equation 2	1.72E-01	Equation 1
2-Methyl naphthalene	91-57-6	1.82E-04	Equation 3	1.04E+02	Equation 2	2.27E-01	Equation 1
5-Nitroacenaphthene	602-87-9	No data	No data	No data	No data	No data	No data
Acenaphthene	83-32-9	2.32E-04	Equation 3	1.26E+02	Equation 2	1.98E-01	Equation 1
Acenaphthylene	208-96-8	2.95E-04	Equation 3	1.54E+02	Equation 2	1.72E-01	Equation 1
Anthracene	120-12-7	7.41E-04	Equation 3	3.27E+02	Equation 2	1.01E-01	Equation 1
Fluorene	86-73-7	3.72E-04	Equation 3	1.86E+02	Equation 2	1.51E-01	Equation 1
Indene	95-13-6	No data	No data	No data	No data	No data	No data
Naphthalene	91-20-3	5.93E-05	Equation 3	4.13E+01	Equation 2	4.35E-01	Equation 1
Phenanthrene	85-01-8	8.92E-04	Equation 3	3.81E+02	Equation 2	9.08E-02	Equation 1

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
Pyrene	129-00-0	5.00	4.83	4.99E-02	Equation 1	3.4E-04	Equation 2
Heavy Polycyclic Aromatic Hydrocarbons (molecular weight >200 g/mole)							
3-Methylcholanthrene	56-49-5	7.11	6.18	3.01E-03	Equation 1	4.8E-04	Mass-limited
5-Methylchrysene	3697-24-3	NA	NA	No data	No data	No data	No data
Benzo[a]anthracene	56-55-3	5.68	5.41	2.02E-02	EPA (1999a)	3.00E-02	EPA (1999a)
Benzo(a)pyrene	50-32-8	6.13	5.99	1.11E-02	EPA (1999a)	7.00E-02	EPA (1999a)
Benzo[a,i]pyrene	191-30-0	NA	NA	No data	No data	No data	No data
Benzo[b]fluoranthene	205-99-2	6.20	5.92	1.01E-02	EPA (1999a)	7.00E-02	EPA (1999a)
Benzo[e]pyrene	192-97-2	7.40	7.20	2.05E-03	Equation 1	5.0E-04	Mass-limited
Benzo[g,h,i]perylene	191-24-2	7.10	6.26	3.05E-03	Equation 1	4.8E-04	Mass-limited
Benzo[j]fluoranthene	205-82-3	6.44	6.15	7.34E-03	Equation 1	4.3E-04	Mass-limited
Benzo[k]fluoranthene	207-08-9	6.19	5.92	1.01E-02	EPA (1999a)	8.00E-02	EPA (1999a)
Chrysene	218-01-9	5.74	5.47	1.87E-02	EPA (1999a)	4.00E-02	EPA (1999a)
Dibenz[a,h]acridine	226-36-8	NA	NA	No data	No data	No data	No data
Dibenzo[a,h]anthracene	53-70-3	6.55	6.25	6.40E-03	EPA (1999a)	7.00E-02	EPA (1999a)
Dibenz[a,j]acridine	224-42-0	NA	NA	No data	No data	No data	No data
Dibenzo[a,e]fluoranthene	5385-75-1	NA	NA	No data	No data	No data	No data
Dibenzo[a,e]pyrene	192-65-4	NA	NA	No data	No data	No data	No data
Dibenzo[a,h]fluoranthene	No CAS #	NA	NA	No data	No data	No data	No data
Dibenzo[a,h]pyrene	189-64-0	NA	NA	No data	No data	No data	No data
Dibenzo[a,i]pyrene	189-55-9	7.29	6.98	2.37E-03	Equation 1	4.9E-04	Mass-limited
Fluoranthene	206-44-0	5.08	4.69	4.47E-02	Equation 1	3.4E-04	Equation 2
Hexachloronaphthalene	1335-87-1	7.59	7.27	1.59E-03	Equation 1	5.1E-04	Mass-limited
Indeno[1,2,3-cd]pyrene	193-39-5	6.91	6.61	3.90E-03	EPA (1999a)	8.00E-02	EPA (1999a)
Octachloronaphthalene	2234-13-1	6.42	6.13	7.54E-03	Equation 1	4.3E-04	Mass-limited
Pentachloronaphthalene	1321-64-8	NA	NA	No data	No data	No data	No data

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
Pyrene	129-00-0	2.51E-03	Equation 3	8.89E+02	Equation 2	4.99E-02	Equation 1
Heavy Polycyclic Aromatic Hydrocarbons (molecular weight >200 g/mole)							
3-Methylcholanthrene	56-49-5	3.24E-01	Equation 3	4.75E+04	Equation 2	3.01E-03	Equation 1
5-Methylchrysene	3697-24-3	No data	No data	No data	No data	No data	No data
Benzo[a]anthracene	56-55-3	1.20E-02	Equation 3	5.26E+03	EPA (1999a)	2.02E-02	EPA (1999a)
Benzo[a]pyrene	50-32-8	2.74E-02	EPA (1999a)	5.26E+03	EPA (1999a)	1.11E-02	EPA (1999a)
Benzo[a,i]pyrene	191-30-0	No data	No data	No data	No data	No data	No data
Benzo[b]fluoranthene	205-99-2	4.00E-02	Equation 3	5.26E+03	EPA (1999a)	1.01E-02	EPA (1999a)
Benzo[e]pyrene	192-97-2	6.31E-01	Equation 3	8.21E+04	Equation 2	2.05E-03	Equation 1
Benzo[g,h,i]perylene	191-24-2	3.16E-01	Equation 3	4.67E+04	Equation 2	3.05E-03	Equation 1
Benzo[j]fluoranthene	205-82-3	6.92E-02	Equation 3	1.34E+04	Equation 2	7.34E-03	Equation 1
Benzo[k]fluoranthene	207-08-9	3.98E-02	Equation 3	5.26E+03	EPA (1999a)	1.01E-02	EPA (1999a)
Chrysene	218-01-9	1.38E-02	Equation 3	5.26E+03	EPA (1999a)	1.87E-02	EPA (1999a)
Dibenz[a,h]acridine	226-36-8	No data	No data	No data	No data	No data	No data
Dibenz[a,h]anthracene	53-70-3	8.86E-02	Equation 3	5.26E+03	EPA (1999a)	6.40E-03	EPA (1999a)
Dibenz[a,j]acridine	224-42-0	No data	No data	No data	No data	No data	No data
Dibenzo[a,e]fluoranthene	5385-75-1	No data	No data	No data	No data	No data	No data
Dibenzo[a,e]pyrene	192-65-4	No data	No data	No data	No data	No data	No data
Dibenzo[a,h]fluoranthene	No CAS #	No data	No data	No data	No data	No data	No data
Dibenzo[a,h]pyrene	189-64-0	No data	No data	No data	No data	No data	No data
Dibenzo[a,i]pyrene	189-55-9	4.90E-01	Equation 3	6.68E+04	Equation 2	2.37E-03	Equation 1
Fluoranthene	206-44-0	3.04E-03	Equation 3	1.04E+03	Equation 2	4.47E-02	Equation 1
Hexachloronaphthalene	1335-87-1	9.77E-01	Equation 3	1.18E+05	Equation 2	1.59E-03	Equation 1
Indeno[1,2,3-cd]pyrene	193-39-5	2.07E-01	Equation 3	5.26E+03	EPA (1999a)	3.90E-03	EPA (1999a)
Octachloronaphthalene	2234-13-1	6.61E-02	Equation 3	1.29E+04	Equation 2	7.54E-03	Equation 1
Pentachloronaphthalene	1321-64-8	No data	No data	No data	No data	No data	No data

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
Tetrachloronaphthalene	1335-88-2	NA	NA	No data	No data	No data	No data
Trichloronaphthalene	1321-65-9	NA	NA	No data	No data	No data	No data
Light Substituted Benzene Compounds (molecular weight <200 g/mole)							
1,2,3-Trichlorobenzene	87-61-6	4.05	3.31	1.78E-01	Equation 1	2.9E-04	Equation 2
1,2,4-Trichlorobenzene	120-82-1	3.99	3.22	1.92E-01	Equation 1	2.9E-04	Equation 2
1,2,4-Trimethyl benzene	95-63-6	3.65	3.00	3.01E-01	Equation 1	2.7E-04	Equation 2
1,2-Dichlorobenzene	95-50-1	3.45	2.58	3.95E-01	Equation 1	2.6E-04	Equation 2
1,3,5-Trimethyl benzene	108-67-8	3.42	3.22	4.09E-01	Equation 1	2.6E-04	Equation 2
1,3-Dichlorobenzene	541-73-1	3.53	2.90	3.53E-01	Equation 1	2.7E-04	Equation 2
1,3-Dinitrobenzene	99-65-0	1.49	1.31	5.32E+00	EPA (1999a)	1.9E-04	EPA (1999a)
1,4-Dichlorobenzene	106-46-7	3.41	2.79	4.13E-01	Equation 1	2.6E-04	Equation 2
1,4-Dinitrobenzene	100-25-4	1.50	2.34	5.26E+00	Equation 1	1.9E-04	Equation 2
2,4,5-Trichlorophenol	95-95-4	3.87	3.05	2.25E-01	Equation 1	2.8E-04	Equation 2
2,4,6-Trichlorophenol	88-06-2	3.71	2.35	2.77E-01	Equation 1	2.8E-04	Equation 2
2,4-Dichlorophenol	120-83-2	3.04	2.14	6.80E-01	Equation 1	2.5E-04	Equation 2
2,4-Dimethylphenol	105-67-9	2.36	2.10	1.68E+00	Equation 1	2.2E-04	Equation 2
2,4-Dinitrophenol	51-28-5	1.52	-2.00	5.13E+00	Equation 1	1.9E-04	Equation 2
2,4-Dinitrotoluene	121-14-2	2.00	1.71	2.72E+00	EPA (1999a)	2.1E-04	EPA (1999a)
2,6-Dinitrotoluene	606-20-2	1.89	1.62	3.15E+00	EPA (1999a)	2.1E-04	EPA (1999a)
2-Chlorophenol	95-57-8	2.16	2.59	2.18E+00	Equation 1	2.1E-04	Equation 2
2-Chlorotoluene	95-49-8	3.42	2.65	3.50E-01	Equation 1	2.6E-04	Equation 2
2-Nitrophenol	88-75-5	1.79	1.55	3.57E+00	Equation 1	2.0E-04	Equation 2
4,6-Dinitro-o-cresol	534-52-1	2.12	2.78	2.30E+00	Equation 1	2.1E-04	Equation 2
4-Chlorotoluene	106-43-4	3.33	2.75	4.61E-01	Equation 1	2.6E-04	Equation 2
4-Nitrophenol	100-02-7	1.91	1.64	3.05E+00	Equation 1	2.1E-04	Equation 2
alpha-Methylstyrene	98-83-9	3.48	2.91	3.86E-01	Equation 1	2.7E-04	Equation 2

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
Tetrachloronaphthalene	1335-88-2	No data	No data	No data	No data	No data	No data
Trichloronaphthalene	1321-65-9	No data	No data	No data	No data	No data	No data
Light Substituted Benzene Compounds (molecular weight <200 g/mole)							
1,2,3-Trichlorobenzene	87-61-6	2.79E-04	Equation 3	1.47E+02	Equation 2	1.78E-01	Equation 1
1,2,4-Trichlorobenzene	120-82-1	2.44E-04	Equation 3	1.32E+02	Equation 2	1.92E-01	Equation 1
1,2,4-Trimethyl benzene	95-63-6	1.12E-04	Equation 3	6.97E+01	Equation 2	3.01E-01	Equation 1
1,2-Dichlorobenzene	95-50-1	7.01E-05	Equation 3	4.74E+01	Equation 2	3.95E-01	Equation 1
1,3,5-Trimethyl benzene	108-67-8	6.61E-05	Equation 3	4.52E+01	Equation 2	4.09E-01	Equation 1
1,3-Dichlorobenzene	541-73-1	8.52E-05	Equation 3	5.56E+01	Equation 2	3.53E-01	Equation 1
1,3-Dinitrobenzene	99-65-0	7.79E-07	Equation 3	2.51E+03	EPA (1999a)	5.32E+00	EPA (1999a)
1,4-Dichlorobenzene	106-46-7	6.48E-05	Equation 3	4.45E+01	Equation 2	4.13E-01	Equation 1
1,4-Dinitrobenzene	100-25-4	7.94E-07	Equation 3	1.21E+00	Equation 2	5.26E+00	Equation 1
2,4,5-Trichlorophenol	95-95-4	1.86E-04	Equation 3	1.06E+02	Equation 2	2.25E-01	Equation 1
2,4,6-Trichlorophenol	88-06-2	1.29E-04	Equation 3	7.83E+01	Equation 2	2.77E-01	Equation 1
2,4-Dichlorophenol	120-83-2	2.74E-05	Equation 3	2.20E+01	Equation 2	6.80E-01	Equation 1
2,4-Dimethylphenol	105-67-9	5.75E-06	Equation 3	6.12E+00	Equation 2	1.68E+00	Equation 1
2,4-Dinitrophenol	51-28-5	8.29E-07	Equation 3	1.25E+00	Equation 2	5.13E+00	Equation 1
2,4-Dinitrotoluene	121-14-2	2.49E-06	Equation 3	2.51E+03	EPA (1999a)	2.72E+00	EPA (1999a)
2,6-Dinitrotoluene	606-20-2	1.93E-06	Equation 3	2.51E+03	EPA (1999a)	3.15E+00	EPA (1999a)
2-Chlorophenol	95-57-8	3.64E-06	Equation 3	4.21E+00	Equation 2	2.18E+00	Equation 1
2-Chlorotoluene	95-49-8	8.64E-05	Equation 3	5.63E+01	Equation 2	3.50E-01	Equation 1
2-Nitrophenol	88-75-5	1.55E-06	Equation 3	2.09E+00	Equation 2	3.57E+00	Equation 1
4,6-Dinitro-o-cresol	534-52-1	3.31E-06	Equation 3	2.13E-04	Equation 2	2.30E+00	Equation 1
4-Chlorotoluene	106-43-4	5.37E-05	Equation 3	3.81E+01	Equation 2	4.61E-01	Equation 1
4-Nitrophenol	100-02-7	2.04E-06	Equation 3	2.62E+00	Equation 2	3.05E+00	Equation 1
alpha-Methylstyrene	98-83-9	7.30E-05	Equation 3	4.90E+01	Equation 2	3.86E-01	Equation 1

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
Aniline	62-53-3	0.98	0.92	1.05E+01	Equation 1	1.8E-04	Equation 2
Benzotrichloride	98-07-7	2.92	3.07	7.95E-01	Equation 1	2.4E-04	Equation 2
Benzyl chloride	100-44-7	2.30	1.95	1.81E+00	Equation 1	2.2E-04	Equation 2
Bromobenzene	108-86-1	2.99	2.65	7.24E-01	Equation 1	2.5E-04	Equation 2
Chlorobenzene	108-90-7	2.79	2.35	9.45E-01	Equation 1	2.4E-04	Equation 2
Cumene	98-82-8	3.61	2.97	3.16E-01	Equation 1	2.7E-04	Equation 2
m-Cresol	108-39-4	1.96	1.68	2.86E+00	Equation 1	2.1E-04	Equation 2
n-Butyl benzene	104-51-8	4.28	3.40	1.30E-01	Equation 1	3.0E-04	Equation 2
Nitrobenzene	98-95-3	1.83	2.08	3.38E+00	EPA (1999a)	2.0E-04	EPA (1999a)
n-Propyl benzene	103-65-1	3.69	2.86	2.85E-01	Equation 1	2.7E-04	Equation 2
o-Cresol	95-48-7	2.02	1.73	2.63E+00	Equation 1	2.1E-04	Equation 2
o-Dinitrobenzene	528-29-0	1.69	2.35	4.08E+00	Equation 1	2.0E-04	Equation 2
o-Nitroaniline	88-74-4	1.85	1.59	3.30E+00	Equation 1	2.0E-04	Equation 2
o-Toluidine	95-53-4	1.34	1.20	6.50E+00	Equation 1	1.9E-04	Equation 2
p-Chloroaniline	106-47-8	1.87	1.61	3.22E+00	Equation 1	2.0E-04	Equation 2
p-Cresol	106-44-5	1.94	1.66	2.93E+00	Equation 1	2.1E-04	Equation 2
Phenol	108-95-2	1.48	1.34	5.42E+00	Equation 1	1.9E-04	Equation 2
p-Nitrochlorobenzene	100-00-5	2.39	2.02	1.61E+00	Equation 1	2.2E-04	Equation 2
p-Toluidine	106-49-0	1.40	1.24	6.01E+00	Equation 1	1.9E-04	Equation 2
sec-Butyl benzene	135-98-8	NA	NA	No data	No data	No data	No data
tert-Butyl benzene	98-06-6	4.11	3.36	1.63E-01	Equation 1	2.9E-04	Equation 2
Toluene-2,6-diamine	823-40-5	0.16	2.09	3.13E+01	Equation 1	1.6E-04	Equation 2
Trimethyl benzene	25551-13-7	3.42	2.85	4.09E-01	Equation 1	2.6E-04	Equation 2
Other Light Semivolatile Compounds (molecular weight <200 g/mole)							
1,1'-Biphenyl	92-52-4	3.90	3.40	2.16E-01	Equation 1	2.8E-04	Equation 2
1,1-Dimethylhydrazine	57-14-7	-1.19	1.30	1.89E+02	Equation 1	1.3E-04	Equation 2

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
Aniline	62-53-3	2.40E-07	Equation 3	4.54E-01	Equation 2	1.05E+01	Equation 1
Benzotrichloride	98-07-7	2.09E-05	Equation 3	1.76E+01	Equation 2	7.95E-01	Equation 1
Benzyl chloride	100-44-7	5.01E-06	Equation 3	5.47E+00	Equation 2	1.81E+00	Equation 1
Bromobenzene	108-86-1	2.45E-05	Equation 3	2.01E+01	Equation 2	7.24E-01	Equation 1
Chlorobenzene	108-90-7	1.55E-05	Equation 3	1.38E+01	Equation 2	9.45E-01	Equation 1
Cumene	98-82-8	1.03E-04	Equation 3	6.50E+01	Equation 2	3.16E-01	Equation 1
m-Cresol	108-39-4	2.29E-06	Equation 3	2.87E+00	Equation 2	2.86E+00	Equation 1
n-Butyl benzene	104-51-8	4.79E-04	Equation 3	2.29E+02	Equation 2	1.30E-01	Equation 1
Nitrobenzene	98-95-3	1.71E-06	Equation 3	2.40E+01	EPA (1999a)	3.38E+00	EPA (1999a)
n-Propyl benzene	103-65-1	1.23E-04	Equation 3	7.52E+01	Equation 2	2.85E-01	Equation 1
o-Cresol	95-48-7	2.64E-06	Equation 3	3.23E+00	Equation 2	2.63E+00	Equation 1
o-Dinitrobenzene	528-29-0	1.23E-06	Equation 3	1.99E-04	Equation 2	4.08E+00	Equation 1
o-Nitroaniline	88-74-4	1.78E-06	Equation 3	2.34E+00	Equation 2	3.30E+00	Equation 1
o-Toluidine	95-53-4	5.50E-07	Equation 3	8.95E-01	Equation 2	6.50E+00	Equation 1
p-Chloroaniline	106-47-8	1.86E-06	Equation 3	2.43E+00	Equation 2	3.22E+00	Equation 1
p-Cresol	106-44-5	2.19E-06	Equation 3	2.77E+00	Equation 2	2.93E+00	Equation 1
Phenol	108-95-2	7.54E-07	Equation 3	1.16E+00	Equation 2	5.42E+00	Equation 1
p-Nitrochlorobenzene	100-00-5	6.17E-06	Equation 3	6.48E+00	Equation 2	1.61E+00	Equation 1
p-Toluidine	106-49-0	6.31E-07	Equation 3	1.00E+00	Equation 2	6.01E+00	Equation 1
sec-Butyl benzene	135-98-8	No data	No data	No data	No data	No data	No data
tert-Butyl benzene	98-06-6	3.24E-04	Equation 3	1.66E+02	Equation 2	1.63E-01	Equation 1
Toluene-2,6-diamine	823-40-5	3.63E-08	Equation 3	1.55E-04	Equation 2	3.13E+01	Equation 1
Trimethyl benzene	25551-13-7	6.61E-05	Equation 3	2.63E-04	Equation 2	4.09E-01	Equation 1
Other Light Semivolatile Compounds (molecular weight <200 g/mole)							
1,1'-Biphenyl	92-52-4	2.00E-04	Equation 3	1.12E+02	Equation 2	2.16E-01	Equation 1
1,1-Dimethylhydrazine	57-14-7	1.62E-09	Equation 3	1.25E-04	Equation 2	1.89E+02	Equation 1

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
1,2-Dimethylhydrazine	540-73-8	-1.37	-0.92	2.39E+02	Equation 1	1.2E-04	Equation 2
1,2-Diphenylhydrazine	122-66-7	2.94	2.44	7.74E-01	Equation 1	2.4E-04	Equation 2
1,3-Propane sultone	1120-71-4	-0.52	-0.26	7.77E+01	Equation 1	1.4E-04	Equation 2
2,4-Toluene diisocyanate	584-84-9	NA	NA	No data	No data	No data	No data
2-Chloroacetophenone	532-27-4	1.93	1.95	2.97E+00	Equation 1	2.1E-04	Equation 2
2-Propenoic acid	79-10-7	0.43	0.49	2.19E+01	Equation 1	1.6E-04	Equation 2
4,4'-Methylenedianiline	101-77-9	1.59	3.69	4.67E+00	Equation 1	2.0E-04	Equation 2
Acetophenone	98-86-2	1.64	1.43	4.36E+00	Equation 1	2.0E-04	Equation 2
Benzoic acid	65-85-0	1.87	-0.26	3.21E+00	Equation 1	2.0E-04	Equation 2
bis(2-Chloroethoxy)methane	111-91-1	1.30	0.44	6.86E+00	Equation 1	1.9E-04	Equation 2
bis(2-Chloroethyl) ether	111-44-4	1.30	1.88	6.85E+00	Equation 1	1.9E-04	Equation 2
Chlorocyclopentadiene	41851-50-7	2.43	2.16	1.53E+00	Equation 1	2.2E-04	Equation 2
Cyclohexanol	108-93-0	1.23	1.11	7.53E+00	Equation 1	1.8E-04	Equation 2
Dichloroisopropyl ether	108-60-1	2.58	1.78	1.25E+00	Equation 1	2.3E-04	Equation 2
Dichloromethyl ether	542-88-1	0.58	0.64	1.79E+01	Equation 1	1.7E-04	Equation 2
Dichloropentadiene	61626-71-9	NA	NA	No data	No data	No data	No data
Dimethyl sulfate	77-78-1	0.16	1.38	3.13E+01	Equation 1	1.6E-04	Equation 2
Dimethylaniline	121-69-7	2.31	1.89	1.79E+00	Equation 1	2.2E-04	Equation 2
Di-n-propylnitrosamine	621-64-7	1.38	1.23	6.17E+00	Equation 1	1.9E-04	Equation 2
Diphenyl ether	101-84-8	4.21	3.43	1.43E-01	Equation 1	3.0E-04	Equation 2
Epichlorohydrin	106-89-8	0.25	0.35	2.77E+01	Equation 1	1.6E-04	Equation 2
Ethyl carbamate (Urethane)	51-79-6	-0.15	0.03	4.73E+01	Equation 1	1.5E-04	Equation 2
Ethyl methanesulfonate	62-50-0	0.05	0.19	3.63E+01	Equation 1	1.5E-04	Equation 2
Ethylene dibromide	106-93-4	1.75	1.52	3.77E+00	Equation 1	2.0E-04	Equation 2
Ethylene glycol	107-21-1	-1.36	0.00	2.37E+02	Equation 1	1.2E-04	Equation 2
Ethylene glycol monobutyl ether	111-76-2	0.83	0.00	1.28E+01	Equation 1	1.7E-04	Equation 2

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
1,2-Dimethylhydrazine	540-73-8	1.08E-09	Equation 3	5.42E-03	Equation 2	2.39E+02	Equation 1
1,2-Diphenylhydrazine	122-66-7	2.19E-05	Equation 3	1.83E+01	Equation 2	7.74E-01	Equation 1
1,3-Propane sultone	1120-71-4	7.53E-09	Equation 3	2.66E-02	Equation 2	7.77E+01	Equation 1
2,4-Toluene diisocyanate	584-84-9	No data	No data	No data	No data	No data	No data
2-Chloroacetophenone	532-27-4	2.14E-06	Equation 3	2.07E-04	Equation 2	2.97E+00	Equation 1
2-Propenoic acid	79-10-7	6.76E-08	Equation 3	1.62E-04	Equation 2	2.19E+01	Equation 1
4,4'-Methylenedianiline	101-77-9	9.77E-07	Equation 3	1.96E-04	Equation 2	4.67E+00	Equation 1
Acetophenone	98-86-2	1.10E-06	Equation 3	1.97E-04	Equation 2	4.36E+00	Equation 1
Benzoic acid	65-85-0	1.86E-06	Equation 3	2.05E-04	Equation 2	3.21E+00	Equation 1
bis(2-Chloroethoxy)methane	111-91-1	5.01E-07	Equation 3	1.87E-04	Equation 2	6.86E+00	Equation 1
bis(2-Chloroethyl) ether	111-44-4	5.02E-07	Equation 3	1.87E-04	Equation 2	6.85E+00	Equation 1
Chlorocyclopentadiene	41851-50-7	6.76E-06	Equation 3	2.24E-04	Equation 2	1.53E+00	Equation 1
Cyclohexanol	108-93-0	4.27E-07	Equation 3	1.85E-04	Equation 2	7.53E+00	Equation 1
Dichloroisopropyl ether	108-60-1	9.55E-06	Equation 3	2.30E-04	Equation 2	1.25E+00	Equation 1
Dichloromethyl ether	542-88-1	9.55E-08	Equation 3	1.66E-04	Equation 2	1.79E+01	Equation 1
Dichloropentadiene	61626-71-9	No data	No data	No data	No data	No data	No data
Dimethyl sulfate	77-78-1	3.63E-08	Equation 3	1.55E-04	Equation 2	3.13E+01	Equation 1
Dimethylaniline	121-69-7	5.13E-06	Equation 3	2.20E-04	Equation 2	1.79E+00	Equation 1
Di-n-propylnitrosamine	621-64-7	6.03E-07	Equation 3	9.65E-01	Equation 2	6.17E+00	Equation 1
Diphenyl ether	101-84-8	4.07E-04	Equation 3	2.00E+02	Equation 2	1.43E-01	Equation 1
Epichlorohydrin	106-89-8	4.47E-08	Equation 3	1.15E-01	Equation 2	2.77E+01	Equation 1
Ethyl carbamate (Urethane)	51-79-6	1.78E-08	Equation 3	5.38E-02	Equation 2	4.73E+01	Equation 1
Ethyl methanesulfonate	62-50-0	2.81E-08	Equation 3	7.84E-02	Equation 2	3.63E+01	Equation 1
Ethylene dibromide	106-93-4	1.41E-06	Equation 3	1.94E+00	Equation 2	3.77E+00	Equation 1
Ethylene glycol	107-21-1	1.10E-09	Equation 3	1.22E-04	Equation 2	2.37E+02	Equation 1
Ethylene glycol monobutyl ether	111-76-2	1.70E-07	Equation 3	1.73E-04	Equation 2	1.28E+01	Equation 1

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
Ethylene glycol monoethyl ether acetate	111-15-9	0.59	0.32	1.77E+01	Equation 1	1.7E-04	Equation 2
Ethylene thiourea	96-45-7	-0.66	0.81	9.32E+01	Equation 1	1.4E-04	Equation 2
Furfural	98-01-1	0.96	0.90	1.08E+01	Equation 1	1.8E-04	Equation 2
Maleic hydrazide	123-33-1	-0.84	1.01	1.18E+02	Equation 1	1.3E-04	Equation 2
Malononitrile	109-77-3	-0.60	1.18	8.61E+01	Equation 1	1.4E-04	Equation 2
Methyl styrene (mixed isomers)	25013-15-4	3.48	2.91	3.77E-01	Equation 1	2.7E-04	Equation 2
Methylhydrazine	60-34-4	-1.05	-0.67	1.57E+02	Equation 1	1.3E-04	Equation 2
N,N-Diphenylamine	122-39-4	3.50	2.54	3.67E-01	Equation 1	2.7E-04	Equation 2
Nitric acid, propyl ester	627-13-4	NA	NA	No data	No data	No data	No data
N-Nitrosodi-n-butylamine	924-16-3	2.41	2.03	1.57E+00	Equation 1	2.2E-04	Equation 2
N-Nitrosomorpholine	59-89-2	0.98	0.92	1.05E+01	Equation 1	1.8E-04	Equation 2
N-Nitroso-N,N-dimethylamine	62-75-9	-0.57	1.58	8.27E+01	Equation 1	1.4E-04	Equation 2
o-Anisidine	90-04-0	1.18	1.07	8.05E+00	Equation 1	1.8E-04	Equation 2
Oxalic acid	144-62-7	NA	NA	No data	No data	No data	No data
Phthalic anhydride	85-44-9	-0.60	-0.68	8.63E+01	Equation 1	1.4E-04	Equation 2
p-Phthalic acid	100-21-0	2.00	1.85	2.70E+00	Equation 1	2.1E-04	Equation 2
Pyridine	110-86-1	0.67	0.67	1.59E+01	Equation 1	1.7E-04	Equation 2
Quinoline	91-22-5	2.03	3.26	2.60E+00	Equation 1	2.1E-04	Equation 2
Quinone	106-51-4	0.20	0.31	2.97E+01	Equation 1	1.6E-04	Equation 2
Safrole	94-59-7	2.66	2.23	1.12E+00	Equation 1	2.3E-04	Equation 2
Tetrahydrofuran	109-99-9	0.45	0.50	2.14E+01	Equation 1	1.6E-04	Equation 2
Other Heavy Semivolatile Compounds (molecular weight >200 g/mole)							
1,2,4,5-Tetrachlorobenzene	95-94-3	4.64	3.77	8.06E-02	Equation 1	3.2E-04	Equation 2
1,3,5-Trinitrobenzene	99-35-4	1.18	1.07	8.06E+00	Equation 1	1.8E-04	Equation 2
2,6-Bis(tert-butyl)-4-methylphenol	128-37-0	4.17	3.40	1.51E-01	Equation 1	3.0E-04	Equation 2
2-Cyclohexyl-4,6-dinitrophenol	131-89-5	4.54	3.69	9.20E-02	Equation 1	3.1E-04	Equation 2

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
Ethylene glycol monoethyl ether acetate	111-15-9	9.77E-08	Equation 3	1.67E-04	Equation 2	1.77E+01	Equation 1
Ethylene thiourea	96-45-7	5.50E-09	Equation 3	1.36E-04	Equation 2	9.32E+01	Equation 1
Furfural	98-01-1	2.29E-07	Equation 3	1.77E-04	Equation 2	1.08E+01	Equation 1
Maleic hydrazide	123-33-1	3.63E-09	Equation 3	1.32E-04	Equation 2	1.18E+02	Equation 1
Malononitrile	109-77-3	6.31E-09	Equation 3	1.38E-04	Equation 2	8.61E+01	Equation 1
Methyl styrene (mixed isomers)	25013-15-4	7.59E-05	Equation 3	2.65E-04	Equation 2	3.77E-01	Equation 1
Methylhydrazine	60-34-4	2.24E-09	Equation 3	9.86E-03	Equation 2	1.57E+02	Equation 1
N,N-Diphenylamine	122-39-4	7.94E-05	Equation 3	5.25E+01	Equation 2	3.67E-01	Equation 1
Nitric acid, propyl ester	627-13-4	No data	No data	No data	No data	No data	No data
N-Nitrosodi-n-butylamine	924-16-3	6.46E-06	Equation 3	6.73E+00	Equation 2	1.57E+00	Equation 1
N-Nitrosomorpholine	59-89-2	2.40E-07	Equation 3	4.54E-01	Equation 2	1.05E+01	Equation 1
N-Nitroso-N,N-dimethylamine	62-75-9	6.76E-09	Equation 3	1.38E-04	Equation 2	8.27E+01	Equation 1
o-Anisidine	90-04-0	3.80E-07	Equation 3	6.61E-01	Equation 2	8.05E+00	Equation 1
Oxalic acid	144-62-7	No data	No data	No data	No data	No data	No data
Phthalic anhydride	85-44-9	6.28E-09	Equation 3	2.30E-02	Equation 2	8.63E+01	Equation 1
p-Phthalic acid	100-21-0	2.51E-06	Equation 3	2.09E-04	Equation 2	2.70E+00	Equation 1
Pyridine	110-86-1	1.18E-07	Equation 3	2.53E-01	Equation 2	1.59E+01	Equation 1
Quinoline	91-22-5	2.69E-06	Equation 3	3.29E+00	Equation 2	2.60E+00	Equation 1
Quinone	106-51-4	3.98E-08	Equation 3	1.04E-01	Equation 2	2.97E+01	Equation 1
Safrole	94-59-7	1.15E-05	Equation 3	1.08E+01	Equation 2	1.12E+00	Equation 1
Tetrahydrofuran	109-99-9	7.03E-08	Equation 3	1.66E-01	Equation 2	2.14E+01	Equation 1
Other Heavy Semivolatile Compounds (molecular weight >200 g/mole)							
1,2,4,5-Tetrachlorobenzene	95-94-3	1.10E-03	Equation 3	4.51E+02	Equation 2	8.06E-02	Equation 1
1,3,5-Trinitrobenzene	99-35-4	3.79E-07	Equation 3	6.60E-01	Equation 2	8.06E+00	Equation 1
2,6-Bis(tert-butyl)-4-methylphenol	128-37-0	3.72E-04	Equation 3	1.86E+02	Equation 2	1.51E-01	Equation 1
2-Cyclohexyl-4,6-dinitrophenol	131-89-5	8.71E-04	Equation 3	3.73E+02	Equation 2	9.20E-02	Equation 1

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
2-sec-Butyl-4,6-dinitrophenol	88-85-7	3.56	3.55	3.39E-01	Equation 1	2.7E-04	Equation 2
3,3'-Dichlorobenzidine	91-94-1	3.58	2.94	3.30E-01	Equation 1	2.7E-04	Equation 2
3,3'-Dimethoxybenzidine	119-90-4	1.81	1.56	3.48E+00	Equation 1	2.0E-04	Equation 2
4-Bromophenylphenyl ether	101-55-3	5.04	4.08	4.72E-02	Equation 1	3.4E-04	Equation 2
Ammonium perfluorooctanoate	3825-26-1	NA	NA	No data	No data	No data	No data
Azobenzene	103-33-3	3.82	3.29	2.40E-01	Equation 1	2.8E-04	Equation 2
Bis(3-tert-butyl-4-hydroxy-6-methyl-phenyl)sulfide	96-69-5	NA	NA	No data	No data	No data	No data
Captan	133-06-2	2.35	2.30	1.70E+00	Equation 1	2.2E-04	Equation 2
Chlorobenzilate	510-15-6	4.38	3.57	1.14E-01	Equation 1	3.1E-04	Equation 2
Dibutylphosphate	107-66-4	NA	NA	No data	No data	No data	No data
Dimethyl aminoazobenzene	60-11-7	4.58	3.72	8.72E-02	Equation 1	3.2E-04	Equation 2
Hexachlorobenzene	118-74-1	5.50	4.90	2.55E-02	EPA (1999a)	3.7E-04	EPA (1999a)
Hexachlorobutadiene	87-68-3	4.73	3.84	7.14E-02	EPA (1999a)	3.2E-04	EPA (1999a)
Hexachlorocyclopentadiene	77-47-4	4.91	3.98	5.65E-02	EPA (1999a)	3.3E-04	EPA (1999a)
Hexachloroethane	67-72-1	3.98	3.26	1.93E-01	Equation 1	2.9E-04	Equation 2
Hexachlorophene	70-30-4	7.54	6.03	1.70E-03	EPA (1999a)	5.1E-04	Mass-limited
Hexamethylene-1,5-diisocyanate	822-06-0	3.20	3.77	5.48E-01	Equation 1	2.5E-04	Equation 2
Mirex	2385-85-5	6.89	6.00	4.03E-03	Equation 1	4.6E-04	Mass-limited
Nitrofen	1836-75-5	5.53	4.46	2.46E-02	Equation 1	3.7E-04	Equation 2
Pentachlorobenzene	608-93-5	5.09	4.51	4.40E-02	EPA (1999a)	3.4E-04	EPA (1999a)
Pentachloronitrobenzene	82-68-8	4.64	3.77	8.00E-02	EPA (1999a)	3.2E-04	EPA (1999a)
Pentachlorophenol	87-86-5	5.08	2.70	4.49E-02	EPA (1999a)	3.4E-04	EPA (1999a)
Picric acid	88-89-1	2.03	1.73	2.60E+00	Equation 1	2.1E-04	Equation 2
Pronamide	23950-58-5	3.51	2.89	3.62E-01	Equation 1	2.7E-04	Equation 2
Strychnine	57-24-9	1.93	1.66	2.97E+00	Equation 1	2.1E-04	Equation 2
Terphenyls	26140-60-3	NA	No data	No data	No data	No data	No data

Appendix Table C-10. Ecological Transfer Factors for COPCs
for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
2-sec-Butyl-4,6-dinitrophenol	88-85-7	9.12E-05	Equation 3	2.69E-04	Equation 2	3.39E-01	Equation 1
3,3'-Dichlorobenzidine	91-94-1	9.44E-05	Equation 3	6.11E+01	Equation 2	3.30E-01	Equation 1
3,3'-Dimethoxybenzidine	119-90-4	1.62E-06	Equation 3	2.17E+00	Equation 2	3.48E+00	Equation 1
4-Bromophenylphenyl ether	101-55-3	2.76E-03	Equation 3	9.59E+02	Equation 2	4.72E-02	Equation 1
Ammonium perfluorooctanoate	3825-26-1	No data	No data	No data	No data	No data	No data
Azobenzene	103-33-3	1.66E-04	Equation 3	9.61E+01	Equation 2	2.40E-01	Equation 1
Bis(3-tert-butyl-4-hydroxy-6-methyl-phenyl)sulfide	96-69-5	No data	No data	No data	No data	No data	No data
Captan	133-06-2	5.62E-06	Equation 3	6.01E+00	Equation 2	1.70E+00	Equation 1
Chlorobenzilate	510-15-6	6.03E-04	Equation 3	2.76E+02	Equation 2	1.14E-01	Equation 1
Dibutylphosphate	107-66-4	No data	No data	No data	No data	No data	No data
Dimethyl aminoazobenzene	60-11-7	9.55E-04	Equation 3	4.03E+02	Equation 2	8.72E-02	Equation 1
Hexachlorobenzene	118-74-1	7.99E-03	Equation 3	1.11E+04	EPA (1999a)	2.55E-02	EPA (1999a)
Hexachlorobutadiene	87-68-3	1.35E-03	Equation 3	1.60E+02	EPA (1999a)	7.14E-02	EPA (1999a)
Hexachlorocyclopentadiene	77-47-4	2.03E-03	EPA (1999a)	6.10E+02	EPA (1999a)	5.65E-02	EPA (1999a)
Hexachloroethane	67-72-1	2.43E-04	Equation 3	1.31E+02	Equation 2	1.93E-01	Equation 1
Hexachlorophene	70-30-4	8.72E-01	Equation 3	1.50E+03	EPA (1999a)	1.70E-03	EPA (1999a)
Hexamethylene-1,5-diisocyanate	822-06-0	3.98E-05	Equation 3	2.54E-04	Equation 2	5.48E-01	Equation 1
Mirex	2385-85-5	1.95E-01	Equation 3	3.14E+04	Equation 2	4.03E-03	Equation 1
Nitrofen	1836-75-5	8.51E-03	Equation 3	2.42E+03	Equation 2	2.46E-02	Equation 1
Pentachlorobenzene	608-93-5	3.08E-03	Equation 3	4.00E+03	EPA (1999a)	4.40E-02	EPA (1999a)
Pentachloronitrobenzene	82-68-8	1.10E-03	Equation 3	4.74E+03	EPA (1999a)	8.00E-02	EPA (1999a)
Pentachlorophenol	87-86-5	3.01E-03	EPA (1999a)	1.71E+03	EPA (1999a)	4.49E-02	EPA (1999a)
Picric acid	88-89-1	2.69E-06	Equation 3	3.29E+00	Equation 2	2.60E+00	Equation 1
Pronamide	23950-58-5	8.14E-05	Equation 3	5.36E+01	Equation 2	3.62E-01	Equation 1
Strychnine	57-24-9	2.14E-06	Equation 3	2.72E+00	Equation 2	2.97E+00	Equation 1
Terphenyls	26140-60-3	No data	No data	No data	No data	No data	No data

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
Tributyl phosphate	126-73-8	4.00	3.27	1.89E-01	Equation 1	2.9E-04	Equation 2
Trifluralin	1582-09-8	5.34	3.78	3.17E-02	Equation 1	3.6E-04	Equation 2
Triphenylamine	603-34-9	NA	No data	No data	No data	No data	No data
Herbicides and Organochlorinated Pesticides							
2,4,5-T	93-76-5	3.36	1.72	4.43E-01	Equation 1	2.6E-04	Equation 2
2,4-D and esters	94-75-7	2.81	1.30	9.20E-01	Equation 1	2.4E-04	Equation 2
4,4'-DDD	72-54-8	6.12	4.66	1.12E-02	Equation 1	4.1E-04	Mass-limited
4,4'-DDE	72-55-9	6.26	4.94	9.37E-03	EPA (1999a)	1.26E+00	EPA (1999a)
4,4'-DDT	50-29-3	6.07	5.83	1.20E-02	Equation 1	1.26E+00	Mass-limited
Aldrin	309-00-2	6.18	4.69	1.04E-02	Equation 1	4.1E-04	Mass-limited
alpha-BHC	319-84-6	3.80	3.25	2.47E-01	Equation 1	2.8E-04	Equation 2
beta-BHC	319-85-7	3.83	3.33	2.36E-01	Equation 1	2.8E-04	Equation 2
Chlordane	57-74-9	5.94	4.71	1.43E-02	Equation 1	3.9E-04	Equation 2
Delta-BHC	319-86-8	4.14	2.82	1.57E-01	Equation 1	3.0E-04	Equation 2
Dieldrin	60-57-1	5.27	4.41	3.49E-02	Equation 1	3.5E-04	Equation 2
Endothall	145-73-3	-0.87	-0.53	1.23E+02	Equation 1	1.3E-04	Equation 2
Endrin	72-20-8	4.89	4.03	5.76E-02	Equation 1	3.3E-04	Equation 2
Endrin aldehyde	7421-93-4	4.80	4.03	6.51E-02	Equation 1	3.3E-04	Equation 2
gamma-BHC (Lindane)	58-89-9	3.72	3.03	2.74E-01	Equation 1	2.8E-04	Equation 2
Lindane	58-89-9	3.72	3.03	2.74E-01	Equation 1	2.8E-04	Equation 2
Heptachlor	76-44-8	5.02	3.98	4.89E-02	EPA (1999a)	1.40E+00	EPA (1999a)
Isodrin	465-73-6	No data	No data	No data	No data	No data	No data
Methoxychlor	72-43-5	4.53	4.90	9.37E-02	Equation 1	3.1E-04	Equation 2
Silvex (2,4,5-TP)	93-72-1	3.80	1.91	2.46E-01	Equation 1	2.8E-04	Equation 2
Toxaphene	8001-35-2	5.50	5.00	2.56E-02	Equation 1	3.7E-04	Equation 2
Inorganic Chemicals and Compounds							

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
Tributyl phosphate	126-73-8	2.51E-04	Equation 3	1.35E+02	Equation 2	1.89E-01	Equation 1
Trifluralin	1582-09-8	5.50E-03	Equation 3	1.69E+03	Equation 2	3.17E-02	Equation 1
Triphenylamine	603-34-9	No data	No data	No data	No data	No data	No data
Herbicides and Organochlorinated Pesticides							
2,4,5-T	93-76-5	5.75E-05	Equation 3	4.03E+01	Equation 2	4.43E-01	Equation 1
2,4-D and esters	94-75-7	1.62E-05	Equation 3	1.43E+01	Equation 2	9.20E-01	Equation 1
4,4'-DDD	72-54-8	3.32E-02	Equation 3	7.35E+03	Equation 2	1.12E-02	Equation 1
4,4'-DDE	72-55-9	4.54E-02	Equation 3	1.13E+04	EPA (1999a)	9.37E-03	EPA (1999a)
4,4'-DDT	50-29-3	2.95E-02	Equation 3	6.69E+03	Equation 2	1.20E-02	Equation 1
Aldrin	309-00-2	3.79E-02	Equation 3	8.21E+03	Equation 2	1.04E-02	Equation 1
alpha-BHC	319-84-6	1.58E-04	Equation 3	9.24E+01	Equation 2	2.47E-01	Equation 1
beta-BHC	319-85-7	1.71E-04	Equation 3	9.85E+01	Equation 2	2.36E-01	Equation 1
Chlordane	57-74-9	2.18E-02	Equation 3	5.21E+03	Equation 2	1.43E-02	Equation 1
Delta-BHC	319-86-8	3.47E-04	Equation 3	1.76E+02	Equation 2	1.57E-01	Equation 1
Dieldrin	60-57-1	4.67E-03	Equation 3	1.48E+03	Equation 2	3.49E-02	Equation 1
Endothall	145-73-3	3.39E-09	Equation 3	1.39E-02	Equation 2	1.23E+02	Equation 1
Endrin	72-20-8	1.96E-03	Equation 3	7.25E+02	Equation 2	5.76E-02	Equation 1
Endrin aldehyde	7421-93-4	1.58E-03	Equation 3	6.84E+02	Equation 2	6.51E-02	Equation 1
gamma-BHC (Lindane)	58-89-9	1.32E-04	Equation 3	7.96E+01	Equation 2	2.74E-01	Equation 1
Lindane	58-89-9	1.32E-04	Equation 3	7.96E+01	Equation 2	2.74E-01	Equation 1
Heptachlor	76-44-8	2.60E-03	Equation 3	2.10E+04	EPA (1999a)	4.89E-02	EPA (1999a)
Isodrin	465-73-6	No data	No data	No data	No data	No data	No data
Methoxychlor	72-43-5	8.44E-04	Equation 3	3.64E+02	Equation 2	9.37E-02	Equation 1
Silvex (2,4,5-TP)	93-72-1	1.58E-04	Equation 3	2.80E-04	Equation 2	2.46E-01	Equation 1
Toxaphene	8001-35-2	7.94E-03	Equation 3	2.28E+03	Equation 2	2.56E-02	Equation 1
Inorganic Chemicals and Compounds							

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
	Metals						
Aluminum	7429-90-5	NA	NA	4.00E-03	Baes et al. (1984)	2.20E-01	EPA (1999a)
Antimony	7440-36-0	NA	NA	2.00E-01	Baes et al. (1984)	2.20E-01	EPA (1999a)
Arsenic	7440-38-2	NA	NA	4.00E-02	Baes et al. (1984)	2.58E-01	Sample et al. 1999
Barium	7440-39-3	NA	NA	1.50E-01	Baes et al. (1984)	2.20E-01	EPA (1999a)
Beryllium	7440-41-7	NA	NA	1.00E-02	Baes et al. (1984)	2.20E-01	EPA (1999a)
Bismuth	7440-69-9	NA	NA	3.50E-02	Baes et al. (1984)	3.21E-01	Average[d]
Boron	7440-42-8	NA	NA	4.00E+00	Baes et al. (1984)	3.21E-01	Average[d]
Cadmium	7440-43-9	NA	NA	5.50E-01	Baes et al. (1984)	1.71E+01	Sample et al. 1999
Calcium	7440-70-2	NA	NA	3.50E+00	Baes et al. (1984)	3.21E-01	Average[d]
Chromium	18540-29-9	NA	NA	7.50E-03	Baes et al. (1984)	1.10E+00	Sample et al. 1999
Cobalt	7440-48-4	NA	NA	2.00E-02	Baes et al. (1984)	3.21E-01	Average[d]
Copper	7440-50-8	NA	NA	4.00E-01	Baes et al. (1984)	4.00E-02	EPA (1999a)
Iron	7439-89-6	NA	NA	4.00E-03	Baes et al. (1984)	3.21E-01	Average[d]
Lead	7439-92-1	NA	NA	4.50E-02	Baes et al. (1984)	3.34E+00	Sample et al. 1999
Lithium	7439-93-2	NA	NA	2.50E-02	Baes et al. (1984)	3.21E-01	Average[d]
Magnesium	7439-95-4	NA	NA	1.00E+00	Baes et al. (1984)	3.21E-01	Average[d]
Manganese	7439-96-5	NA	NA	2.50E-01	Baes et al. (1984)	6.40E-02	Sample et al. 1999
Mercury	7439-97-6	NA	NA	9.00E-01	Baes et al. (1984)	5.23E+00	Sample et al. 1999
Mercury - Hg+2	7487-94-7	NA	NA	3.75E-02	EPA (1999a)	4.00E-02	EPA (1999a)
Methylmercury	22967-92-6	NA	NA	1.37E-01	EPA (1999a)	8.50E+00	EPA (1999a)
Molybdenum	7439-98-7	NA	NA	2.50E-01	Baes et al. (1984)	3.21E-01	Average[d]
Nickel	7440-02-0	NA	NA	6.00E-02	Baes et al. (1984)	1.66E+00	Sample et al. 1999
Potassium	7440-09-7	NA	NA	1.00E+00	Baes et al. (1984)	3.21E-01	Average[d]

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
	Metals						
Aluminum	7429-90-5	1.50E-03	Baes et al. (1984)	8.33E+02	EPA (1999a)	4.00E-03	Baes et al. (1984)
Antimony	7440-36-0	1.00E-03	Baes et al. (1984)	1.48E+03	EPA (1999a)	2.00E-01	Baes et al. (1984)
Arsenic	7440-38-2	2.00E-03	Baes et al. (1984)	2.93E+02	EPA (1999a)	4.00E-02	Baes et al. (1984)
Barium	7440-39-3	1.50E-04	Baes et al. (1984)	2.60E+02	EPA (1999a)	1.50E-01	Baes et al. (1984)
Beryllium	7440-41-7	1.00E-03	Baes et al. (1984)	1.41E+02	EPA (1999a)	1.00E-02	Baes et al. (1984)
Bismuth	7440-69-9	4.00E-04	Baes et al. (1984)	4.06E+03	Average[d]	3.50E-02	Baes et al. (1984)
Boron	7440-42-8	8.00E-04	Baes et al. (1984)	4.06E+03	Average[d]	4.00E+00	Baes et al. (1984)
Cadmium	7440-43-9	3.40E-03	Baes et al. (1984)	7.82E+02	EPA (1999a)	5.50E-01	Baes et al. (1984)
Calcium	7440-70-2	7.00E-04	Baes et al. (1984)	4.06E+03	Average[d]	3.50E+00	Baes et al. (1984)
Chromium	18540-29-9	5.51E-03	Baes et al. (1984)	4.41E+03	EPA (1999a)	7.50E-03	Baes et al. (1984)
Cobalt	7440-48-4	2.00E-02	Baes et al. (1984)	4.06E+03	Average[d]	2.00E-02	Baes et al. (1984)
Copper	7440-50-8	1.00E-02	Baes et al. (1984)	5.41E+02	EPA (1999a)	4.00E-01	Baes et al. (1984)
Iron	7439-89-6	2.00E-02	Baes et al. (1984)	4.06E+03	Average[d]	4.00E-03	Baes et al. (1984)
Lead	7439-92-1	3.00E-04	Baes et al. (1984)	1.71E+03	EPA (1999a)	4.50E-02	Baes et al. (1984)
Lithium	7439-93-2	1.00E-02	Baes et al. (1984)	4.06E+03	Average[d]	2.50E-02	Baes et al. (1984)
Magnesium	7439-95-4	5.00E-03	Baes et al. (1984)	4.06E+03	Average[d]	1.00E+00	Baes et al. (1984)
Manganese	7439-96-5	4.00E-04	Baes et al. (1984)	4.06E+03	Average[d]	2.50E-01	Baes et al. (1984)
Mercury	7439-97-6	5.21E-03	EPA (1999a)	NA	NA	9.00E-01	Baes et al. (1984)
Mercury - Hg+2	7487-94-7	5.21E-03	EPA (1999a)	2.48E+04	EPA (1999a)	3.75E-02	EPA (1999a)
Methylmercury	22967-92-6	7.81E-04	EPA (1999a)	8.00E+04	EPA (1999a)	1.37E-01	EPA (1999a)
Molybdenum	7439-98-7	6.00E-03	Baes et al. (1984)	4.06E+03	Average[c]	2.50E-01	Baes et al. (1984)
Nickel	7440-02-0	6.00E-03	Baes et al. (1984)	6.10E+01	EPA (1999a)	6.00E-02	Baes et al. (1984)
Potassium	7440-09-7	2.00E-02	Baes et al. (1984)	4.06E+03	Average[d]	1.00E+00	Baes et al. (1984)

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow}[a]	Log K_{oc}[a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
Rhodium	7440-16-6	NA	NA	1.50E-01	Baes et al. (1984)	3.21E-01	Average[d]
Selenium	7782-49-2	NA	NA	2.50E-02	Baes et al. (1984)	2.20E-01	EPA (1999a)
Silicon	7440-21-3	NA	NA	3.50E-01	Baes et al. (1984)	3.21E-01	Average[d]
Silver	7440-22-4	NA	NA	4.00E-01	Baes et al. (1984)	2.20E-01	EPA (1999a)
Sodium	7440-23-5	NA	NA	7.50E-02	Baes et al. (1984)	3.21E-01	Average[d]
Strontium	7440-24-6	NA	NA	2.50E+00	Baes et al. (1984)	3.21E-01	Average[d]
Tantalum	7440-25-7	NA	NA	1.00E-02	Baes et al. (1984)	3.21E-01	Average[d]
Thallium	7440-28-0	NA	NA	4.00E-03	Baes et al. (1984)	2.20E-01	EPA (1999a)
Tin	7440-31-5	NA	NA	3.00E-02	Baes et al. (1984)	3.21E-01	Average[d]
Tungsten	7440-33-7	NA	NA	4.50E-02	Baes et al. (1984)	3.21E-01	Average[d]
Uranium	7440-61-1	NA	NA	8.50E-03	Baes et al. (1984)	3.21E-01	Average[d]
Vanadium	7440-62-2	NA	NA	5.50E-03	Baes et al. (1984)	3.21E-01	Average[d]
Yttrium	7440-65-5	NA	NA	1.50E-02	Baes et al. (1984)	3.21E-01	Average[d]
Zinc	7440-66-6	NA	NA	1.50E+00	Baes et al. (1984)	5.77E+00	Sample et al. 1999
Zirconium	7440-67-7	NA	NA	2.00E-03	Baes et al. (1984)	3.21E-01	Average[d]
Non-metals and Anions							
Ammonia/Ammonium	7664-41-7	NA	NA	1.72E+00	Average[d]	3.21E-01	Average[d]
Bromide	24959-67-9	NA	NA	1.50E+00	Baes et al. (1984)	3.21E-01	Average[d]
Chloride	16887-00-6	NA	NA	7.00E+01	Baes et al. (1984)	3.21E-01	Average[d]
Cyanide	57-12-5	NA	NA	1.72E+00	Average[d]	1.12E+00	EPA (1999a)
Fluoride	16984-48-8	NA	NA	6.00E-02	Baes et al. (1984)	3.21E-01	Average[d]
Hydroxide	14280-30-9	NA	NA	NA	NA	NA	NA

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
Rhodium	7440-16-6	2.00E-03	Baes et al. (1984)	4.06E+03	Average[d]	1.50E-01	Baes et al. (1984)
Selenium	7782-49-2	1.90E-03	Baes et al. (1984)	1.85E+03	EPA (1999a)	2.50E-02	Baes et al. (1984)
Silicon	7440-21-3	4.00E-05	Baes et al. (1984)	4.06E+03	Average[d]	3.50E-01	Baes et al. (1984)
Silver	7440-22-4	3.00E-03	Baes et al. (1984)	1.07E+04	EPA (1999a)	4.00E-01	Baes et al. (1984)
Sodium	7440-23-5	5.50E-02	Baes et al. (1984)	4.06E+03	Average[d]	7.50E-02	Baes et al. (1984)
Strontium	7440-24-6	3.00E-04	Baes et al. (1984)	4.06E+03	Average[d]	2.50E+00	Baes et al. (1984)
Tantalum	7440-25-7	6.00E-04	Baes et al. (1984)	4.06E+03	Average[d]	1.00E-02	Baes et al. (1984)
Thallium	7440-28-0	4.00E-02	Baes et al. (1984)	1.50E+04	EPA (1999a)	4.00E-03	Baes et al. (1984)
Tin	7440-31-5	8.00E-02	Baes et al. (1984)	4.06E+03	Average[d]	3.00E-02	Baes et al. (1984)
Tungsten	7440-33-7	4.50E-02	Baes et al. (1984)	4.06E+03	Average[d]	4.50E-02	Baes et al. (1984)
Uranium	7440-61-1	2.00E-04	Baes et al. (1984)	4.06E+03	Average[d]	8.50E-03	Baes et al. (1984)
Vanadium	7440-62-2	2.50E-03	Baes et al. (1984)	4.06E+03	Average[d]	5.50E-03	Baes et al. (1984)
Yttrium	7440-65-5	3.00E-04	Baes et al. (1984)	4.06E+03	Average[d]	1.50E-02	Baes et al. (1984)
Zinc	7440-66-6	1.00E-01	Baes et al. (1984)	2.18E+03	EPA (1999a)	1.50E+00	Baes et al. (1984)
Zirconium	7440-67-7	5.50E-03	Baes et al. (1984)	4.06E+03	Average[d]	2.00E-03	Baes et al. (1984)
	Non-metals and Anions						
Ammonia/Ammonium	7664-41-7	1.95E-02	Average[d]	4.06E+03	Average[d]	1.72E+00	Average[d]
Bromide	24959-67-9	2.50E-02	Baes et al. (1984)	4.06E+03	Average[d]	1.50E+00	Baes et al. (1984)
Chloride	16887-00-6	8.00E-02	Baes et al. (1984)	4.06E+03	Average[d]	7.00E+01	Baes et al. (1984)
Cyanide	57-12-5	1.95E-02	Average[d]	2.20E+01	EPA (1999a)	1.72E+00	Average[d]
Fluoride	16984-48-8	1.50E-01	Baes et al. (1984)	4.06E+03	Average[d]	6.00E-02	Baes et al. (1984)
Hydroxide	14280-30-9	NA	NA	NA	NA	NA	NA

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Log K_{ow} [a]	Log K_{oc} [a]	SPv (kg dry soil/kg dry tissue)	Source	BAF-S (kg dry soil/ kg tissue)	Source
Iodine	7553-56-2	NA	NA	1.50E-01	Baes et al. (1984)	3.21E-01	Average[d]
Nitrate	14797-55-8	NA	NA	1.72E+00	Average[d]	3.21E-01	Average[d]
Nitrite	14797-65-0	NA	NA	1.72E+00	Average[d]	3.21E-01	Average[d]
Phosphate	14265-44-2	NA	NA	3.50E+00	Baes et al. (1984)	3.21E-01	Average[d]
Phosphorus	7723-14-0	NA	NA	3.50E+00	Baes et al. (1984)	3.21E-01	Average[d]
Sulfate	14808-79-8	NA	NA	1.50E+00	Baes et al. (1984)	3.21E-01	Average[d]
Total Sulfur	63705-05-5	NA	NA	1.50E+00	Baes et al. (1984)	3.21E-01	Average[d]

Appendix Table C-10. Ecological Transfer Factors for COPCs for the 40 mm Range, Ravenna, Ohio Ecological Risk Assessment

Constituent of Potential Concern	CAS Registry Number	Mammal Ba ([mg/kg tissue] / [mg ingested /day])	Source	WP (L/kg tissue)	Source	SP (kg dry sediment/ kg dry tissue)	Source
Iodine	7553-56-2	7.00E-03	Baes et al. (1984)	4.06E+03	Average[d]	1.50E-01	Baes et al. (1984)
Nitrate	14797-55-8	7.50E-02	Baes et al. (1984)	4.06E+03	Average[d]	1.72E+00	Average[d]
Nitrite	14797-65-0	7.50E-02	Baes et al. (1984)	4.06E+03	Average[d]	1.72E+00	Average[d]
Phosphate	14265-44-2	5.50E-02	Baes et al. (1984)	4.06E+03	Average[d]	3.50E+00	Baes et al. (1984)
Phosphorus	7723-14-0	5.50E-02	Baes et al. (1984)	4.06E+03	Average[d]	3.50E+00	Baes et al. (1984)
Sulfate	14808-79-8	1.00E-01	Baes et al. (1984)	4.06E+03	Average[d]	1.50E+00	Baes et al. (1984)
Total Sulfur	63705-05-5	1.00E-01	Baes et al. (1984)	4.06E+03	Average[d]	1.50E+00	Baes et al. (1984)

Appendix Table C-11. Area Use Factors (AUFs) for Terrestrial Receptors at 40 mm Range, Ravenna, Ohio

		AUF
		40 mm Range
Receptor	**HR** ha	**Area ha =** 0.81 (2 ac)
Red fox	5.04E+02	1.61E-03
Red-tailed hawk	8.76E+02	9.24E-04
Eastern Cottontail	3.10E+00	2.61E-01

AUF = Fraction of receptor exposure from the unit = area of unit/ area of HR; AUF = 1 when area of unit exceeds area of HR

HR = Home range

ha = hectares

Appendix Table C-12. Ingestion rates of animal, plant, and soil for wildlife receptors at 40 mm Range, Ravenna, Ohio

Receptor	IR_F (kg/kg/d)	I_P (kg/kg/d)	I_A (kg/kg/d)	I_S (kg/kg/d)	IR_W (kg/kg/d)
Terrestrial					
Cottontail rabbit	2.00E-01	1.88E-01	0.00E+00	1.26E-02	9.70E-02
Short-tailed shrew	5.60E-01	7.28E-02	4.87E-01	3.36E-02	2.23E-01
Red Fox	9.50E-02	4.37E-03	9.06E-02	2.66E-03	8.50E-02
Red-tailed hawk	1.10E-01	0.00E+00	1.10E-01	0.00E+00	5.70E-02

IR_F = ingestion rate of food (kg/kg body wt/d)
I_P = ingestion rate of plant material (kg/kg body wt/d)
I_A = ingestion rate of plant material (kg/kg body wt/d)
I_S = ingestion rate of plant material (kg/kg body wt/d)
IR_W = ingestion rate of water (kg/kg body wt/d)

Appendix Table C-13. Toxicity Reference Values (TRVs) for Plants Exposed to Soil (1997)

Ecological constituent of potential concern	Plant TRV (mg/kg)	Type of Media	Reference
Inorganics			
Aluminum	5.00E+01	Soil	Efroymson et al. (1997a)
Antimony	5.00E+00	Soil	Efroymson et al. (1997a)
Arsenic	1.00E+01	Soil	Efroymson et al. (1997a)
Barium	5.00E+02	Soil	Efroymson et al. (1997a)
Beryllium	1.00E+01	Soil	Efroymson et al. (1997a)
Bismuth	2.00E+01	Soil Solution	Efroymson et al. (1997a)
Boron	5.00E-01	Soil	Efroymson et al. (1997a)
Bromine	1.00E+01	Soil	Efroymson et al. (1997a)
Cadmium	4.00E+00	Soil	Efroymson et al. (1997a)
Chromium	1.00E+00	Soil	Efroymson et al. (1997a)
Cobalt	2.00E+01	Soil	Efroymson et al. (1997a)
Copper	1.00E+02	Soil	Efroymson et al. (1997a)
Cyanide	No TRV	None	None
Fluorine	2.00E+02	Soil	Efroymson et al. (1997a)
Iodine	4.00E+00	Soil	Efroymson et al. (1997a)
Iron	1.00E+01	Soil Solution	Efroymson et al. (1997a)
Lead	5.00E+01	Soil	Efroymson et al. (1997a)
Lithium	2.00E+00	Soil	Efroymson et al. (1997a)
Magnesium	No TRV	None	None
Manganese	5.00E+02	Soil	Efroymson et al. (1997a)
Mercury	3.00E-01	Soil	Efroymson et al. (1997a)
Methyl mercury	2.00E-04	Soil Solution	Efroymson et al. (1997a)
Molybdenum	2.00E+00	Soil	Efroymson et al. (1997a)
Nickel	3.00E+01	Soil	Efroymson et al. (1997a)
Selenium	1.00E+00	Soil	Efroymson et al. (1997a)
Silver	2.00E+00	Soil	Efroymson et al. (1997a)
Sodium	No TRV	None	None
Technetium	2.00E-01	Soil	Efroymson et al. (1997a)
Tellurium	2.00E+00	Soil Solution	Efroymson et al. (1997a)
Thallium	1.00E+00	Soil	Efroymson et al. (1997a)
Tin	5.00E+01	Soil	Efroymson et al. (1997a)
Titanium	6.00E-02	Soil Solution	Efroymson et al. (1997a)
Uranium	5.00E+00	Soil	Efroymson et al. (1997a)
Vanadium	2.00E+00	Soil	Efroymson et al. (1997a)
Zinc	5.00E+01	Soil	Efroymson et al. (1997a)
Organics			
2-Amino-4,6-Dinitrotoluene	No TRV	None	None
4-Amino-2,6-Dinitrotoluene	No TRV	None	None
2,4,6-Trinitrotoluene	No TRV	None	None
4,4'-DDE	No TRV	None	None
Acenaphthene	2.00E+01	Soil	Efroymson et al. (1997a)
Aldrin	No TRV	None	None
Aroclor-1254	4.00E+01	Soil	Efroymson et al. (1997a)
Aniline	2.00E+02	Soil Solution	Efroymson et al. (1997a)
Anthracene	No TRV	None	None
Benzo(a)anthracene	No TRV	None	None
Benzo(a)pyrene	No TRV	None	None
Benzo(b)fluoranthene	No TRV	None	None
Benzo(g,h,i)perylene	No TRV	None	None
Benzoic acid	No TRV	None	None
Benzo(k)fluoranthene	No TRV	None	None
Biphenyl	6.00E+01	Soil	Efroymson et al. (1997a)

Appendix Table C-13. Toxicity Reference Values (TRVs) for Plants Exposed to Soil (1997)

Ecological constituent of potential concern	Plant TRV (mg/kg)	Type of Media	Reference
Bis(2-ethylhexyl)phthalate	No TRV	None	None
4-Bromoaniline	1.00E+02	Soil Solution	Efroymson et al. (1997a)
Carbazole	No TRV	None	None
3-Chloroaniline	2.00E+01	Soil	Efroymson et al. (1997a)
4-Chloroaniline	4.00E+01	Soil Solution	Efroymson et al. (1997a)
2-Chlorophenol	6.00E+01	Soil Solution	Efroymson et al. (1997a)
3-Chlorophenol	7.00E+00	Soil	Efroymson et al. (1997a)
4-Chlorophenol	5.00E+01	Soil Solution	Efroymson et al. (1997a)
2-Cresol	5.00E+01	Soil Solution	Efroymson et al. (1997a)
Chrysene	No TRV	None	None
4,4'-DDT	No TRV	None	None
Dibenzo(a,h)anthracene	No TRV	None	None
3,4-dichloroaniline	1.00E+01	Soil Solution	Efroymson et al. (1997a)
2,4-Dichlorophenol	2.00E+01	Soil Solution	Efroymson et al. (1997a)
3,4-Dichlorophenol	2.00E+01	Soil	Efroymson et al. (1997a)
2,6-Dinitrotoluene	No TRV	None	None
Dieldrin	No TRV	None	None
2,4-Dinitrophenol	2.00E+01	Soil	Efroymson et al. (1997a)
Dibenzofuran	No TRV	None	None
Dimethylphthalate	No TRV	None	None
Di-n-butyl phthalate	2.00E+02	Soil	Efroymson et al. (1997a)
Diethylphthalate	1.00E+02	Soil	Efroymson et al. (1997a)
Endrin aldehyde	No TRV	None	None
Fluoranthene	No TRV	None	None
Fluorene	No TRV	None	None
Furan	6.00E+02	Soil	Efroymson et al. (1997a)
Heptachlor	No TRV	None	None
Heptane	1.00E+00	Soil Solution	Efroymson et al. (1997a)
Hexachlorocyclopentadiene	1.00E+01	Soil	Efroymson et al. (1997a)
Indeno(1,2,3-cd)pyrene	No TRV	None	None
Lindane	No TRV	None	None
Naphthalene	1.00E+01	Soil Solution	Efroymson et al. (1997a)
3-Nitroaniline	7.00E+01	Soil Solution	Efroymson et al. (1997a)
4-Nitroaniline	4.00E+01	Soil Solution	Efroymson et al. (1997a)
Nitrobenzene	8.00E+00	Soil Solution	Efroymson et al. (1997a)
Nitrocellulose	No TRV	None	None
4-Nitrophenol	1.00E+01	Soil Solution	Efroymson et al. (1997a)
4-Nitrotoluene	No TRV	None	None
Pentachlorophenol	3.00E+00	Soil	Efroymson et al. (1997a)
Phenanthrene	No TRV	None	None
Phenol	7.00E+01	Soil	Efroymson et al. (1997a)
Pyrene	No TRV	None	None
PCBs	4.00E+01	Soil	Efroymson et al. (1997a)
PCB-1254	4.00E+01		
Styrene	3.00E+02	Soil	Efroymson et al. (1997a)
2,3,5,6-Tetrachloroaniline	2.00E+01	Soil	Efroymson et al. (1997a)
tetrachloroethene	1.00E+01	Soil Solution	Efroymson et al. (1997a)
Toluene	2.00E+02	Soil	Efroymson et al. (1997a)
4-Toluidine	1.00E+02	Soil Solution	Efroymson et al. (1997a)
2,4,5-Trichloroaniline	2.00E+01	Soil	Efroymson et al. (1997a)
Trichloroethene	1.00E+02	Soil Solution	Efroymson et al. (1997a)
2,4,5-Trichlorophenol	4.00E+00	Soil	Efroymson et al. (1997a)
2,4,5-Trichlorophenol	1.00E+01	Soil Solution	Efroymson et al. (1997a)
Ortho-xylene	1.00E+00	Soil Solution	Efroymson et al. (1997a)

Appendix Table C-13. Toxicity Reference Values (TRVs) for Plants Exposed to Soil (1997)

Ecological constituent of potential concern	Plant TRV (mg/kg)	Type of Media	Reference
Xylene	1.00E+02	Soil Solution	Efroymson et al. (1997a)

Appendix Table C-14. Toxicity Reference Values (TRVs) for Earthworms Exposed to Soil (1997)

Ecological constituent of potential concern	Earthworm TRV[a] (mg/kg)	Reference
Inorganics		
Aluminum	No TRV	None
Antimony	No TRV	None
Arsenic	6.00E+01	Efroymson et al. (1997b)
Barium	No TRV	None
Beryllium	No TRV	None
Cadmium	2.00E+01	Efroymson et al. (1997b)
Calcium	No TRV	None
Chromium	4.00E-01	Efroymson et al. (1997b)
Chromium VI	No TRV	None
Cobalt	No TRV	None
Copper	6.00E+01	Efroymson et al. (1997b)
Cyanide	No TRV	None
Iron	No TRV	None
Lead	5.00E+02	Efroymson et al. (1997b)
Magnesium	No TRV	None
Manganese	No TRV	None
Mercury	1.00E-01	Efroymson et al. (1997b)
Nickel	2.00E+02	Efroymson et al. (1997b)
Potassium	No TRV	None
Selenium	7.00E+01	Efroymson et al. (1997b)
Silver	No TRV	None
Sodium	No TRV	None
Thallium	No TRV	None
Vanadium	No TRV	None
Zinc	2.00E+02	Efroymson et al. (1997b)
Organics		
2,2,5-Trimethylhexane	No TRV	None
2-Amino-4,6-Dinitrotoluene	No TRV	None
4-Amino-2,6-Dinitrotoluene	No TRV	None
2,6-Dinitrotoluene	No TRV	None
Acenaphthene	No TRV	None
Acenaphthylene	No TRV	None
Acetone	No TRV	None
Aldrin	No TRV	None
alpha-Chlordane	No TRV	None
Anthracene	No TRV	None
Aroclor-1254	No TRV	None
Aroclor-1260	No TRV	None
Benzo(a)anthracene	No TRV	None
Benzo(a)pyrene	No TRV	None
Benzo(b)fluoranthene	No TRV	None
Benzo(g,h,i)perylene	No TRV	None
Benzo(k)fluoranthene	No TRV	None

Appendix Table C-14. Toxicity Reference Values (TRVs) for Earthworms Exposed to Soil (1997)

Ecological constituent of potential concern	Earthworm TRV[a] (mg/kg)	Reference
Benzoic Acid	No TRV	None
Bis(2-ethylhexyl)phthalate	No TRV	None
Butylbenzylphthalate	No TRV	None
Carbazole	No TRV	None
Chrysene	No TRV	None
delta-BHC	No TRV	None
1,2-Dichlorobenzene	No TRV	None
1,2-Dichloroethene	No TRV	None
1,3-Dichlorobenzene	No TRV	None
1,4-Dichlorobenzene	2.00E+01	Efroymson et al. (1997b)
2,4-Dimethylphenol	No TRV	None
4,4'-DDD	No TRV	None
4,4'-DDE	No TRV	None
4,4'-DDT	No TRV	None
Dibenzo(a,h)anthracene	No TRV	None
Dibenzofuran	No TRV	None
Diethylphthalate	No TRV	None
Dieldrin	No TRV	None
Di-n-butylphthalate	No TRV	None
Endosulfan	No TRV	None
Endosulfan sulfate	No TRV	None
Endrin aldehyde	No TRV	None
Endrin ketone	No TRV	None
Fluoranthene	No TRV	None
Fluorene	No TRV	None
gamma-BHC (Lindane)	No TRV	None
Lindane	No TRV	None
gamma-Chlordane	No TRV	None
Heptachlor	No TRV	None
Heptachlor epoxide	No TRV	None
Indeno(1,2,3-cd)pyrene	No TRV	None
2-Methylnaphthalene	No TRV	None
2-Methylphenol	No TRV	None
4-Methylphenol	No TRV	None
Methoxychlor	No TRV	None
Methylene chloride	No TRV	None
Naphthalene	No TRV	None
Nitrocellulose	No TRV	None
Pentachlorophenol	6.00E+00	Efroymson et al. (1997b)
Phenanthrene	No TRV	None
Phenol	3.00E+01	Efroymson et al. (1997b)
Pyrene	No TRV	None
Toluene	No TRV	None
Trichloroethene	No TRV	None
1,2,4-Trichlorobenzene	2.00E+01	Efroymson et al. (1997b)

Appendix Table C-14. Toxicity Reference Values (TRVs) for Earthworms Exposed to Soil (1997)

Ecological constituent of potential concern	Earthworm TRV[a] (mg/kg)	Reference
2,4,5-Trichlorophenol	9.00E+00	Efroymson et al. (1997b)
Dioxins and Furans		
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	No TRV	None
1,2,3,4,6,7,8-Heptachlorodibenzofuran	No TRV	None
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	No TRV	None
1,2,3,4,7,8-Hexachlorodibenzofuran	No TRV	None
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	No TRV	None
Octachlorodibenzo-p-dioxin	1.00E-03	TEF
Octachlorodibenzofuran	1.00E-03	TEF

[a] Lowest Observed Adverse Effect Level
TRV = Toxicity Reference Values

Appendix Table C-15. Derivation of No Observed Adverse Effect Level (NOAEL) Toxicity Reference Values (TRVs) for Mammal Test Species

Ecological constituent of potential concern	Test species	Test species body weight (kg) BW_t	Benchmark (mg/kgBW/d)	Test duration	Endpoint	Effect	Source	Duration conversion factor DCF	Endpoint conversion factor ECF	TRV (mg/kgBW/d) benchmark x DCF x ECF
Inorganics										
Aluminum	Mouse	3.00E-02	1.93E+01	chronic	LOAEL	Reproduction	Ondreicka et al. (1966) in [1]	1.0	0.1	1.93E+00
Ammonia	none	none	none	none	none	none	none	none	none	No TRV
Antimony	Mouse	3.00E-02	1.25E+00	chronic	LOAEL	Longevity	Schroeder et al. (1968b) in [1]	1.0	0.1	1.25E-01
Arsenic	Mouse	3.00E-02	1.26E+00	chronic	LOAEL	Reproduction	Schroeder and Mitchner (1971) in [1]	1.0	0.1	1.26E-01
Arsenic (dissolved)	Mouse	3.00E-02	1.26E+00	chronic	LOAEL	Reproduction	Schroeder and Mitchner (1971) in [1]	1.0	0.1	1.26E-01
Barium	Rat	4.35E-01	5.06E+00	chronic	NOAEL	Growth	Perry et al. (1983) in [1]	1.0	1.0	5.06E+00
Barium (dissolved)	Rat	4.35E-01	5.06E+00	chronic	NOAEL	Growth	Perry et al. (1983) in [1]	1.0	1.0	5.06E+00
Beryllium	Rat	3.50E-01	6.60E-01	chronic	NOAEL	Longevity	Schroeder and Mitchner (1975) in [1]	1.0	1.0	6.60E-01
Beryllium (dissolved)	Rat	3.50E-01	6.60E-01	chronic	NOAEL	Longevity	Schroeder and Mitchner (1975) in [1]	1.0	1.0	6.60E-01
Boron	Rat	3.50E-01	2.80E+01	chronic	NOAEL	Reproduction	Weir and Fisher (1972) in [1]	1.0	1.0	2.80E+01
Cadmium	Rat	3.03E-01	1.00E+00	chronic	NOAEL	Reproduction	Sutou et al. (1980b) in [1]	1.0	1.0	1.00E+00
Cadmium (dissolved)	Rat	3.03E-01	1.00E+00	chronic	NOAEL	Reproduction	Sutou et al. (1980b) in [1]	1.0	1.0	1.00E+00
Calcium	none	none	none	none	none	none	none	none	none	No TRV
Chloride	none	none	none	none	none	none	none	none	none	No TRV
Chromium	Rat	3.50E-01	2.74E+03	chronic	NOAEL	Reproduction	Ivankovic and Preussmann (1975) in [1]	1.0	1.0	2.74E+03
Chromium, hexavalent	Rat	3.50E-01	1.31E+01	subchronic	LOAEL	Mortality	Steven et al. (1976) cited in Eisler 1986 in [1]	1.0	0.1	1.31E+00
Cobalt	Rat	none	1.00E+00	subchronic	NOAEL	Mortality	Underhill et al. (1931) in [2]	0.1	1.0	1.00E-01
Copper	Mink	1.00E+00	1.17E+01	chronic	NOAEL	Reproduction	Aulerich et al. (1982) in [1]	1.0	1.0	1.17E+01
Copper (dissolved)	Mink	1.00E+00	1.17E+01	chronic	NOAEL	Reproduction	Aulerich et al. (1982) in [1]	1.0	1.0	1.17E+01
Cyanide	Rat	2.73E-01	6.87E+01	chronic	NOAEL	Reproduction	Tewe and Maner (1981) in [1]	1.0	1.0	6.87E+01
Fluoride	Mink	1.00E+00	3.14E+01	chronic	NOAEL	Reproduction	Bleavinss et Aulerich (1981) in [1]	1.0	1.0	3.14E+01
Iron	none	none	none	none	none	none	none	none	none	No TRV
Lead	Rat	3.50E-01	8.00E+00	chronic	NOAEL	Reproduction	Azar et al. (1973) in [1]	1.0	1.0	8.00E+00
Lead (dissolved)	Rat	3.50E-01	8.00E+00	chronic	NOAEL	Reproduction	Azar et al. (1973) in [1]	1.0	1.0	8.00E+00
Magnesium	none	none	none	none	none	none	none	none	none	No TRV
Manganese	Rat	3.50E-01	8.80E+01	chronic	NOAEL	Reproduction	Laskey et al. (1982) in [1]	1.0	1.0	8.80E+01
Mercury	Mink	1.00E+00	1.01E+00	chronic	NOAEL	Reproduction	Aulerich et al. (1974) in [1]	1.0	1.0	1.01E+00
Molybdenum	Mouse	3.00E-02	2.58E+00	chronic	LOAEL	Reproduction	Schroeder and Mitchner (1971) in [1]	1.0	0.1	2.58E-01
Nickel	Rat	3.50E-01	4.00E+01	chronic	NOAEL	Reproduction	Ambrose et al. (1976) in [1]	1.0	1.0	4.00E+01
Nickel (dissolved)	Rat	3.50E-01	4.00E+01	chronic	NOAEL	Reproduction	Ambrose et al. (1976) in [1]	1.0	1.0	4.00E+01
Nitrate	none	none	none	none	none	none	none	none	none	No TRV
Phosphorus	none	none	none	none	none	none	none	none	none	No TRV
Potassium	none	none	none	none	none	none	none	none	none	No TRV
Selenium	Rat	3.50E-01	2.00E-01	chronic	NOAEL	Reproduction	Rosenfeld and Beath (1954) in [1]	1.0	1.0	2.00E-01
Silver	none	none	none	none	none	none	none	none	none	No TRV
Silicon	none	none	none	none	none	none	none	none	none	No TRV
Sodium	none	none	none	none	none	none	none	none	none	No TRV
Sulfate	none	none	none	none	none	none	none	none	none	No TRV
Thallium	Rat	3.65E-01	7.40E-01	subchronic	LOAEL	Reproduction	Formigli et al. (1986) in [1]	0.1	0.1	7.40E-03
Vanadium	Rat	2.60E-01	2.10E+00	chronic	LOAEL	Reproduction	Domingo et al. (1986) in [1]	1.0	0.1	2.10E-01
Zinc	Rat	3.50E-01	1.60E+02	chronic	NOAEL	Reproduction	Schlicker and Cox (1968) in [1]	1.0	1.0	1.60E+02
Organics										
1,1,1-Trichloroethane	Mouse	3.50E-02	1.00E+03	chronic	NOAEL	Reproduction	Lane et al. (1982) in [1]	1.0	1.0	1.00E+03
1,1,2,2-Tetrachloroethane	none	none	none	none	none	none	none	none	none	No TRV

Appendix Table C-15. Derivation of No Observed Adverse Effect Level (NOAEL) Toxicity Reference Values (TRVs) for Mammal Test Species

Ecological constituent of potential concern	Test species	Test species body weight (kg) BW$_t$	Benchmark (mg/kgBW/d)	Test duration	Endpoint	Effect	Source	Duration conversion factor DCF	Endpoint conversion factor ECF	TRV (mg/kgBW/d) benchmarkx DCF x ECF
1,1,2-Trichloroethane	none	none	none	none	none	none	none	none	none	No TRV
1,1-Dichloroethane	none	none	none	none	none	none	none	none	none	No TRV
1,1-Dichloroethene	Rat	3.50E-01	3.00E+01	chronic	NOAEL	Mortality	Quast et al. (1983) in [1]	1.0	1.0	3.00E+01
1,1-Dichloroethene	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,4,6,7,8-HpCDF	none	none	none	none	none	none	none	none	none	No TRV
1,2,4-trichlorobenzene	none	none	none	none	none	none	none	none	none	No TRV
1,2-cis-Dichloroethene	Mouse	3.00E-02	4.52E+01	subchronic	NOAEL	Hepatotoxicity	Palmer et al. (1979) in [1]	0.1	1.0	4.52E+00
1,2-Dichlorobenzene	none	none	none	none	none	none	none	none	none	No TRV
1,2-Dichlorobenzene	none	none	none	none	none	none	none	none	none	No TRV
1,2-Dichloroethane	Mouse	3.50E-02	5.00E+01	chronic	NOAEL	Reproduction	Lane et al. (1982) in [1]	1.0	1.0	5.00E+01
1,2-Dichloroethane	Mouse	3.50E-02	5.00E+01	chronic	NOAEL	Reproduction	Lane et al. (1982) in [1]	1.0	1.0	5.00E+01
1,2-Dichloroethene	Mouse	3.00E-02	4.52E+02	subchronic	NOAEL	Blood chemistry	Palmer et al. (1979) in [1]	0.1	1.0	4.52E+01
1,2-Dichloroethene	Mouse	3.00E-02	4.52E+01	subchronic	NOAEL	Hepatotoxicity	Palmer et al. (1979) in [1]	0.1	1.0	4.52E+00
1,2-Dichloropropane	none	none	none	none	none	none	none	none	none	No TRV
1,2-trans-Dichloroethene	Mouse	3.00E-02	4.52E+01	subchronic	NOAEL	Hepatotoxicity	Palmer et al. (1979) in [1]	0.1	1.0	4.52E+00
1,3-Dichlorobenzene	none	none	none	none	none	none	none	none	none	No TRV
1,4-Dichlorobenzene	none	none	none	none	none	none	none	none	none	No TRV
2,2,5-Trimethylhexane	none	none	none	none	none	none	none	none	none	No TRV
2,4,5-trichlorophenol	none	none	none	none	none	none	none	none	none	No TRV
2,4-D	none	none	none	none	none	none	none	none	none	No TRV
2,4-Dimethylphenol	none	none	none	none	none	none	none	none	none	No TRV
2-Chlorophenol	none	none	none	none	none	none	none	none	none	No TRV
2-Hexanone	none	none	none	none	none	none	none	none	none	No TRV
2-Methylnaphthalene	none	none	none	none	none	none	none	none	none	No TRV
2-Methylnaphthalene	none	none	none	none	none	none	none	none	none	No TRV
2-Methylphenol	none	none	none	none	none	none	none	none	none	No TRV
4,4'-DDD	none	none	none	none	none	none	none	none	none	No TRV
4,4'-DDE	Rat	3.50E-01	1.00E+01	subchronic	NOAEL	none	Kornburst et al. (1986) in EPA (1999)	0.1	1.0	1.00E+00
4,4'-DDT	Rat	3.50E-01	8.00E-01	chronic	NOAEL	Reproduction	Fitzhugh (1948) in [1]	1.0	1.0	8.00E-01
4-Chloro-3-methylphenol	none	none	none	none	none	none	none	none	none	No TRV
4-Methyl-2-pentanone	Rat	3.50E-01	2.50E+02	subchronic	NOAEL	Liver/Kidney	Microbiological Associates (1986) in [1	0.1	1.0	2.50E+01
4-Methylphenol	none	none	none	none	none	none	none	none	none	No TRV
4-Methylphenol	none	none	none	none	none	none	none	none	none	No TRV
4-Nitrophenol	none	none	none	none	none	none	none	none	none	No TRV
Acenaphthene	none	none	none	none	none	none	none	none	none	No TRV
Acenaphthylene	none	none	none	none	none	none	none	none	none	No TRV
Acetone	Rat	3.50E-01	1.00E+02	subchronic	NOAEL	Reproduction	EPA (1986c) in [1]	0.1	1.0	1.00E+01
Aldrin	Rat	3.50E-01	2.00E-01	chronic	NOAEL	Reproduction	EPA (1988a) in [1]	1.0	1.0	2.00E-01
Alkalinity	none	none	none	none	none	none	none	none	none	No TRV
alpha-Chlordane	Mouse	3.00E-02	4.58E+00	chronic	NOAEL	Reproduction	Keplinger et al. (1968) in [1]	1.0	1.0	4.58E+00
Anthracene	none	none	none	none	none	none	none	none	none	No TRV
Aroclor-1242	Mink	1.00E+00	6.85E-01	chronic	LOAEL	Reproduction	Bleavins et al. (1980) in [1]	1.0	0.1	6.85E-02
Aroclor-1248	Rhesus monkey	5.00E+00	1.00E-01	chronic	LOAEL	Reproduction	Barsotti et al. (1976) in [1]	1.0	0.1	1.00E-02
Aroclor-1254	Oldfield mouse	1.40E-02	6.80E-01	chronic	LOAEL	Reproduction	McCoy et al. (1995) in [1]	1.0	0.1	6.80E-02
Aroclor-1260	none	none	none	none	none	none	none	none	none	No TRV
Benzene	Mouse	3.00E-02	2.64E+02	chronic	LOAEL	Reproduction	Nawrot and Staples (1979) in [1]	1.0	0.1	2.64E+01
Benzo(a)anthracene	none	none	none	none	none	none	none	none	none	No TRV

Appendix Table C-15. Derivation of No Observed Adverse Effect Level (NOAEL) Toxicity Reference Values (TRVs) for Mammal Test Species

Ecological constituent of potential concern	Test species	Test species body weight (kg) BW_t	Benchmark (mg/kgBW/d)	Test duration	Endpoint	Effect	Source	Duration conversion factor DCF	Endpoint conversion factor ECF	TRV (mg/kgBW/d) benchmark x DCF x ECF
Benzo(a)pyrene	Mouse	3.00E-02	1.00E+01	chronic	LOAEL	Reproduction	Mackenzie and Angevine (1981) in [1]	1.0	0.1	1.00E+00
Benzo(b)fluoranthene	none	none	none	none	none	none	none	none	none	No TRV
Benzo(g,h,i)perylene	none	none	none	none	none	none	none	none	none	No TRV
Benzo(k)fluoranthene	none	none	none	none	none	none	none	none	none	No TRV
Benzoic acid	Mouse	0.03	40	chronic	LOAEL	unknown	Shtenberg and Ignat'ev (1970) in [3]	1.0	0.1	4.00E+00
Benzyl alcohol	none	none	none	none	none	none	none	none	none	No TRV
Bis(2-chloroisopropyl)ether	none	none	none	none	none	none	none	none	none	No TRV
Bis(2-ethylhexyl)phthalate	Mouse	3.00E-02	1.83E+01	chronic	NOAEL	Reproduction	Lamb et al. (1987) in [1]	1.0	1.0	1.83E+01
Butylbenzylphthalate	none	none	none	none	none	none	none	none	none	No TRV
Carbazole	none	none	none	none	none	none	none	none	none	No TRV
Carbon disulfide	none	none	none	none	none	none	none	none	none	No TRV
Chlordane	Mouse	3.00E-02	4.58E+00	chronic	NOAEL	Reproduction	Keplinger et al. (1968) in [1]	1.0	1.0	4.58E+00
Chlorobenzene	none	none	none	none	none	none	none	none	none	No TRV
Chloroethane	none	none	none	none	none	none	none	none	none	No TRV
Chloroform	Rat	3.50E-01	1.50E+02	subchronic	NOAEL	Gonad atrophy	Palmer et al. (1979) in [1]	0.1	1.0	1.50E+01
m,p-cresol	none	none	none	none	none	none	none	none	none	No TRV
Chrysene	none	none	none	none	none	none	none	none	none	No TRV
Dalapon	none	none	none	none	none	none	none	none	none	No TRV
delta-BHC	none	none	none	none	none	none	none	none	none	No TRV
Dibenzo(a,h)anthracene	none	none	none	none	none	none	none	none	none	No TRV
Dibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
Dicamba	none	none	none	none	none	none	none	none	none	No TRV
Dichloroprop	none	none	none	none	none	none	none	none	none	No TRV
Dieldrin	Rat	3.50E-01	2.00E-01	Chronic	Loael	Reproduction	Treon and Cleveland (1955) in [1]	1.0	0.1	2.00E-02
Diethylphthalate	Mouse	3.00E-02	4.58E+03	chronic	NOAEL	Reproduction	Lamb et al. (1987) in [1]	1.0	1.0	4.58E+03
Di-n-butylphthalate	Mouse	3.00E-02	5.50E+02	chronic	NOAEL	Reproduction	Lamb et al. (1987) in [1]	1.0	1.0	5.50E+02
Di-n-octylphthalate	none	none	none	none	none	none	none	none	none	No TRV
Endosulfan	Rat	3.50E-01	1.50E+00	subchronic	NOAEL	Reproduction	Dikshith et al.(1984) in [1]	0.1	1.0	1.50E-01
Endosulfan sulfate	none	none	none	none	none	none	none	none	none	No TRV
Endrin	Mouse	3.00E-02	9.20E-01	chronic	LOAEL	Reproduction	Good and Ware (1969) in [1]	1.0	0.1	9.20E-02
Endrin ketone	none	none	none	none	none	none	none	none	none	No TRV
Ethylbenzene	none	none	none	none	none	none	none	none	none	No TRV
Fluoranthene	none	none	none	none	none	none	none	none	none	No TRV
Fluorene	none	none	none	none	none	none	none	none	none	No TRV
gamma-Chlordane	Mouse	3.00E-02	4.58E+00	chronic	NOAEL	Reproduction	Keplinger et al. (1968) in [1]	1.0	1.0	4.58E+00
gamma-BHC (Lindane)	Rat	3.50E-01	8.00E+00	chronic	NOAEL	Reproduction	Palmer et al. (1978) in [1]	1.0	1.0	8.00E+00
Lindane	Rat	3.50E-01	8.00E+00	chronic	NOAEL	Reproduction	Palmer et al. (1978) in [1]	1.0	1.0	8.00E+00
Heptachlor	Mink	1.00E+00	1.00E+00	chronic	LOAEL	Reproduction	Crumet al. (1993) in [1]	1.0	0.1	1.00E-01
Heptachlor epoxide	none	none	none	none	none	none	none	none	none	No TRV
Indeno(1,2,3-cd)pyrene	none	none	none	none	none	none	none	none	none	No TRV
MCPA	none	none	none	none	none	none	none	none	none	No TRV
MCPP	none	none	none	none	none	none	none	none	none	No TRV
Methyl bromide	none	none	none	none	none	none	none	none	none	No TRV
Methyl ethyl ketone	Rat	3.50E-01	1.77E+03	chronic	NOAEL	Reproduction	Cox et al. (1975) in [1]	1.0	1.0	1.77E+03
Methyl mercury chloride	Rat	3.50E-01	3.20E-02	chronic	NOAEL	Reproduction	Verschuuren et al. (1976) in [1]	1.0	1.0	3.20E-02
Methylene chloride	Rat	3.50E-01	5.85E+00	chronic	NOAEL	Liver histology	NCA (1982) in [1]	1.0	1.0	5.85E+00
Methoxychlor	Rat	3.50E-01	4.00E+00	chronic	NOAEL	Reproduction	Gray et al. (1988) in [1]	none	none	4.00E+00

Appendix Table C-15. Derivation of No Observed Adverse Effect Level (NOAEL) Toxicity Reference Values (TRVs) for Mammal Test Species

Ecological constituent of potential concern	Test species	Test species body weight (kg) BW_t	Benchmark (mg/kgBW/d)	Test duration	Endpoint	Effect	Source	Duration conversion factor DCF	Endpoint conversion factor ECF	TRV (mg/kgBW/d) benchmark*x* DCF *x* ECF
Naphthalene	none	none	none	none	none	none	none	none	none	No TRV
N-Nitroso-di-N-propylamine	none	none	none	none	none	none	none	none	none	No TRV
N-Nitrosodiphenylamine	none	none	none	none	none	none	none	none	none	No TRV
Pentachlorophenol	Rat	3.50E-01	2.40E-01	chronic	NOAEL	Reproduction	Schwetz et al. (1978) in [1]	1.0	1.0	2.40E-01
Phenanthrene	none	none	none	none	none	none	none	none	none	No TRV
Phenol	none	none	none	none	none	none	none	none	none	No TRV
Pyrene	none	none	none	none	none	none	none	none	none	No TRV
Styrene	Dog	1.00E+01	2.00E+02	chronic	NOAEL	unknown	Quast et al. (1979)	1.0	1.0	2.00E+02
Tetrachloroethene	Mouse	3.00E-02	1.40E+01	subchronic	NOAEL	Hepatotoxicity	Buben and O'Flaherty (1985) in [1]	0.1	1.0	1.40E+00
Toluene	Mouse	3.00E-02	2.60E+02	chronic	LOAEL	Reproduction	Nawrot and Staples (1979) in [1]	1.0	0.1	2.60E+01
Trichloroethene	Mouse	3.00E-02	7.00E+01	subchronic	LOAEL	Hepatotoxicity	Buben and O'Flaherty (1985) in [1]	0.1	0.1	7.00E-01
Vinyl chloride	Rat	3.50E-01	1.70E+00	chronic	LOAEL	Mortality	Feron et al. (1981) in [1]	1.0	0.1	1.70E-01
Xylenes, total	Mouse	3.00E-02	2.06E+00	chronic	NOAEL	Reproduction	Marks et al. (1982) in [1]	1.0	1.0	2.06E+00
1,2-Dimethylbenzene	Mouse	3.00E-02	2.06E+00	chronic	NOAEL	Reproduction	Marks et al. (1982) in [1]	1.0	1.0	2.06E+00
Dioxins and Furans										
1,2,3,4,6,7,8-Heptachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,4,7,8,9-Heptachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,4,7,8-Hexachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,6,7,8-Hexachlorodibenzofuran	Rat	3.50E-01	1.60E-03	subchronic	NOAEL	Organ weight	Poiger et al. (1989) in [1]	0.1	1.0	1.60E-04
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,7,8,9-Hexachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,7,8-Pentachlorodibenzofuran	Rat	3.50E-01	1.60E-03	subchronic	NOAEL	Organ weight	Poiger et al. (1989) in [1]	0.1	1.0	1.60E-04
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	none	none	none	none	none	none	none	none	none	No TRV
2,3,4,6,7,8-Hexachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
2,3,4,7,8-Pentachlorodibenzofuran	Rat	3.50E-01	1.60E-04	subchronic	NOAEL	Organ weight	Poiger et al. (1989) in [1]	0.1	1.0	1.60E-05
2,3,7,8-Tetrachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
2,3,7,8-Tetrachlorodibenzo-p-dioxin	Rat	3.50E-01	1.00E-06	chronic	NOAEL	Reproduction	Murray et al. (1979) in [1]	1.0	1.0	1.00E-06
Octachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
Octachlorodibenzo-p-dioxin	none	none	none	none	none	none	none	none	none	No TRV
Explosives										
1,3,5-Trinitrobenzene	none	none	none	none	none	none	none	none	none	No TRV
1,3-Dinitrobenzene	none	none	none	none	none	none	none	none	none	No TRV
2,4,6-Trinitrotoluene	Rat	3.50E-01	1.60E+02	subchronic	LOAEL	Reproduction	Dilley et al. (1982)	0.1	0.1	1.60E+00
2,4-Dinitrotoluene	Mouse	3.00E-02	1.35E+01	chronic	NOAEL	Reproduction	Ellis et al. (1979)	1.0	1.0	1.35E+01
2,6-Dinitrotoluene	Rat	3.50E-01	7.00E+00	subchronic	NOAEL	Reproduction	ATSDR (1989)	0.1	1.0	7.00E-01
2-Amino-4,6-dinitrotoluene	none	none	none	none	none	none	none	none	none	No TRV
4-Amino-2,6-dinitrotoluene	none	none	none	none	none	none	none	none	none	No TRV
Nitrobenzene	none	none	none	none	none	none	none	none	none	No TRV
Tetryl	none	none	none	none	none	none	none	none	none	No TRV

TRV = toxicity reference value

DCF = Duration conversion factor; 1 if chronic, 0.1 if subchronic (Sample et al. 1996)

Appendix Table C-15. Derivation of No Observed Adverse Effect Level (NOAEL) Toxicity Reference Values (TRVs) for Mammal Test Species

Ecological constituent of potential concern	Test species	Test species body weight (kg) BW_t	Benchmark (mg/kgBW/d)	Test duration	Endpoint	Effect	Source	Duration conversion factor DCF	Endpoint conversion factor ECF	TRV (mg/kgBW/d) benchmark *x* DCF *x* ECF

ECF = Endpoint conversion factor; 1 if NOAEL, 0.1 if LOAEL (Sample et al. 1996)
NOAEL = No observed adverse effect level
LOAEL = Lowest observed adverse effect level
[1] = Sample et al. (1996)
[2] = Clayton and Clayton (1981)
[3] = IRIS (1996)

Appendix Table C-16. Body-Weight-Adjusted NOAEL Toxicity Reference Values (TRVs) for Mammal Receptors

				Short-tailed shrew		Cottontail		Mink		Muskrat		Red Fox	
Ecological constituent of potential concern	Test species	Test species body weight (kg)	TRV_t (mg/kgBW/d)	Body-weight conversion factor BW_{conv} $(BW_t/BW)^{0.25}$	TRV (mg/kgBW/d) $TRV_t \times BW_{conv}$	Body-weight conversion factor BW_{conv} $(BW_t/BW)^{0.25}$	TRV (mg/kgBW/d) $TRV_t \times BW_{conv}$	Body-weight conversion factor BW_{conv} $(BW_t/BW)^{0.25}$	TRV (mg/kgBW/d) $TRV_t \times BW_{conv}$	Body-weight conversion factor BW_{conv} $(BW_t/BW)^{0.25}$	TRV (mg/kgBW/d) $TRV_t \times BW_{conv}$	Body-weight conversion factor BW_{conv} $(BW_t/BW)^{0.25}$	TRV (mg/kgBW/d) $TRV_t \times BW_{conv}$
Inorganics													
Aluminum	Mouse	3.00E-02	1.93E+00	1.15E+00	2.22E+00	3.96E-01	7.64E-01	4.14E-01	7.99E-01	4.00E-01	7.72E-01	2.85E-01	5.50E-01
Ammonia	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Antimony	Mouse	3.00E-02	1.25E-01	1.15E+00	1.44E-01	3.96E-01	4.95E-02	4.14E-01	5.18E-02	4.00E-01	5.00E-02	2.85E-01	3.56E-02
Arsenic	Mouse	3.00E-02	1.26E-01	1.15E+00	1.45E-01	3.96E-01	4.99E-02	4.14E-01	5.22E-02	4.00E-01	5.04E-02	2.85E-01	3.59E-02
Arsenic (dissolved)	Mouse	3.00E-02	1.26E-01	1.15E+00	1.45E-01	3.96E-01	4.99E-02	4.14E-01	5.22E-02	4.00E-01	5.04E-02	2.85E-01	3.59E-02
Barium	Rat	4.35E-01	5.06E+00	2.25E+00	1.14E+01	7.73E-01	3.91E+00	8.08E-01	4.09E+00	7.81E-01	3.95E+00	5.57E-01	2.82E+00
Barium (dissolved)	Rat	4.35E-01	5.06E+00	2.25E+00	1.14E+01	7.73E-01	3.91E+00	8.08E-01	4.09E+00	7.81E-01	3.95E+00	5.57E-01	2.82E+00
Beryllium	Rat	3.50E-01	6.60E-01	2.13E+00	1.41E+00	7.32E-01	4.83E-01	7.65E-01	5.05E-01	7.39E-01	4.88E-01	5.27E-01	3.48E-01
Beryllium (dissolved)	Rat	3.50E-01	6.60E-01	2.13E+00	1.41E+00	7.32E-01	4.83E-01	7.65E-01	5.05E-01	7.39E-01	4.88E-01	5.27E-01	3.48E-01
Boron	Rat	3.50E-01	2.80E+01	2.13E+00	5.96E+01	7.32E-01	2.05E+01	7.65E-01	2.14E+01	7.39E-01	2.07E+01	5.27E-01	1.48E+01
Cadmium	Rat	3.03E-01	1.00E+00	2.05E+00	2.05E+00	7.06E-01	7.06E-01	7.38E-01	7.38E-01	7.13E-01	7.13E-01	5.08E-01	5.08E-01
Cadmium (dissolved)	Rat	3.03E-01	1.00E+00	2.05E+00	2.05E+00	7.06E-01	7.06E-01	7.38E-01	7.38E-01	7.13E-01	7.13E-01	5.08E-01	5.08E-01
Calcium	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Chloride	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Chromium	Rat	3.50E-01	2.74E+03	2.13E+00	5.83E+03	7.32E-01	2.00E+03	7.65E-01	2.09E+03	7.39E-01	2.02E+03	5.27E-01	1.44E+03
Chromium, hexavalent	Rat	3.50E-01	1.31E+00	2.13E+00	2.80E+00	7.32E-01	9.62E-01	7.65E-01	1.01E+00	7.39E-01	9.72E-01	5.27E-01	6.93E-01
Cobalt	Rat	none	1.00E-01	none	none	none	none	none	none	none	none	none	none
Copper	Mink	1.00E+00	1.17E+01	2.77E+00	3.24E+01	9.52E-01	1.11E+01	9.95E-01	1.17E+01	9.61E-01	1.13E+01	6.85E-01	8.02E+00
Copper (dissolved)	Mink	1.00E+00	1.17E+01	2.77E+00	3.24E+01	9.52E-01	1.11E+01	9.95E-01	1.17E+01	9.61E-01	1.13E+01	6.85E-01	8.02E+00
Cyanide	Rat	2.73E-01	6.87E+01	2.00E+00	1.38E+02	6.88E-01	4.73E+01	7.19E-01	4.94E+01	6.95E-01	4.77E+01	4.95E-01	3.40E+01
Fluoride	Mink	1.00E+00	3.14E+01	2.77E+00	8.69E+01	9.52E-01	2.98E+01	9.95E-01	3.12E+01	9.61E-01	3.02E+01	6.85E-01	2.15E+01
Iron	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Lead	Rat	3.50E-01	8.00E+00	2.13E+00	1.70E+01	7.32E-01	5.85E+00	7.65E-01	6.12E+00	7.39E-01	5.92E+00	5.27E-01	4.22E+00
Lead (dissolved)	Rat	3.50E-01	8.00E+00	2.13E+00	1.70E+01	7.32E-01	5.85E+00	7.65E-01	6.12E+00	7.39E-01	5.92E+00	5.27E-01	4.22E+00
Magnesium	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Manganese	Rat	3.50E-01	8.80E+01	2.13E+00	1.87E+02	7.32E-01	6.44E+01	7.65E-01	6.74E+01	7.39E-01	6.51E+01	5.27E-01	4.64E+01
Mercury	Mink	1.00E+00	1.01E+00	2.77E+00	2.80E+00	9.52E-01	9.61E-01	9.95E-01	1.01E+00	9.61E-01	9.71E-01	6.85E-01	6.92E-01
Molybdenum	Mouse	3.00E-02	2.58E-01	1.15E+00	2.98E-01	3.96E-01	1.02E-01	4.14E-01	1.07E-01	4.00E-01	1.03E-01	2.85E-01	7.37E-02
Nickel	Rat	3.50E-01	4.00E+01	2.13E+00	8.52E+01	7.32E-01	2.93E+01	7.65E-01	3.06E+01	7.39E-01	2.96E+01	5.27E-01	2.11E+01
Nickel (dissolved)	Rat	3.50E-01	4.00E+01	2.13E+00	8.52E+01	7.32E-01	2.93E+01	7.65E-01	3.06E+01	7.39E-01	2.96E+01	5.27E-01	2.11E+01
Nitrate	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Phosphorus	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Potassium	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Selenium	Rat	3.50E-01	2.00E-01	2.13E+00	4.26E-01	7.32E-01	1.46E-01	7.65E-01	1.53E-01	7.39E-01	1.48E-01	5.27E-01	1.05E-01
Silver	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Silicon	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Sodium	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Sulfate	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Thallium	Rat	3.65E-01	7.40E-03	2.15E+00	1.59E-02	7.40E-01	5.47E-03	7.73E-01	5.72E-03	7.47E-01	5.53E-03	5.33E-01	3.94E-03
Vanadium	Rat	2.60E-01	2.10E-01	1.98E+00	4.15E-01	6.79E-01	1.43E-01	7.11E-01	1.49E-01	6.86E-01	1.44E-01	4.89E-01	1.03E-01
Zinc	Rat	3.50E-01	1.60E+02	2.13E+00	3.41E+02	7.32E-01	1.17E+02	7.65E-01	1.22E+02	7.39E-01	1.18E+02	5.27E-01	8.43E+01
Organics													
1,1,1-Trichloroethane	Mouse	3.50E-02	1.00E+03	1.20E+00	1.20E+03	4.12E-01	4.12E+02	4.30E-01	4.30E+02	4.16E-01	4.16E+02	2.96E-01	2.96E+02
1,1,2,2-Tetrachloroethane	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,1,2-Trichloroethane	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,1-Dichloroethane	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,1-Dichloroethene	Rat	3.50E-01	3.00E+01	2.13E+00	6.39E+01	7.32E-01	2.20E+01	7.65E-01	2.30E+01	7.39E-01	2.22E+01	5.27E-01	1.58E+01
1,1-Dichloroethene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,2,3,4,6,7,8-HpCDF	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,2,4-trichlorobenzene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,2-cis-Dichloroethene	Mouse	3.00E-02	4.52E+00	1.15E+00	5.21E+00	3.96E-01	1.79E+00	4.14E-01	1.87E+00	4.00E-01	1.81E+00	2.85E-01	1.29E+00
1,2-Dichlorobenzene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,2-Dichlorobenzene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,2-Dichloroethane	Mouse	3.50E-02	5.00E+01	1.20E+00	5.99E+01	4.12E-01	2.06E+01	4.30E-01	2.15E+01	4.16E-01	2.08E+01	2.96E-01	1.48E+01
1,2-Dichloroethane	Mouse	3.50E-02	5.00E+01	1.20E+00	5.99E+01	4.12E-01	2.06E+01	4.30E-01	2.15E+01	4.16E-01	2.08E+01	2.96E-01	1.48E+01
1,2-Dichloroethene	Mouse	3.00E-02	4.52E+01	1.15E+00	5.21E+01	3.96E-01	1.79E+01	4.14E-01	1.87E+01	4.00E-01	1.81E+01	2.85E-01	1.29E+01
1,2-Dichloroethene	Mouse	3.00E-02	4.52E+00	1.15E+00	5.21E+00	3.96E-01	1.79E+00	4.14E-01	1.87E+00	4.00E-01	1.81E+00	2.85E-01	1.29E+00
1,2-Dichloropropane	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,2-trans-Dichloroethene	Mouse	3.00E-02	4.52E+00	1.15E+00	5.21E+00	3.96E-01	1.79E+00	4.14E-01	1.87E+00	4.00E-01	1.81E+00	2.85E-01	1.29E+00
1,3-Dichlorobenzene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,4-Dichlorobenzene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
2,2,5-Trimethylhexane	none	none	No TRV	none	none	none	none	none	none	none	none	none	none

Appendix Table C-16. Body-Weight-Adjusted NOAEL Toxicity Reference Values (TRVs) for Mammal Receptors

				Short-tailed shrew		Cottontail		Mink		Muskrat		Red Fox	
Ecological constituent of potential concern	Test species	Test species body weight (kg)	TRV_t (mg/kgBW/d)	Body-weight conversion factor BW_{conv} $(BW_t/BW)^{0.25}$	TRV (mg/kgBW/d) $TRV_t \times BW_{conv}$	Body-weight conversion factor BW_{conv} $(BW_t/BW)^{0.25}$	TRV (mg/kgBW/d) $TRV_t \times BW_{conv}$	Body-weight conversion factor BW_{conv} $(BW_t/BW)^{0.25}$	TRV (mg/kgBW/d) $TRV_t \times BW_{conv}$	Body-weight conversion factor BW_{conv} $(BW_t/BW)^{0.25}$	TRV (mg/kgBW/d) $TRV_t \times BW_{conv}$	Body-weight conversion factor BW_{conv} $(BW_t/BW)^{0.25}$	TRV (mg/kgBW/d) $TRV_t \times BW_{conv}$
2,4,5-trichlorophenol	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
2,4-D	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
2,4-Dimethylphenol	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
2-Chlorophenol	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
2-Hexanone	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
2-Methylnaphthalene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
2-Methylnaphthalene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
2-Methylphenol	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
4,4'-DDD	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
4,4'-DDE	Rat	3.50E-01	1.00E+00	2.13E+00	2.13E+00	7.32E-01	7.32E-01	7.65E-01	7.65E-01	7.39E-01	7.39E-01	5.27E-01	5.27E-01
4,4'-DDT	Rat	3.50E-01	8.00E-01	2.13E+00	1.70E+00	7.32E-01	5.85E-01	7.65E-01	6.12E-01	7.39E-01	5.92E-01	5.27E-01	4.22E-01
4-Chloro-3-methylphenol	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
4-Methyl-2-pentanone	Rat	3.50E-01	2.50E+01	2.13E+00	5.33E+01	7.32E-01	1.83E+01	7.65E-01	1.91E+01	7.39E-01	1.85E+01	5.27E-01	1.32E+01
4-Methylphenol	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
4-Methylphenol	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
4-Nitrophenol	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Acenaphthene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Acenaphthylene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Acetone	Rat	3.50E-01	1.00E+01	2.13E+00	2.13E+01	7.32E-01	7.32E+00	7.65E-01	7.65E+00	7.39E-01	7.39E+00	5.27E-01	5.27E+00
Aldrin	Rat	3.50E-01	2.00E-01	2.13E+00	4.26E-01	7.32E-01	1.46E-01	7.65E-01	1.53E-01	7.39E-01	1.48E-01	5.27E-01	1.05E-01
Alkalinity	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
alpha-Chlordane	Mouse	3.00E-02	4.58E+00	1.15E+00	5.28E+00	3.96E-01	1.81E+00	4.14E-01	1.90E+00	4.00E-01	1.83E+00	2.85E-01	1.31E+00
Anthracene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Aroclor-1242	Mink	1.00E+00	6.85E-02	2.77E+00	1.90E-01	9.52E-01	6.52E-02	9.95E-01	6.82E-02	9.61E-01	6.58E-02	6.85E-01	4.69E-02
Aroclor-1248	Rhesus monkey	5.00E+00	1.00E-02	4.14E+00	4.14E-02	1.42E+00	1.42E-02	1.49E+00	1.49E-02	1.44E+00	1.44E-02	1.02E+00	1.02E-02
Aroclor-1254	Oldfield mouse	1.40E-02	6.80E-02	9.53E-01	6.48E-02	3.27E-01	2.23E-02	3.42E-01	2.33E-02	3.31E-01	2.25E-02	2.36E-01	1.60E-02
Aroclor-1260	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Benzene	Mouse	3.00E-02	2.64E+01	1.15E+00	3.04E+01	3.96E-01	1.04E+01	4.14E-01	1.09E+01	4.00E-01	1.05E+01	2.85E-01	7.52E+00
Benzo(a)anthracene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Benzo(a)pyrene	Mouse	3.00E-02	1.00E+00	1.15E+00	1.15E+00	3.96E-01	3.96E-01	4.14E-01	4.14E-01	4.00E-01	4.00E-01	2.85E-01	2.85E-01
Benzo(b)fluoranthene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Benzo(g,h,i)perylene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Benzo(k)fluoranthene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Benzoic acid	Mouse	3.00E-02	4.00E+00	1.15E+00	4.61E+00	3.96E-01	1.58E+00	4.14E-01	1.66E+00	4.00E-01	1.60E+00	2.85E-01	1.14E+00
Benzyl alcohol	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Bis(2-chloroisopropyl)ether	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Bis(2-ethylhexyl)phthalate	Mouse	3.00E-02	1.83E+01	1.15E+00	2.11E+01	3.96E-01	7.25E+00	4.14E-01	7.58E+00	4.00E-01	7.32E+00	2.85E-01	5.22E+00
Butylbenzylphthalate	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Carbazole	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Carbon disulfide	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Chlordane	Mouse	3.00E-02	4.58E+00	1.15E+00	5.28E+00	3.96E-01	1.81E+00	4.14E-01	1.90E+00	4.00E-01	1.83E+00	2.85E-01	1.31E+00
Chlorobenzene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Chloroethane	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Chloroform	Rat	3.50E-01	1.50E+01	2.13E+00	3.20E+01	7.32E-01	1.10E+01	7.65E-01	1.15E+01	7.39E-01	1.11E+01	5.27E-01	7.91E+00
m,p-cresol	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Chrysene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Dalapon	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
delta-BHC	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Dibenzo(a,h)anthracene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Dibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Dicamba	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Dichloroprop	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Dieldrin	Rat	3.50E-01	2.00E-02	2.13E+00	4.26E-02	7.32E-01	1.46E-02	7.65E-01	1.53E-02	7.39E-01	1.48E-02	5.27E-01	1.05E-02
Diethylphthalate	Mouse	3.00E-02	4.58E+03	1.15E+00	5.28E+03	3.96E-01	1.81E+03	4.14E-01	1.90E+03	4.00E-01	1.83E+03	2.85E-01	1.31E+03
Di-n-butylphthalate	Mouse	3.00E-02	5.50E+02	1.15E+00	6.34E+02	3.96E-01	2.18E+02	4.14E-01	2.28E+02	4.00E-01	2.20E+02	2.85E-01	1.57E+02
Di-n-octylphthalate	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Endosulfan	Rat	3.50E-01	1.50E-01	2.13E+00	3.20E-01	7.32E-01	1.10E-01	7.65E-01	1.15E-01	7.39E-01	1.11E-01	5.27E-01	7.91E-02
Endosulfan sulfate	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Endrin	Mouse	3.00E-02	9.20E-02	1.15E+00	1.06E-01	3.96E-01	3.64E-02	4.14E-01	3.81E-02	4.00E-01	3.68E-02	2.85E-01	2.62E-02
Endrin ketone	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Ethylbenzene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Fluoranthene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Fluorene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
gamma-Chlordane	Mouse	3.00E-02	4.58E+00	1.15E+00	5.28E+00	3.96E-01	1.81E+00	4.14E-01	1.90E+00	4.00E-01	1.83E+00	2.85E-01	1.31E+00
gamma-BHC (Lindane)	Rat	3.50E-01	8.00E+00	2.13E+00	1.70E+01	7.32E-01	5.85E+00	7.65E-01	6.12E+00	7.39E-01	5.92E+00	5.27E-01	4.22E+00

Appendix Table C-16. Body-Weight-Adjusted NOAEL Toxicity Reference Values (TRVs) for Mammal Receptors

Ecological constituent of potential concern	Test species	Test species body weight (kg)	TRV_t (mg/kgBW/d)	Short-tailed shrew: Body-weight conversion factor BW_{conv} $(BW_t / BW)^{0.25}$	Short-tailed shrew: TRV (mg/kgBW/d) $TRV_t \times BW_{conv}$	Cottontail: Body-weight conversion factor BW_{conv} $(BW_t / BW)^{0.25}$	Cottontail: TRV (mg/kgBW/d) $TRV_t \times BW_{conv}$	Mink: Body-weight conversion factor BW_{conv} $(BW_t / BW)^{0.25}$	Mink: TRV (mg/kgBW/d) $TRV_t \times BW_{conv}$	Muskrat: Body-weight conversion factor BW_{conv} $(BW_t / BW)^{0.25}$	Muskrat: TRV (mg/kgBW/d) $TRV_t \times BW_{conv}$	Red Fox: Body-weight conversion factor BW_{conv} $(BW_t / BW)^{0.25}$	Red Fox: TRV (mg/kgBW/d) $TRV_t \times BW_{conv}$
Lindane	Rat	3.50E-01	8.00E+00	2.13E+00	1.70E+01	7.32E-01	5.85E+00	7.65E-01	6.12E+00	7.39E-01	5.92E+00	5.27E-01	4.22E+00
Heptachlor	Mink	1.00E+00	1.00E-01	2.77E+00	2.77E-01	9.52E-01	9.52E-02	9.95E-01	9.95E-02	9.61E-01	9.61E-02	6.85E-01	6.85E-02
Heptachlor epoxide	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Indeno(1,2,3-cd)pyrene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
MCPA	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
MCPP	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Methyl bromide	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Methyl ethyl ketone	Rat	3.50E-01	1.77E+03	2.13E+00	3.77E+03	7.32E-01	1.30E+03	7.65E-01	1.36E+03	7.39E-01	1.31E+03	5.27E-01	9.33E+02
Methyl mercury chloride	Rat	3.50E-01	3.20E-02	2.13E+00	6.82E-02	7.32E-01	2.34E-02	7.65E-01	2.45E-02	7.39E-01	2.37E-02	5.27E-01	1.69E-02
Methylene chloride	Rat	3.50E-01	5.85E+00	2.13E+00	1.25E+01	7.32E-01	4.28E+00	7.65E-01	4.48E+00	7.39E-01	4.33E+00	5.27E-01	3.08E+00
Methoxychlor	Rat	3.50E-01	4.00E+00	2.13E+00	8.52E+00	7.32E-01	2.93E+00	7.65E-01	3.06E+00	7.39E-01	2.96E+00	5.27E-01	2.11E+00
Naphthalene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
N-Nitroso-di-N-propylamine	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
N-Nitrosodiphenylamine	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Pentachlorophenol	Rat	3.50E-01	2.40E-01	2.13E+00	5.11E-01	7.32E-01	1.76E-01	7.65E-01	1.84E-01	7.39E-01	1.77E-01	5.27E-01	1.26E-01
Phenanthrene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Phenol	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Pyrene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Styrene	Dog	1.00E+01	2.00E+02	4.92E+00	9.85E+02	1.69E+00	3.38E+02	1.77E+00	3.54E+02	1.71E+00	3.42E+02	1.22E+00	2.44E+02
Tetrachloroethene	Mouse	3.00E-02	1.40E+00	1.15E+00	1.61E+00	3.96E-01	5.54E-01	4.14E-01	5.80E-01	4.00E-01	5.60E-01	2.85E-01	3.99E-01
Toluene	Mouse	3.00E-02	2.60E+01	1.15E+00	2.99E+01	3.96E-01	1.03E+01	4.14E-01	1.08E+01	4.00E-01	1.04E+01	2.85E-01	7.41E+00
Trichloroethene	Mouse	3.00E-02	7.00E-01	1.15E+00	8.07E-01	3.96E-01	2.77E-01	4.14E-01	2.90E-01	4.00E-01	2.80E-01	2.85E-01	2.00E-01
Vinyl chloride	Rat	3.50E-01	1.70E-01	2.13E+00	3.62E-01	7.32E-01	1.24E-01	7.65E-01	1.30E-01	7.39E-01	1.26E-01	5.27E-01	8.96E-02
Xylenes, total	Mouse	3.00E-02	2.06E+00	1.15E+00	2.37E+00	3.96E-01	8.16E-01	4.14E-01	8.53E-01	4.00E-01	8.24E-01	2.85E-01	5.87E-01
1,2-Dimethylbenzene	Mouse	3.00E-02	2.06E+00	1.15E+00	2.37E+00	3.96E-01	8.16E-01	4.14E-01	8.53E-01	4.00E-01	8.24E-01	2.85E-01	5.87E-01
Dioxins and Furans													
1,2,3,4,6,7,8-Heptachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,2,3,4,7,8,9-Heptachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,2,3,4,7,8-Hexachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,2,3,6,7,8-Hexachlorodibenzofuran	Rat	3.50E-01	1.60E-04	2.13E+00	3.41E-04	7.32E-01	1.17E-04	7.65E-01	1.22E-04	7.39E-01	1.18E-04	5.27E-01	8.43E-05
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,2,3,7,8,9-Hexachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,2,3,7,8-Pentachlorodibenzofuran	Rat	3.50E-01	1.60E-04	2.13E+00	3.41E-04	7.32E-01	1.17E-04	7.65E-01	1.22E-04	7.39E-01	1.18E-04	5.27E-01	8.43E-05
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
2,3,4,6,7,8-Hexachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
2,3,4,7,8-Pentachlorodibenzofuran	Rat	3.50E-01	1.60E-05	2.13E+00	3.41E-05	7.32E-01	1.17E-05	7.65E-01	1.22E-05	7.39E-01	1.18E-05	5.27E-01	8.43E-06
2,3,7,8-Tetrachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
2,3,7,8-Tetrachlorodibenzo-p-dioxin	Rat	3.50E-01	1.00E-06	2.13E+00	2.13E-06	7.32E-01	7.32E-07	7.65E-01	7.65E-07	7.39E-01	7.39E-07	5.27E-01	5.27E-07
Octachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Octachlorodibenzo-p-dioxin	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Explosives													
1,3,5-Trinitrobenzene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
1,3-Dinitrobenzene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
2,4,6-Trinitrotoluene	Rat	3.50E-01	1.60E+00	2.13E+00	3.41E+00	7.32E-01	1.17E+00	7.65E-01	1.22E+00	7.39E-01	1.18E+00	5.27E-01	8.43E-01
2,4-Dinitrotoluene	Mouse	3.00E-02	1.35E+01	1.15E+00	1.56E+01	3.96E-01	5.35E+00	4.14E-01	5.59E+00	4.00E-01	5.40E+00	2.85E-01	3.85E+00
2,6-Dinitrotoluene	Rat	3.50E-01	7.00E-01	2.13E+00	1.49E+00	7.32E-01	5.12E-01	7.65E-01	5.36E-01	7.39E-01	5.18E-01	5.27E-01	3.69E-01
2-Amino-4,6-dinitrotoluene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
4-Amino-2,6-dinitrotoluene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Nitrobenzene	none	none	No TRV	none	none	none	none	none	none	none	none	none	none
Tetryl	none	none	No TRV	none	none	none	none	none	none	none	none	none	none

BW(kg) Red fox =	4.535
BW(kg) Muskrat =	1.171
BW(kg) Short-tailed shrew =	0.017
BW(kg) Cottontail =	1.22
BW(kg) Mink =	1.02

Appendix Table C-17. Derivation of No observed Adverse Effect Level (NOAEL) Toxicity Reference Values (TRVs) for Bird Test Species

Ecological constituent of potential concern	Test species	Test species body weight (kg) BW_t	Benchmark (mg/kgBW/d)	Test duration	Endpoint	Effect	Source	Duration conversion factor DCF	Endpoint conversion factor ECF	TRV (mg/kgBW/d) benchmark x DCF x ECF
Metals										
Aluminum	Ringed dove	1.55E-01	1.10E+02	chronic	NOAEL	Reproduction	Carriere et al. (1986) in [1]	1.0	1.0	1.10E+02
Ammonia	none	none	none	none	none	none	none	none	none	No TRV
Antimony	none	none	none	none	none	none	none	none	none	No TRV
Arsenic	Mallard duck	1.00E+00	5.14E+00	chronic	NOAEL	Mortality	USFWS (1979) in [1]	1.0	1.0	5.14E+00
Arsenic (dissolved)	Mallard duck	1.00E+00	5.14E+00	chronic	NOAEL	Mortality	USFWS (1979) in [1]	1.0	1.0	5.14E+00
Barium	Chick (14 day old)	1.21E-01	2.08E+02	subchronic	NOAEL	Mortality	Johnson et al. (1960) in [1]	0.1	1.0	2.08E+01
Barium (dissolved)	Chick (14 day old)	1.21E-01	2.08E+02	subchronic	NOAEL	Mortality	Johnson et al. (1960) in [1]	0.1	1.0	2.08E+01
Beryllium	none	none	none	none	none	none	none	none	none	No TRV
Beryllium (dissolved)	none	none	none	none	none	none	none	none	none	No TRV
Boron	Mallard duck	1.00E+00	2.88E+01	chronic	NOAEL	Reproduction	Smith and Anders (1989) in [1]	1.0	1.0	2.88E+01
Cadmium	Mallard duck	1.15E+00	1.45E+00	chronic	NOAEL	Reproduction	White and Finley (1978) in [1]	1.0	1.0	1.45E+00
Cadmium (dissolved)	Mallard duck	1.15E+00	1.45E+00	chronic	NOAEL	Reproduction	White and Finley (1978) in [1]	1.0	1.0	1.45E+00
Calcium	none	none	none	none	none	none	none	none	none	No TRV
Chloride	none	none	none	none	none	none	none	none	none	No TRV
Chromium	Black duck	1.25E+00	1.00E+00	chronic	NOAEL	Reproduction	Haseltine et al. (unpubl.) in [1]	1.0	1.0	1.00E+00
Chromium, hexavalent	none	none	none	none	none	none	none	none	none	No TRV
Cobalt	none	none	none	none	none	none	none	none	none	No TRV
Copper	Chick (5 week old)	5.34E-01	4.70E+01	chronic	NOAEL	Mortality	Mehring et al. (1960) in [1]	1.0	1.0	4.70E+01
Copper (dissolved)	Chick (5 week old)	5.34E-01	4.70E+01	chronic	NOAEL	Mortality	Mehring et al. (1960) in [1]	1.0	1.0	4.70E+01
Cyanide	none	none	none	none	none	none	none	none	none	No TRV
Fluoride	Screech Owl	1.81E-01	7.80E+00	chronic	NOAEL	Reproduction	Pattee et al. 1988	1.0	1.0	7.80E+00
Iron	none	none	none	none	none	none	none	none	none	No TRV
Lead	Quail	1.50E-01	1.13E+00	chronic	NOAEL	Reproduction	Edens et al. (1976) in [1]	1.0	1.0	1.13E+00
Lead (dissolved)	Quail	1.50E-01	1.13E+00	chronic	NOAEL	Reproduction	Edens et al. (1976) in [1]	1.0	1.0	1.13E+00
Magnesium	none	none	none	none	none	none	none	none	none	No TRV
Manganese	Quail	7.20E-02	9.77E+02	chronic	NOAEL	Growth	Laskey and Edens (1985) in [1]	1.0	1.0	9.77E+02
Mercury	Quail	1.50E-01	4.50E-01	chronic	NOAEL	Reproduction	Hill and Schaffner (1976) in [1]	1.0	1.0	4.50E-01
Molybdenum	Chicken	1.50E+00	3.53E+01	chronic	LOAEL	Reproduction	Lepore and Miller (1965) in [1]	1.0	0.1	3.53E+00
Nickel	Mallard duckling	7.82E-01	7.74E+01	chronic	NOAEL	Growth	Cain and Pafford (1981) in [1]	1.0	1.0	7.74E+01
Nickel (dissolved)	Mallard duckling	7.82E-01	7.74E+01	chronic	NOAEL	Growth	Cain and Pafford (1981) in [1]	1.0	1.0	7.74E+01
Nitrate	none	none	none	none	none	none	none	none	none	No TRV
Phosphorus	none	none	none	none	none	none	none	none	none	No TRV
Potassium	none	none	none	none	none	none	none	none	none	No TRV
Selenium	Mallard duck	1.00E+00	5.00E-01	chronic	NOAEL	Reproduction	Heinz et al. (1989) in [1]	1.0	1.0	5.00E-01
Silver	none	none	none	none	none	none	none	none	none	No TRV
Silicon	none	none	none	none	none	none	none	none	none	No TRV
Sodium	none	none	none	none	none	none	none	none	none	No TRV
Sulfate	none	none	none	none	none	none	none	none	none	No TRV
Thallium	none	none	none	none	none	none	none	none	none	No TRV
Vanadium	Mallard duck	1.17E+00	1.14E+01	chronic	NOAEL	Mortality	White and Dieter (1978) in [1]	1.0	1.0	1.14E+01
Zinc	Leghorn chicken	1.94E+00	1.45E+01	chronic	NOAEL	Reproduction	Stahl et al. (1990) in [1]	1.0	1.0	1.45E+01
Zinc (dissolved)	Leghorn chicken	1.94E+00	1.45E+01	chronic	NOAEL	Reproduction	Stahl et al. (1990) in [1]	1.0	1.0	1.45E+01
Organics										
1,1,1-Trichloroethane	none	none	none	none	none	none	none	none	none	No TRV
1,1,2,2-Tetrachloroethane	none	none	none	none	none	none	none	none	none	No TRV
1,1,2-Trichloroethane	none	none	none	none	none	none	none	none	none	No TRV

Appendix Table C-17. Derivation of No observed Adverse Effect Level (NOAEL) Toxicity Reference Values (TRVs) for Bird Test Species

Ecological constituent of potential concern	Test species	Test species body weight (kg) BW$_t$	Benchmark (mg/kgBW/d)	Test duration	Endpoint	Effect	Source	Duration conversion factor DCF	Endpoint conversion factor ECF	TRV (mg/kgBW/d) benchmark*x* DCF *x* ECF
1,1-Dichloroethane	none	none	none	none	none	none	none	none	none	No TRV
1,1-Dichloroethene	none	none	none	none	none	none	none	none	none	No TRV
1,1-Dichloroethene	none	none	none	none	none	none	none	none	none	No TRV
1,1-Dichloroethene	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,4,6,7,8-HpCDF	none	none	none	none	none	none	none	none	none	No TRV
1,2,4-trichlorobenzene	none	none	none	none	none	none	none	none	none	No TRV
1,2-cis-Dichloroethene	none	none	none	none	none	none	none	none	none	No TRV
1,2-Dichlorobenzene	none	none	none	none	none	none	none	none	none	No TRV
1,2-Dichloroethane	Chicken	1.60E+00	1.72E+01	chronic	NOAEL	Reproduction	Alumot et al. (1976b) in [1]	1.0	1.0	1.72E+01
1,2-Dichloroethane	none	none	none	none	none	none	none	none	none	No TRV
1,2-Dichloroethene	none	none	none	none	none	none	none	none	none	No TRV
1,2-Dichloroethene	none	none	none	none	none	none	none	none	none	No TRV
1,2-Dichloropropane	none	none	none	none	none	none	none	none	none	No TRV
1,2-trans-Dichloroethene	none	none	none	none	none	none	none	none	none	No TRV
1,3-Dichlorobenzene	none	none	none	none	none	none	none	none	none	No TRV
1,4-Dichlorobenzene	none	none	none	none	none	none	none	none	none	No TRV
2,2,5-Trimethylhexane	none	none	none	none	none	none	none	none	none	No TRV
2,4,5-trichlorophenol	none	none	none	none	none	none	none	none	none	No TRV
2,4-D	none	none	none	none	none	none	none	none	none	No TRV
2,4-Dimethylphenol	none	none	none	none	none	none	none	none	none	No TRV
2-Chlorophenol	none	none	none	none	none	none	none	none	none	No TRV
2-Hexanone	none	none	none	none	none	none	none	none	none	No TRV
2-Methylnaphthalene	none	none	none	none	none	none	none	none	none	No TRV
2-Methylnaphthalene	none	none	none	none	none	none	none	none	none	No TRV
2-Methylphenol	none	none	none	none	none	none	none	none	none	No TRV
4,4'-DDD	none	none	none	none	none	none	none	none	none	No TRV
4,4'-DDE	Quail	1.50E-01	8.45E+01	Acute	LOAEL	Mortality	Hill and Camardese (1986) in EPA (	0.1	0.1	8.45E-01
4,4'-DDT	Brown pelican	3.50E+00	2.80E-02	chronic	LOAEL	Reproduction	Anderson et al. (1975) in [1]	1.0	0.1	2.80E-03
4-Chloro-3-methylphenol	none	none	none	none	none	none	none	none	none	No TRV
4-Methyl-2-pentanone	none	none	none	none	none	none	none	none	none	No TRV
4-Methylphenol	none	none	none	none	none	none	none	none	none	No TRV
4-Methylphenol	none	none	none	none	none	none	none	none	none	No TRV
4-Nitrophenol	none	none	none	none	none	none	none	none	none	No TRV
Acenaphthene	none	none	none	none	none	none	none	none	none	No TRV
Acenaphthylene	none	none	none	none	none	none	none	none	none	No TRV
Acetone	none	none	none	none	none	none	none	none	none	No TRV
Alkalinity	none	none	none	none	none	none	none	none	none	No TRV
Aldrin	none	none	none	none	none	none	none	none	none	No TRV
alpha-Chlordane	Red-winged blackbird	6.40E-02	2.14E+00	chronic	NOAEL	Mortality	Stickel et al. (1983) in [1]	1.0	1.0	2.14E+00
Anthracene	none	none	none	none	none	none	none	none	none	No TRV
Aroclor-1242	Screech owl	1.81E-01	4.10E-01	chronic	NOAEL	Reproduction	McLane and Hughes (1980) in [1]	1.0	1.0	4.10E-01
Aroclor-1248	none	none	none	none	none	none	none	none	none	No TRV
Aroclor-1254	Ring-necked pheasant	1.00E+00	1.80E+00	chronic	LOAEL	Reproduction	Dahlgren et al. (1972) in [1]	1.0	0.1	1.80E-01
Aroclor-1260	none	none	none	none	none	none	none	none	none	No TRV
Benzene	none	none	none	none	none	none	none	none	none	No TRV
Benzo(a)anthracene	none	none	none	none	none	none	none	none	none	No TRV
Benzo(a)pyrene	none	none	none	none	none	none	none	none	none	No TRV
Benzo(b)fluoranthene	none	none	none	none	none	none	none	none	none	No TRV

Appendix Table C-17. Derivation of No observed Adverse Effect Level (NOAEL) Toxicity Reference Values (TRVs) for Bird Test Species

Ecological constituent of potential concern	Test species	Test species body weight (kg) BW_t	Benchmark (mg/kgBW/d)	Test duration	Endpoint	Effect	Source	Duration conversion factor DCF	Endpoint conversion factor ECF	TRV (mg/kgBW/d) benchmark x DCF x ECF
Benzo(g,h,i)perylene	none	none	none	none	none	none	none	none	none	No TRV
Benzo(k)fluoranthene	none	none	none	none	none	none	none	none	none	No TRV
Benzoic acid	none	none	none	none	none	none	none	none	none	No TRV
Benzyl alcohol	none	none	none	none	none	none	none	none	none	No TRV
Bis(2-chloroisopropyl)ether	none	none	none	none	none	none	none	none	none	No TRV
Bis(2-ethylhexyl)phthalate	Ringed dove	1.55E-01	1.10E+00	chronic	NOAEL	Reproduction	Peakall (1974) in [1]	1.0	1.0	1.10E+00
Butylbenzylphthalate	none	none	none	none	none	none	none	none	none	No TRV
Carbazole	none	none	none	none	none	none	none	none	none	No TRV
Carbon disulfide	none	none	none	none	none	none	none	none	none	No TRV
Chlordane	Red-winged blackbird	6.40E-02	2.14E+00	chronic	NOAEL	Mortality	Stickel et al. (1983) in [1]	1.0	1.0	2.14E+00
Chlorobenzene	none	none	none	none	none	none	none	none	none	No TRV
Chloroethane	none	none	none	none	none	none	none	none	none	No TRV
Chloroform	none	none	none	none	none	none	none	none	none	No TRV
Chrysene	none	none	none	none	none	none	none	none	none	No TRV
m,p-cresol	none	none	none	none	none	none	none	none	none	No TRV
Dalapon	none	none	none	none	none	none	none	none	none	No TRV
delta-BHC	none	none	none	none	none	none	none	none	none	No TRV
Dibenzo(a,h)anthracene	none	none	none	none	none	none	none	none	none	No TRV
Dibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
Dicamba	none	none	none	none	none	none	none	none	none	No TRV
Dichloroprop	none	none	none	none	none	none	none	none	none	No TRV
Dieldrin	Barn owl	4.66E-01	7.70E-02	chronic	NOAEL	Reproduction	Mendenhall et al. (1983) in [1]	1.0	1.0	7.70E-02
Diethylphthalate	none	none	none	none	none	none	none	none	none	No TRV
Di-n-butylphthalate	Ringed dove	1.55E-01	1.11E+00	chronic	LOAEL	Reproduction	Peakall (1974) in [1]	1.0	0.1	1.11E-01
Di-n-octylphthalate	none	none	none	none	none	none	none	none	none	No TRV
Endosulfan	Gray partridge	4.00E-01	1.00E+01	chronic	NOAEL	Reproduction	Abiola (1992) in [1]	1.0	1.0	1.00E+01
Endosulfan sulfate	none	none	none	none	none	none	none	none	none	No TRV
Endrin	Mallard duck	1.15E+00	3.00E-01	chronic	NOAEL	Reproduction	Spann et al. (1986) in [1]	1.0	1.0	3.00E-01
Endrin aldehyde	none	none	none	none	none	none	none	none	none	No TRV
Endrin ketone	none	none	none	none	none	none	none	none	none	No TRV
Ethylbenzene	none	none	none	none	none	none	none	none	none	No TRV
Fluoranthene	none	none	none	none	none	none	none	none	none	No TRV
Fluorene	none	none	none	none	none	none	none	none	none	No TRV
gamma-Chlordane	Red-winged blackbird	6.40E-02	2.14E+00	chronic	NOAEL	Mortality	Stickel et al. (1983) in [1]	1.0	1.0	2.14E+00
gamma-BHC (Lindane)	Mallard Duck	1.00E+00	2.00E+00	chronic	NOAEL	Reproduction	Chakravarty et al. (1986) in [1]	1.0	1.0	2.00E+00
Lindane	Mallard Duck	1.00E+00	2.00E+00	chronic	NOAEL	Reproduction	Chakravarty et al. (1986) in [1]	1.0	1.0	2.00E+00
Heptachlor	Quail	1.50E-01	6.50E+00	Acute	LOAEL	Mortality	Hill and Camardese (1986) in EPA (	0.1	0.1	6.50E-02
Heptachlor epoxide	none	none	none	none	none	none	none	none	none	No TRV
Indeno(1,2,3-cd)pyrene	none	none	none	none	none	none	none	none	none	No TRV
MCPA	none	none	none	none	none	none	none	none	none	No TRV
MCPP	none	none	none	none	none	none	none	none	none	No TRV
Methyl bromide	none	none	none	none	none	none	none	none	none	No TRV
Methyl ethyl ketone	none	none	none	none	none	none	none	none	none	No TRV
Methyl mercury dicyandiamide	Mallard duck	1.00E+00	6.40E-02	chronic	LOAEL	Reproduction	Heinz (1979) in [1]	1.0	0.1	6.40E-03
Methylene chloride	none	none	none	none	none	none	none	none	none	No TRV
Methoxychlor	none	none	none	none	none	none	none	none	none	No TRV
Naphthalene	none	none	none	none	none	none	none	none	none	No TRV
N-Nitroso-di-N-propylamine	none	none	none	none	none	none	none	none	none	No TRV

Appendix Table C-17. Derivation of No observed Adverse Effect Level (NOAEL) Toxicity Reference Values (TRVs) for Bird Test Species

Ecological constituent of potential concern	Test species	Test species body weight (kg) BW_t	Benchmark (mg/kgBW/d)	Test duration	Endpoint	Effect	Source	Duration conversion factor DCF	Endpoint conversion factor ECF	TRV (mg/kgBW/d) benchmark*x* DCF *x* ECF
N-Nitrosodiphenylamine	none	none	none	none	none	none	none	none	none	No TRV
Pentachlorophenol	none	none	none	none	none	none	none	none	none	No TRV
Phenanthrene	none	none	none	none	none	none	none	none	none	No TRV
Phenol	none	none	none	none	none	none	none	none	none	No TRV
Pyrene	none	none	none	none	none	none	none	none	none	No TRV
Styrene	none	none	none	none	none	none	none	none	none	No TRV
Tetrachloroethene	none	none	none	none	none	none	none	none	none	No TRV
Toluene	none	none	none	none	none	none	none	none	none	No TRV
Trichloroethene	none	none	none	none	none	none	none	none	none	No TRV
Vinyl chloride	none	none	none	none	none	none	none	none	none	No TRV
Xylenes, Total	none	none	none	none	none	none	none	none	none	No TRV
1,2-Dimethylbenzene	none	none	none	none	none	none	none	none	none	No TRV
Dioxins and Furans										
1,2,3,4,6,7,8-Heptachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,4,7,8,9-Heptachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,4,7,8-Hexachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,6,7,8-Hexachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxi	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,7,8,9-Hexachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,7,8-Pentachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	none	none	none	none	none	none	none	none	none	No TRV
2,3,4,6,7,8-Hexachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
2,3,4,7,8-Pentachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
2,3,7,8-Tetrachlorodibenzofuran	Chick (1 day old)	1.21E-01	1.00E-04	subchronic	LOAEL	Mortality	McKinney et al. (1976) in [1]	0.1	0.1	1.00E-06
2,3,7,8-Tetrachlorodibenzo-p-dioxin	Ring-necked Pheasant	1.00E+00	1.40E-05	chronic	NOAEL	Reproduction	Nosek et al. (1992) in [1]	1.0	1.0	1.40E-05
Octachlorodibenzofuran	none	none	none	none	none	none	none	none	none	No TRV
Octachlorodibenzo-p-dioxin	none	none	none	none	none	none	none	none	none	No TRV
Explosives										
1,3,5-Trinitrobenzene	none	none	none	none	none	none	none	none	none	No TRV
1,3-Dinitrobenzene	none	none	none	none	none	none	none	none	none	No TRV
2,4,6-Trinitrotoluene	none	none	none	none	none	none	none	none	none	No TRV
2,4-Dinitrotoluene	none	none	none	none	none	none	none	none	none	No TRV
2,6-Dinitrotoluene	none	none	none	none	none	none	none	none	none	No TRV
2-Amino-4,6-dinitrotoluene	none	none	none	none	none	none	none	none	none	No TRV
4-Amino-2,6-dinitrotoluene	none	none	none	none	none	none	none	none	none	No TRV
Nitrobenzene	none	none	none	none	none	none	none	none	none	No TRV
Tetryl	none	none	none	none	none	none	none	none	none	No TRV

TRV = toxicity reference value
DCF = Duration conversion factor; 1 if chronic, 0.1 if subchronic (Sample et al. 19
ECF = Endpoint conversion factor; 1 if NOAEL, 0.1 if LOAEL (Sample et al. 199
NOAEL = No observed adverse effect level
LOAEL = Lowest observed adverse effect leve
[1] = Sample et al. (1996

Appendix Table C-18. NOAEL Toxicity Reference Values (TRVs) for Bird Receptors

				American Robin		Great Blue Heron		Mallard Duck		Red-tailed Hawk	
Ecological constituent of potential concern	Test species	Test species body weight (kg)	TRV_t (mg/kgBW/d)	Taxonomic conversion factor[a] CF_{tax}	TRV (mg/kgBW/d) TRV_t x CF_{tax}	Taxonomic conversion factor[a]	TRV (mg/kgBW/d) TRV_t x CF_{tax}	Taxonomic conversion factor[a]	TRV (mg/kgBW/d) TRV_t x CF_{tax}	Taxonomic conversion factor[a]	TRV (mg/kgBW/d) TRV_t x CF_{tax}
Metals											
Aluminum	Ringed dove	1.55E-01	1.10E+02	1.00E-02	1.10E+00	1.00E-02	1.10E+00	1.00E-02	1.10E+00	1.00E-02	1.10E+00
Ammonia	none	none	No TRV	none	none	none	none	none	none	none	none
Antimony	none	none	No TRV	none	none	none	none	none	none	none	none
Arsenic	Mallard duck	1.00E+00	5.14E+00	1.00E-02	5.14E-02	1.00E-02	5.14E-02	1.00E+00	5.14E+00	1.00E-02	5.14E-02
Arsenic (dissolved)	Mallard duck	1.00E+00	5.14E+00	1.00E-02	5.14E-02	1.00E-02	5.14E-02	1.00E+00	5.14E+00	1.00E-02	5.14E-02
Barium	Chick (14 day old)	1.21E-01	2.08E+01	1.00E-02	2.08E-01	1.00E-02	2.08E-01	1.00E-02	2.08E-01	1.00E-02	2.08E-01
Barium (dissolved)	Chick (14 day old)	1.21E-01	2.08E+01	1.00E-02	2.08E-01	1.00E-02	2.08E-01	1.00E-02	2.08E-01	1.00E-02	2.08E-01
Beryllium	none	none	No TRV	none	none	none	none	none	none	none	none
Beryllium (dissolved)	none	none	No TRV	none	none	none	none	none	none	none	none
Boron	Mallard duck	1.00E+00	2.88E+01	1.00E-02	2.88E-01	1.00E-02	2.88E-01	1.00E+00	2.88E+01	1.00E-02	2.88E-01
Cadmium	Mallard duck	1.15E+00	1.45E+00	1.00E-02	1.45E-02	1.00E-02	1.45E-02	1.00E+00	1.45E+00	1.00E-02	1.45E-02
Cadmium (dissolved)	Mallard duck	1.15E+00	1.45E+00	1.00E-02	1.45E-02	1.00E-02	1.45E-02	1.00E+00	1.45E+00	1.00E-02	1.45E-02
Calcium	none	none	No TRV	none	none	none	none	none	none	none	none
Chloride	none	none	No TRV	none	none	none	none	none	none	none	none
Chromium	Black duck	1.25E+00	1.00E+00	1.00E-02	1.00E-02	1.00E-02	1.00E-02	1.00E+00	1.00E+00	1.00E-02	1.00E-02
Chromium, hexavalent	none	none	No TRV	none	none	none	none	none	none	none	none
Cobalt	none	none	No TRV	none	none	none	none	none	none	none	none
Copper	Chick (5 week old)	5.34E-01	4.70E+01	1.00E-02	4.70E-01	1.00E-02	4.70E-01	1.00E-02	4.70E-01	1.00E-02	4.70E-01
Copper (dissolved)	Chick (5 week old)	5.34E-01	4.70E+01	1.00E-02	4.70E-01	1.00E-02	4.70E-01	1.00E-02	4.70E-01	1.00E-02	4.70E-01
Cyanide	none	none	No TRV	none	none	none	none	none	none	none	none
Fluoride	Screech Owl	1.81E-01	7.80E+00	1.00E-02	7.80E-02	1.00E-02	7.80E-02	1.00E-02	7.80E-02	1.00E-02	7.80E-02
Iron	none	none	No TRV	none	none	none	none	none	none	none	none
Lead	Quail	1.50E-01	1.13E+00	1.00E-02	1.13E-02	1.00E-02	1.13E-02	1.00E-02	1.13E-02	1.00E-02	1.13E-02
Lead (dissolved)	Quail	1.50E-01	1.13E+00	1.00E-02	1.13E-02	1.00E-02	1.13E-02	1.00E-02	1.13E-02	1.00E-02	1.13E-02
Magnesium	none	none	No TRV	none	none	none	none	none	none	none	none
Manganese	Quail	7.20E-02	9.77E+02	1.00E-02	9.77E+00	1.00E-02	9.77E+00	1.00E-02	9.77E+00	1.00E-02	9.77E+00
Mercury	Quail	1.50E-01	4.50E-01	1.00E-02	4.50E-03	1.00E-02	4.50E-03	1.00E-02	4.50E-03	1.00E-02	4.50E-03
Molybdenum	Chicken	1.50E+00	3.53E+00	1.00E-02	3.53E-02	1.00E-02	3.53E-02	1.00E-02	3.53E-02	1.00E-02	3.53E-02
Nickel	Mallard duckling	7.82E-01	7.74E+01	1.00E-02	7.74E-01	1.00E-02	7.74E-01	1.00E+00	7.74E+01	1.00E-02	7.74E-01
Nickel (dissolved)	Mallard duckling	7.82E-01	7.74E+01	1.00E-02	7.74E-01	1.00E-02	7.74E-01	1.00E+00	7.74E+01	1.00E-02	7.74E-01
Nitrate	none	none	No TRV	none	none	none	none	none	none	none	none
Phosphorus	none	none	No TRV	none	none	none	none	none	none	none	none
Potassium	none	none	No TRV	none	none	none	none	none	none	none	none
Selenium	Mallard duck	1.00E+00	5.00E-01	1.00E-02	5.00E-03	1.00E-02	5.00E-03	1.00E+00	5.00E-01	1.00E-02	5.00E-03
Silver	none	none	No TRV	none	none	none	none	none	none	none	none
Silicon	none	none	No TRV	none	none	none	none	none	none	none	none
Sodium	none	none	No TRV	none	none	none	none	none	none	none	none
Sulfate	none	none	No TRV	none	none	none	none	none	none	none	none
Thallium	none	none	No TRV	none	none	none	none	none	none	none	none
Vanadium	Mallard duck	1.17E+00	1.14E+01	1.00E-02	1.14E-01	1.00E-02	1.14E-01	1.00E+00	1.14E+01	1.00E-02	1.14E-01
Zinc	Leghorn chicken	1.94E+00	1.45E+01	1.00E-02	1.45E-01	1.00E-02	1.45E-01	1.00E-02	1.45E-01	1.00E-02	1.45E-01
Zinc (dissolved)	Leghorn chicken	1.94E+00	1.45E+01	1.00E-02	1.45E-01	1.00E-02	1.45E-01	1.00E-02	1.45E-01	1.00E-02	1.45E-01
Organics											
1,1,1-Trichloroethane	none	none	No TRV	none	none	none	none	none	none	none	none
1,1,2,2-Tetrachloroethane	none	none	No TRV	none	none	none	none	none	none	none	none
1,1,2-Trichloroethane	none	none	No TRV	none	none	none	none	none	none	none	none

Appendix Table C-18. NOAEL Toxicity Reference Values (TRVs) for Bird Receptors

				American Robin		Great Blue Heron		Mallard Duck		Red-tailed Hawk	
Ecological constituent of potential concern	Test species	Test species body weight (kg)	TRV_t (mg/kgBW/d)	Taxonomic conversion factor[a] CF_{tax}	TRV (mg/kgBW/d) $TRV_t x\ CF_{tax}$	Taxonomic conversion factor[a]	TRV (mg/kgBW/d) $TRV_t x\ CF_{tax}$	Taxonomic conversion factor[a]	TRV (mg/kgBW/d) $TRV_t x\ CF_{tax}$	Taxonomic conversion factor[a]	TRV (mg/kgBW/d) $TRV_t x\ CF_{tax}$
1,1-Dichloroethane	none	none	No TRV	none	none	none	none	none	none	none	none
1,1-Dichloroethene	none	none	No TRV	none	none	none	none	none	none	none	none
1,1-Dichloroethene	none	none	No TRV	none	none	none	none	none	none	none	none
1,1-Dichloroethene	none	none	No TRV	none	none	none	none	none	none	none	none
1,2,3,4,6,7,8-HpCDF	none	none	No TRV	none	none	none	none	none	none	none	none
1,2,4-trichlorobenzene	none	none	No TRV	none	none	none	none	none	none	none	none
1,2-cis-Dichloroethene	none	none	No TRV	none	none	none	none	none	none	none	none
1,2-Dichlorobenzene	none	none	No TRV	none	none	none	none	none	none	none	none
1,2-Dichloroethane	Chicken	1.60E+00	1.72E+01	1.00E-02	1.72E-01	1.00E-02	1.72E-01	1.00E-02	1.72E-01	1.00E-02	1.72E-01
1,2-Dichloroethane	none	none	No TRV	none	none	none	none	none	none	none	none
1,2-Dichloroethene	none	none	No TRV	none	none	none	none	none	none	none	none
1,2-Dichloroethene	none	none	No TRV	none	none	none	none	none	none	none	none
1,2-Dichloropropane	none	none	No TRV	none	none	none	none	none	none	none	none
1,2-trans-Dichloroethene	none	none	No TRV	none	none	none	none	none	none	none	none
1,3-Dichlorobenzene	none	none	No TRV	none	none	none	none	none	none	none	none
1,4-Dichlorobenzene	none	none	No TRV	none	none	none	none	none	none	none	none
2,2,5-Trimethylhexane	none	none	No TRV	none	none	none	none	none	none	none	none
2,4,5-trichlorophenol	none	none	No TRV	none	none	none	none	none	none	none	none
2,4-D	none	none	No TRV	none	none	none	none	none	none	none	none
2,4-Dimethylphenol	none	none	No TRV	none	none	none	none	none	none	none	none
2-Chlorophenol	none	none	No TRV	none	none	none	none	none	none	none	none
2-Hexanone	none	none	No TRV	none	none	none	none	none	none	none	none
2-Methylnaphthalene	none	none	No TRV	none	none	none	none	none	none	none	none
2-Methylnaphthalene	none	none	No TRV	none	none	none	none	none	none	none	none
2-Methylphenol	none	none	No TRV	none	none	none	none	none	none	none	none
4,4'-DDD	none	none	No TRV	none	none	none	none	none	none	none	none
4,4'-DDE	Quail	1.50E-01	8.45E-01	1.00E-02	8.45E-03	1.00E-02	8.45E-03	1.00E-02	8.45E-03	1.00E-02	8.45E-03
4,4'-DDT	Brown pelican	3.50E+00	2.80E-03	1.00E-02	2.80E-05	1.00E-02	2.80E-05	1.00E-02	2.80E-05	1.00E-02	2.80E-05
4-Chloro-3-methylphenol	none	none	No TRV	none	none	none	none	none	none	none	none
4-Methyl-2-pentanone	none	none	No TRV	none	none	none	none	none	none	none	none
4-Methylphenol	none	none	No TRV	none	none	none	none	none	none	none	none
4-Methylphenol	none	none	No TRV	none	none	none	none	none	none	none	none
4-Nitrophenol	none	none	No TRV	none	none	none	none	none	none	none	none
Acenaphthene	none	none	No TRV	none	none	none	none	none	none	none	none
Acenaphthylene	none	none	No TRV	none	none	none	none	none	none	none	none
Acetone	none	none	No TRV	none	none	none	none	none	none	none	none
Alkalinity	none	none	No TRV	none	none	none	none	none	none	none	none
Aldrin	none	none	No TRV	none	none	none	none	none	none	none	none
alpha-Chlordane	Red-winged blackbird	6.40E-02	2.14E+00	3.30E-01	7.06E-01	1.00E-02	2.14E-02	1.00E-02	2.14E-02	1.00E-02	2.14E-02
Anthracene	none	none	No TRV	none	none	none	none	none	none	none	none
Aroclor-1242	Screech owl	1.81E-01	4.10E-01	1.00E-02	4.10E-03	1.00E-02	4.10E-03	1.00E-02	4.10E-03	1.00E-02	4.10E-03
Aroclor-1248	none	none	No TRV	none	none	none	none	none	none	none	none
Aroclor-1254	Ring-necked pheasant	1.00E+00	1.80E-01	1.00E-02	1.80E-03	1.00E-02	1.80E-03	1.00E-02	1.80E-03	1.00E-02	1.80E-03
Aroclor-1260	none	none	No TRV	none	none	none	none	none	none	none	none
Benzene	none	none	No TRV	none	none	none	none	none	none	none	none
Benzo(a)anthracene	none	none	No TRV	none	none	none	none	none	none	none	none
Benzo(a)pyrene	none	none	No TRV	none	none	none	none	none	none	none	none
Benzo(b)fluoranthene	none	none	No TRV	none	none	none	none	none	none	none	none

Appendix Table C-18. NOAEL Toxicity Reference Values (TRVs) for Bird Receptors

Ecological constituent of potential concern	Test species	Test species body weight (kg)	TRV_t (mg/kgBW/d)	American Robin		Great Blue Heron		Mallard Duck		Red-tailed Hawk	
				Taxonomic conversion factor[a] CF_{tax}	TRV (mg/kgBW/d) $TRV_t x CF_{tax}$	Taxonomic conversion factor[a]	TRV (mg/kgBW/d) $TRV_t x CF_{tax}$	Taxonomic conversion factor[a]	TRV (mg/kgBW/d) $TRV_t x CF_{tax}$	Taxonomic conversion factor[a]	TRV (mg/kgBW/d) $TRV_t x CF_{tax}$
Benzo(g,h,i)perylene	none	none	No TRV	none	none	none	none	none	none	none	none
Benzo(k)fluoranthene	none	none	No TRV	none	none	none	none	none	none	none	none
Benzoic acid	none	none	No TRV	none	none	none	none	none	none	none	none
Benzyl alcohol	none	none	No TRV	none	none	none	none	none	none	none	none
Bis(2-chloroisopropyl)ether	none	none	No TRV	none	none	none	none	none	none	none	none
Bis(2-ethylhexyl)phthalate	Ringed dove	1.55E-01	1.10E+00	1.00E-02	1.10E-02	1.00E-02	1.10E-02	1.00E-02	1.10E-02	1.00E-02	1.10E-02
Butylbenzylphthalate	none	none	No TRV	none	none	none	none	none	none	none	none
Carbazole	none	none	No TRV	none	none	none	none	none	none	none	none
Carbon disulfide	none	none	No TRV	none	none	none	none	none	none	none	none
Chlordane	Red-winged blackbird	6.40E-02	2.14E+00	3.30E-01	7.06E-01	1.00E-02	2.14E-02	1.00E-02	2.14E-02	1.00E-02	2.14E-02
Chlorobenzene	none	none	No TRV	none	none	none	none	none	none	none	none
Chloroethane	none	none	No TRV	none	none	none	none	none	none	none	none
Chloroform	none	none	No TRV	none	none	none	none	none	none	none	none
Chrysene	none	none	No TRV	none	none	none	none	none	none	none	none
m,p-cresol	none	none	No TRV	none	none	none	none	none	none	none	none
Dalapon	none	none	No TRV	none	none	none	none	none	none	none	none
delta-BHC	none	none	No TRV	none	none	none	none	none	none	none	none
Dibenzo(a,h)anthracene	none	none	No TRV	none	none	none	none	none	none	none	none
Dibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none
Dicamba	none	none	No TRV	none	none	none	none	none	none	none	none
Dichloroprop	none	none	No TRV	none	none	none	none	none	none	none	none
Dieldrin	Barn owl	4.66E-01	7.70E-02	1.00E-02	7.70E-04	1.00E-02	7.70E-04	1.00E-02	7.70E-04	1.00E-02	7.70E-04
Diethylphthalate	none	none	No TRV	none	none	none	none	none	none	none	none
Di-n-butylphthalate	Ringed dove	1.55E-01	1.11E-01	1.00E-02	1.11E-03	1.00E-02	1.11E-03	1.00E-02	1.11E-03	1.00E-02	1.11E-03
Di-n-octylphthalate	none	none	No TRV	none	none	none	none	none	none	none	none
Endosulfan	Gray partridge	4.00E-01	1.00E+01	1.00E-02	1.00E-01	1.00E-02	1.00E-01	1.00E-02	1.00E-01	1.00E-02	1.00E-01
Endosulfan sulfate	none	none	No TRV	none	none	none	none	none	none	none	none
Endrin	Mallard duck	1.15E+00	3.00E-01	1.00E-02	3.00E-03	1.00E-02	3.00E-03	1.00E+00	3.00E-01	1.00E-02	3.00E-03
Endrin aldehyde	none	none	No TRV	none	none	none	none	none	none	none	none
Endrin ketone	none	none	No TRV	none	none	none	none	none	none	none	none
Ethylbenzene	none	none	No TRV	none	none	none	none	none	none	none	none
Fluoranthene	none	none	No TRV	none	none	none	none	none	none	none	none
Fluorene	none	none	No TRV	none	none	none	none	none	none	none	none
gamma-Chlordane	Red-winged blackbird	6.40E-02	2.14E+00	3.30E-01	7.06E-01	1.00E-02	2.14E-02	1.00E-02	2.14E-02	1.00E-02	2.14E-02
gamma-BHC (Lindane)	Mallard Duck	1.00E+00	2.00E+00	1.00E-02	2.00E-02	1.00E-02	2.00E-02	1.00E+00	2.00E+00	1.00E-02	2.00E-02
Lindane	Mallard Duck	1.00E+00	2.00E+00	1.00E-02	2.00E-02	1.00E-02	2.00E-02	1.00E+00	2.00E+00	1.00E-02	2.00E-02
Heptachlor	Quail	1.50E-01	6.50E-02	1.00E-02	6.50E-04	1.00E-02	6.50E-04	1.00E-02	6.50E-04	1.00E-02	6.50E-04
Heptachlor epoxide	none	none	No TRV	none	none	none	none	none	none	none	none
Indeno(1,2,3-cd)pyrene	none	none	No TRV	none	none	none	none	none	none	none	none
MCPA	none	none	No TRV	none	none	none	none	none	none	none	none
MCPP	none	none	No TRV	none	none	none	none	none	none	none	none
Methyl bromide	none	none	No TRV	none	none	none	none	none	none	none	none
Methyl ethyl ketone	none	none	No TRV	none	none	none	none	none	none	none	none
Methyl mercury dicyandiamide	Mallard duck	1.00E+00	6.40E-03	1.00E-02	6.40E-05	1.00E-02	6.40E-05	1.00E+00	6.40E-03	1.00E-02	6.40E-05
Methylene chloride	none	none	No TRV	none	none	none	none	none	none	none	none
Methoxychlor	none	none	No TRV	none	none	none	none	none	none	none	none
Naphthalene	none	none	No TRV	none	none	none	none	none	none	none	none
N-Nitroso-di-N-propylamine	none	none	No TRV	none	none	none	none	none	none	none	none

Appendix Table C-18. NOAEL Toxicity Reference Values (TRVs) for Bird Receptors

Ecological constituent of potential concern	Test species	Test species body weight (kg)	TRV_t (mg/kgBW/d)	American Robin: Taxonomic conversion factor[a] CF_{tax}	American Robin: TRV (mg/kgBW/d) $TRV_t x CF_{tax}$	Great Blue Heron: Taxonomic conversion factor[a]	Great Blue Heron: TRV (mg/kgBW/d) $TRV_t x CF_{tax}$	Mallard Duck: Taxonomic conversion factor[a]	Mallard Duck: TRV (mg/kgBW/d) $TRV_t x CF_{tax}$	Red-tailed Hawk: Taxonomic conversion factor[a]	Red-tailed Hawk: TRV (mg/kgBW/d) $TRV_t x CF_{tax}$
N-Nitrosodiphenylamine	none	none	No TRV	none	none	none	none	none	none	none	none
Pentachlorophenol	none	none	No TRV	none	none	none	none	none	none	none	none
Phenanthrene	none	none	No TRV	none	none	none	none	none	none	none	none
Phenol	none	none	No TRV	none	none	none	none	none	none	none	none
Pyrene	none	none	No TRV	none	none	none	none	none	none	none	none
Styrene	none	none	No TRV	none	none	none	none	none	none	none	none
Tetrachloroethene	none	none	No TRV	none	none	none	none	none	none	none	none
Toluene	none	none	No TRV	none	none	none	none	none	none	none	none
Trichloroethene	none	none	No TRV	none	none	none	none	none	none	none	none
Vinyl chloride	none	none	No TRV	none	none	none	none	none	none	none	none
Xylenes, Total	none	none	No TRV	none	none	none	none	none	none	none	none
1,2-Dimethylbenzene	none	none	No TRV	none	none	none	none	none	none	none	none
Dioxins and Furans											
1,2,3,4,6,7,8-Heptachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	none	none	No TRV	none	none	none	none	none	none	none	none
1,2,3,4,7,8,9-Heptachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none
1,2,3,4,7,8-Hexachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	none	none	No TRV	none	none	none	none	none	none	none	none
1,2,3,6,7,8-Hexachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	none	none	No TRV	none	none	none	none	none	none	none	none
1,2,3,7,8,9-Hexachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	none	none	No TRV	none	none	none	none	none	none	none	none
1,2,3,7,8-Pentachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none
1,2,3,7,8-Pentachlorodibenzo-p-dioxin	none	none	No TRV	none	none	none	none	none	none	none	none
2,3,4,6,7,8-Hexachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none
2,3,4,7,8-Pentachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none
2,3,7,8-Tetrachlorodibenzofuran	Chick (1 day old)	1.21E-01	1.00E-06	1.00E-02	1.00E-08	1.00E-02	1.00E-08	1.00E-02	1.00E-08	1.00E-02	1.00E-08
2,3,7,8-Tetrachlorodibenzo-p-dioxin	Ring-necked Pheasant	1.00E+00	1.40E-05	1.00E-02	1.40E-07	1.00E-02	1.40E-07	1.00E-02	1.40E-07	1.00E-02	1.40E-07
Octachlorodibenzofuran	none	none	No TRV	none	none	none	none	none	none	none	none
Octachlorodibenzo-p-dioxin	none	none	No TRV	none	none	none	none	none	none	none	none
Explosives											
1,3,5-Trinitrobenzene	none	none	No TRV	none	none	none	none	none	none	none	none
1,3-Dinitrobenzene	none	none	No TRV	none	none	none	none	none	none	none	none
2,4,6-Trinitrotoluene	none	none	No TRV	none	none	none	none	none	none	none	none
2,4-Dinitrotoluene	none	none	No TRV	none	none	none	none	none	none	none	none
2,6-Dinitrotoluene	none	none	No TRV	none	none	none	none	none	none	none	none
2-Amino-4,6-dinitrotoluene	none	none	No TRV	none	none	none	none	none	none	none	none
4-Amino-2,6-dinitrotoluene	none	none	No TRV	none	none	none	none	none	none	none	none
Nitrobenzene	none	none	No TRV	none	none	none	none	none	none	none	none
Tetryl	none	none	No TRV	none	none	none	none	none	none	none	none

TRV = toxicity reference value

[a] Taxonomic adjustment factor for relatedness of test species and receptor (Ohio EPA 2003): 1 if same genus, 0.33 if same family, 0.10 if same order, 0.01 if same class

Appendix Table C-19. 40 mm Range Hazard Quotients for Plants and Earthworms Exposed to Shallow Surface Soil (0-1 ft) COPECs at Ravenna, Ohio

COPECs inputted from ESV media screen	Shallow Surface Soil RME Concentrations (mg/kg)	Plants: Plant TRV[a] (mg/kg)	Plants: Plant HQ Plant RME/TRV	Plants: COEC?	Earthworms: Earthworm TRV[b] (mg/kg)	Earthworms: Earthworm HQ Earthworm RME/TRV	Earthworms: COEC?
Inorganics							
Aluminum	1.24E+04	5.00E+01	**2.48E+02**	yes	No TRV	No TRV	yes
Arsenic	1.25E+01	1.00E+01	**1.25E+00**	yes	6.00E+01	2.08E-01	no
Cadmium	1.78E-01	4.00E+00	4.45E-02	no	2.00E+01	8.90E-03	no
Chromium	4.39E+01	1.00E+00	**4.39E+01**	yes	4.00E-01	**1.10E+02**	yes
Chromium, hexavalent	2.73E+00	No TRV	No TRV	yes	No TRV	No TRV	yes
Copper	2.02E+01	1.00E+02	2.02E-01	no	6.00E+01	3.37E-01	no
Lead	1.85E+01	5.00E+01	3.70E-01	no	5.00E+02	3.70E-02	no
Mercury	1.36E-02	3.00E-01	4.53E-02	no	1.00E-01	1.36E-01	no
Thallium	8.04E-01	1.00E+00	8.04E-01	no	No TRV	No TRV	yes
Vanadium	2.27E+01	2.00E+00	**1.14E+01**	yes	No TRV	No TRV	yes
Zinc	6.39E+01	5.00E+01	**1.28E+00**	yes	2.00E+02	3.20E-01	no
Organics-Explosives							
2,6-Dinitrotoluene	5.00E-02	No TRV	No TRV	yes	No TRV	No TRV	yes
Organics-Semivolatiles							
Bis(2-ethylhexyl)phthalate	1.50E-01	No TRV	No TRV	yes	No TRV	No TRV	yes
Organics-Pesticides							
4,4'-DDE	3.30E-04	No TRV	No TRV	yes	No TRV	No TRV	yes
Aldrin	1.20E-03	No TRV	No TRV	yes	No TRV	No TRV	yes
Dieldrin	1.17E-03	No TRV	No TRV	yes	No TRV	No TRV	yes
Endrin aldehyde	8.50E-04	No TRV	No TRV	yes	No TRV	No TRV	yes
Heptachlor	7.90E-04	No TRV	No TRV	yes	No TRV	No TRV	yes
Lindane	9.30E-04	No TRV	No TRV	yes	No TRV	No TRV	yes

COPEC = chemical of potential ecological concern

ESV = ecological screening value
RME = Reasonable maximum exposure (lower of maximum and 95% upper confidence limit of mean)
[a]Plant TRV reference from Efroymson et al. (1997a)
TRV = toxicity reference value
HQ = Hazard quotient
COEC = chemical of ecological concern
"**yes**" = HQ > 1 or "No TRV"
"no" = HQ less than or equal to 1
[b]Earthworm TRV reference from Efroymson et al. (1997b)
HQs in **bold font** are > 1

Appendix Table C-20. 40 mm Range Hazard Quotients for Cottontail Rabbits Exposed to Shallow Surface Soil (0-1 ft) COPECs at Ravanna, Ohio

COPECs inputted from ESV media screen	RME Concentration (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME x SP_v x *CF* x I_P x AUF	BAF_i	ADD_A (mg/kgBW/d) RME x BAF_i x CF_i x I_A x AUF	ADD_S (mg/kgBW/d) RME x I_S x AUF	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	NOAEL TRV (mg/kgBW/d)	HQ ADD_{total} / TRV	COEC?
Inorganics										
Aluminum	1.24E+04	4.00E-03	3.65E-01	2.20E-01	0.00E+00	4.08E+01	4.11E+01	7.64E-01	**5.38E+01**	**yes**
Arsenic	1.25E+01	4.00E-02	3.68E-03	2.58E-01	0.00E+00	4.11E-02	4.48E-02	4.99E-02	8.98E-01	no
Cadmium	1.78E-01	5.50E-01	7.21E-04	1.71E+01	0.00E+00	5.85E-04	1.31E-03	7.06E-01	1.85E-03	no
Chromium	4.39E+01	7.50E-03	2.42E-03	1.10E+00	0.00E+00	1.44E-01	1.47E-01	2.00E+03	7.33E-05	no
Chromium, hexavalent	2.73E+00	7.50E-03	1.51E-04	1.10E+00	0.00E+00	8.98E-03	9.13E-03	9.62E-01	9.49E-03	no
Copper	2.02E+01	4.00E-01	5.95E-02	4.00E-02	0.00E+00	6.64E-02	1.26E-01	1.11E+01	1.13E-02	no
Lead	1.85E+01	4.50E-02	6.13E-03	3.34E+00	0.00E+00	6.08E-02	6.70E-02	5.85E+00	1.14E-02	no
Mercury	1.36E-02	9.00E-01	9.01E-05	5.23E+00	0.00E+00	4.47E-05	1.35E-04	9.61E-01	1.40E-04	no
Thallium	8.04E-01	4.00E-03	2.37E-05	2.20E-01	0.00E+00	2.64E-03	2.67E-03	5.47E-03	4.87E-01	no
Vanadium	2.27E+01	5.50E-03	9.19E-04	3.21E-01	0.00E+00	7.47E-02	7.56E-02	1.43E-01	5.30E-01	no
Zinc	6.39E+01	1.50E+00	7.05E-01	5.77E+00	0.00E+00	2.10E-01	9.16E-01	1.17E+02	7.82E-03	no
Organics-Explosives										
2,6-Dinitrotoluene	5.00E-02	3.15E+00	1.16E-03	2.05E-04	0.00E+00	1.64E-04	1.32E-03	5.12E-01	2.58E-03	no
Organics-Semivolatiles										
Bis(2-ethylhexyl)phthalate	1.50E-01	3.80E-02	4.20E-05	3.51E-04	0.00E+00	4.93E-04	5.35E-04	7.25E+00	7.39E-05	no
Organics-Pesticides										
4,4'-DDE	3.30E-04	9.37E-03	2.28E-08	1.26E+00	0.00E+00	1.09E-06	1.11E-06	7.32E-01	1.51E-06	no
Aldrin	1.20E-03	1.04E-02	9.18E-08	4.10E-04	0.00E+00	3.95E-06	4.04E-06	1.46E-01	2.76E-05	no
Dieldrin	1.17E-03	3.49E-02	3.00E-07	3.54E-04	0.00E+00	3.85E-06	4.15E-06	1.46E-02	2.83E-04	no
Endrin aldehyde	8.50E-04	6.51E-02	4.07E-07	3.28E-04	0.00E+00	2.80E-06	3.20E-06	No TRV	No TRV	**yes**
Heptachlor	7.90E-04	4.89E-02	2.84E-07	1.40E+00	0.00E+00	2.60E-06	2.88E-06	9.52E-02	3.03E-05	no
Lindane	9.30E-04	2.74E-01	1.88E-06	2.76E-04	0.00E+00	3.06E-06	4.93E-06	5.85E+00	8.43E-07	no

COPEC = Constituents of potential ecological concern
ESV = ecological screening value
CF = correction factor dry wt to wet wt [0.15 kd dry plant/kg wet plant]
RME = Reasonable maximum exposure (lower of maximum or 95% UCL of mean)
SP_v = Soil-to-plant uptake factor; vegetative
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = Plant ingestion rate for cottontails = 1.88E-01
AUF = Area use factor = 2.61E-01
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
CF_i = correction factor (earthworms) [0.13 for As, Cd, Cr, Cu, Hg, Mn, Ni, Pb, Zn, PCBs, and 1 for all other COPECs - fraction dry wt worm/kg wet wet]

I_A (kg/kgBW/d) = Animal ingestion rate for cottontails = 0.00E+00
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = Soil ingestion rate for cottontails = 1.26E-02
ADDtotal = Average daily dose; total
NOAEL = lowest observed adverse effect level
TRV (mg/kgBW/d) = toxicity reference value
HQ = hazard quotient
COEC = contaminant of ecological concern
"**yes**" = HQ > 1 or "No TRV"
"no" = HQ less than or equal to 1
HQs in **bold font** are > 1

Appendix Table C-21. 40 mm Range Hazard Quotients for Shrews Exposed to Shallow Surface Soil (0-1 ft) COPECs at Ravanna, Ohio

COPECs following ESV screen	RME Concentration (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME *x* SP_v *x* *CF x* I_P *x* AUF	BAF_i	ADD_A (mg/kgBW/d) RME *x* BAF_i *x* CF_i *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	NOAEL TRV (mg/kgBW/d)	HQ ADD_{total} / TRV	COEC?
Inorganics										
Aluminum	1.24E+04	4.00E-03	5.42E-01	2.20E-01	1.33E+03	4.17E+02	1.75E+03	2.22E+00	**7.85E+02**	yes
Arsenic	1.25E+01	4.00E-02	5.46E-03	2.58E-01	2.04E-01	4.20E-01	6.30E-01	1.45E-01	**4.34E+00**	yes
Cadmium	1.78E-01	5.50E-01	1.07E-03	1.71E+01	1.93E-01	5.98E-03	2.00E-01	2.05E+00	9.73E-02	no
Chromium	4.39E+01	7.50E-03	3.60E-03	1.10E+00	3.06E+00	1.48E+00	4.53E+00	5.83E+03	7.78E-04	no
Chromium, hexavalent	2.73E+00	7.50E-03	2.24E-04	1.10E+00	1.90E-01	9.17E-02	2.82E-01	2.80E+00	1.01E-01	no
Copper	2.02E+01	4.00E-01	8.82E-02	4.00E-02	5.12E-02	6.79E-01	8.18E-01	3.24E+01	2.52E-02	no
Lead	1.85E+01	4.50E-02	9.09E-03	3.34E+00	3.92E+00	6.22E-01	4.55E+00	1.70E+01	2.67E-01	no
Mercury	1.36E-02	9.00E-01	1.34E-04	5.23E+00	4.51E-03	4.57E-04	5.10E-03	2.80E+00	1.82E-03	no
Thallium	8.04E-01	4.00E-03	3.51E-05	2.20E-01	8.62E-02	2.70E-02	1.13E-01	1.59E-02	**7.11E+00**	yes
Vanadium	2.27E+01	5.50E-03	1.36E-03	3.21E-01	3.55E+00	7.63E-01	4.31E+00	4.15E-01	**1.04E+01**	yes
Zinc	6.39E+01	1.50E+00	1.05E+00	5.77E+00	2.33E+01	2.15E+00	2.65E+01	3.41E+02	7.78E-02	no
Organics-Explosives										
2,6-Dinitrotoluene	5.00E-02	3.15E+00	1.72E-03	2.05E-04	5.00E-06	1.68E-03	3.40E-03	1.49E+00	2.28E-03	no
Organics-Semivolatiles										
Bis(2-ethylhexyl)phthalate	1.50E-01	3.80E-02	6.22E-05	3.51E-04	2.56E-05	5.04E-03	5.13E-03	2.11E+01	2.43E-04	no
Organics-Pesticides										
4,4'-DDE	3.30E-04	9.37E-03	3.38E-08	1.26E+00	2.03E-04	1.11E-05	2.14E-04	2.13E+00	1.00E-04	no
Aldrin	1.20E-03	1.04E-02	1.36E-07	4.10E-04	2.40E-07	4.03E-05	4.07E-05	4.26E-01	9.55E-05	no
Dieldrin	1.17E-03	3.49E-02	4.45E-07	3.54E-04	2.02E-07	3.93E-05	4.00E-05	4.26E-02	9.38E-04	no
Endrin aldehyde	8.50E-04	6.51E-02	6.04E-07	3.28E-04	1.36E-07	2.86E-05	2.93E-05	No TRV	No TRV	yes
Heptachlor	7.90E-04	4.89E-02	4.22E-07	1.40E+00	5.39E-04	2.65E-05	5.66E-04	2.77E-01	2.04E-03	no
Lindane	9.30E-04	2.74E-01	2.78E-06	2.76E-04	1.25E-07	3.12E-05	3.42E-05	1.70E+01	2.00E-06	no

COPEC = Constituents of potential ecological concern
ESV = ecological screening value
CF = correction factor dry wt to wet wt [0.15 kd dry plant/kg wet plant]
RME = Reasonable maximum exposure (lower of maximum or 95% UCL of mean)
SP_v = Soil-to-plant uptake factor; vegetative
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = Plant ingestion rate for shrews = 7.28E-02
AUF = Area use factor (1.0)
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
CF_i = correction factor (earthworms) [0.13 for As, Cd, Cr, Cu, Hg, Mn, Ni, Pb, Zn, PCBs, and 1 for all other COPECs - fraction dry wt worm/kg wet wet]

I_A (kg/kgBW/d) = Animal ingestion rate for shrews = 4.87E-01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = Soil ingestion rate for shrews = 3.36E-02
ADDtotal = Average daily dose; total
NOAEL = lowest observed adverse effect level
TRV (mg/kgBW/d) = toxicity reference value
HQ = hazard quotient
COEC = contaminant of ecological concern
"**yes**" = HQ > 1 or "No TRV"
"no" = HQ less than or equal to 1
HQs in **bold font** are >1

Appendix Table C-22. 40 mm Range Hazard Quotients for Red Foxes Exposed to Shallow Surface Soil (0-1 ft) PBT COPECs at Ravenna, Ohio

PBT COPECs remaining after ESV screen	RME Concentration (mg/kg)	SPr	ADD_P (mg/kgBW/d) RME x SP_r x CF_r x I_P x AUF_F	SP_v	Prey ADD_P (mg/kgBW/d) RME x SP_v x CF_v x I_{P-s} x AUF-s	BAF_i	Prey ADD_A (mg/kgBW/d) RME x BAF_i x CF_i x I_{A-s} x AUF-s	Prey ADD_S (mg/kgBW/d) RME x I_{S-s} x AUF-s	Prey ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S
Inorganics									
Cadmium	1.78E-01	1.50E-01	1.87E-08	5.50E-01	1.07E-03	1.71E+01	1.93E-01	5.98E-03	2.00E-01
Lead	1.85E+01	9.00E-03	1.17E-07	4.50E-02	9.09E-03	3.34E+00	3.92E+00	6.22E-01	4.55E+00
Mercury	1.36E-02	2.00E-01	1.91E-09	9.00E-01	1.34E-04	5.23E+00	4.51E-03	4.57E-04	5.10E-03
Zinc	6.39E+01	9.00E-01	4.04E-05	1.50E+00	1.05E+00	5.77E+00	2.33E+01	2.15E+00	2.65E+01
Organics-Semivolatiles									
Bis(2-ethylhexyl)phthalate	1.50E-01	3.80E-02	4.00E-09	3.80E-02	6.22E-05	3.51E-04	2.56E-05	5.04E-03	5.13E-03
Organics-Pesticides									
4,4'-DDE	3.30E-04	9.37E-03	2.17E-12	9.37E-03	3.38E-08	1.26E+00	2.03E-04	1.11E-05	2.14E-04
Aldrin	1.20E-03	1.04E-02	8.75E-12	1.04E-02	1.36E-07	4.10E-04	2.40E-07	4.03E-05	4.07E-05
Dieldrin	1.17E-03	3.49E-02	2.86E-11	3.49E-02	4.45E-07	3.54E-04	2.02E-07	3.93E-05	4.00E-05
Endrin aldehyde	8.50E-04	6.51E-02	3.88E-11	6.51E-02	6.04E-07	3.28E-04	1.36E-07	2.86E-05	2.93E-05
Heptachlor	7.90E-04	4.89E-02	2.71E-11	4.89E-02	4.22E-07	1.40E+00	5.39E-04	2.65E-05	5.66E-04
Lindane	9.30E-04	2.74E-01	1.79E-10	2.74E-01	2.78E-06	2.76E-04	1.25E-07	3.12E-05	3.42E-05

PBT = persistent, bioaccumulative, and toxic
RME = Reasonable maximum exposure (lower of 95% UCL of mean or maximum detection)
SP_r = Soil-to-plant; reproductive
SP_v = Soil-to-plant; vegetative
I_P (kg/kgBW/d) = Plant ingestion rate for red foxes = 0.00437
ADD_P = Average daily dose; plant
I_{P-s} (kg/kgBW/d) = Plant ingestion rate for shrews = 0.0728
AUF_{-F} = Area use factor for red fox = 0.00161
AUF_{-s} = Area use factor for shrews = 1.0
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_{A-s} (kg/kgBW/d) = Animal ingestion rate for shrews = 0.487
ADD_S = Average daily dose; soil
I_{S-s} (kg/kgBW/d) = Soil ingestion rate for shrews = 0.0336
Cs (mg/kg) = Concentration in the prey
IR_f (kg/kg body wt/d) = Ingestion rate of food for shrews = 0.56
CF_r = correction factor dry wt to wet wt [(0.1) kg dry wt reproductive part plant/kg wet wt]
CF_v = correction factor dry wt to wet wt [0.15 kg dry wt vegetative part plant/kg wet wt]
CF_i = correction factor (earthworms) [0.13 for As, Cd, Cr, Cu, Hg, Mn, Ni, Pb, Zn, PCBs, and 1 for all other COPECs - fraction dry wt worm/kg wet wet]

COPEC = chemical of potential ecological concern
ESV = ecological screening value
BAF_{-TP} = Animal-to-mammal transfer factor (Ba_{cow} x $BW_{receptor}$ x lipid ratio) where lipid ratio = 1 for inorganics, 0.8 for organics; mammal Ba = biotransfer food to cow, and $BW_{receptor}$ = body wt (kg) of the receptor
I_A (kg/kgBW/d) = Animal ingestion rate for red foxes = 0.0906
I_S (kg/kgBW/d) = Soil ingestion rate for red foxes = 0.00266
ADD_{total} = Average daily dose; total
TRV (mg/kgBW/d) = toxicity reference value
COEC = contaminant of ecological concern
"**yes**" = HQ is >1 or there is "No TRV"
"no" = HQ less than or equal to 1
HQ = Hazard quotient
HQ > 1 in **bold font**

Appendix Table C-22. 40 mm Range Hazard Quotients for Red Foxes Exposed to Shallow Surface Soil (0-1 ft) PBT COPECs at Ravenna, Ohio (cont'd)

PBT COPECs remaining after ESV screen	Cs (mg/kg) Prey ADD_{total}/IR_f	BAF-TP	ADD_A (mg/kgBW/d) Cs x BAF_{TP} x I_A x AUF_{-F}	ADD_S (mg/kgBW/d) RME x I_S x AUF_{-F}	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	NOAEL TRV (mg/kgBW/d)	Site HQ ADD_{total} / TRV	COEC?
Inorganics								
Cadmium	3.57E-01	1.54E-02	8.01E-07	7.60E-07	1.58E-06	5.08E-01	3.11E-06	no
Lead	8.12E+00	1.36E-03	1.61E-06	7.90E-05	8.08E-05	4.22E+00	1.92E-05	no
Mercury	9.10E-03	2.36E-02	3.13E-08	5.81E-08	9.13E-08	6.92E-01	1.32E-07	no
Zinc	4.74E+01	4.54E-01	3.13E-03	2.73E-04	3.44E-03	8.43E+01	4.08E-05	no
Organics-Semivolatiles								
Bis(2-ethylhexyl)phthalate	9.16E-03	1.46E-02	1.94E-08	6.41E-07	6.64E-07	5.22E+00	1.27E-07	no
Organics-Pesticides								
4,4'-DDE	3.82E-04	1.65E-01	9.14E-09	1.41E-09	1.06E-08	5.27E-01	2.00E-08	no
Aldrin	7.27E-05	1.38E-01	1.46E-09	5.13E-09	6.59E-09	1.05E-01	6.25E-08	no
Dieldrin	7.14E-05	1.70E-02	1.76E-10	5.00E-09	5.20E-09	1.05E-02	4.94E-07	no
Endrin aldehyde	5.23E-05	5.75E-03	4.38E-11	3.63E-09	3.71E-09	No TRV	**No TRV**	**yes**
Heptachlor	1.01E-03	9.44E-03	1.39E-09	3.37E-09	4.79E-09	6.85E-02	6.99E-08	no
Lindane	6.10E-05	4.78E-04	4.25E-12	3.97E-09	4.16E-09	4.22E+00	9.86E-10	no

Appendix Table C-23. 40 mm Range Hazard Quotients for Red-Tailed Hawks Exposed to Shallow Surface Soil (0-1 ft) PBT COPECs at Ravenna, Ohio

PBT COPECs remaining after the ESV Screen	RME Concentration (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME x SP_v x CFv x I_P x AUF_{-H}	Prey ADD_P (mg/kgBW/d) RME x SP_v x CFv x $I_{P\text{-}s}$ x AUF-s	BAF_i	Prey ADD_A (mg/kgBW/d) RME x BAF_i x CF_i x $I_{A\text{-}s}$ x AUF-s	Prey ADD_S (mg/kgBW/d) RME x $I_{S\text{-}s}$ x AUF-s	Prey ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$
Inorganics								
Cadmium	1.78E-01	5.50E-01	0.00E+00	1.07E-03	1.71E+01	1.93E-01	5.98E-03	2.00E-01
Lead	1.85E+01	4.50E-02	0.00E+00	9.09E-03	3.34E+00	3.92E+00	6.22E-01	4.55E+00
Mercury	1.36E-02	9.00E-01	0.00E+00	1.34E-04	5.23E+00	4.51E-03	4.57E-04	5.10E-03
Zinc	6.39E+01	1.50E+00	0.00E+00	1.05E+00	5.77E+00	2.33E+01	2.15E+00	2.65E+01
Organics-Semivolatiles								
Bis(2-ethylhexyl)phthalate	1.50E-01	3.80E-02	0.00E+00	6.22E-05	3.51E-04	2.56E-05	5.04E-03	5.13E-03
1,2-Dimethylbenzene	2.00E-03	6.01E-01	0.00E+00	1.31E-05	2.51E-04	2.45E-07	6.72E-05	8.06E-05
3,3'-Dichlorobenzidine	4.00E-01	3.30E-01	0.00E+00	1.44E-03	2.70E-04	5.25E-05	1.34E-02	1.49E-02
Organics-Pesticides								
4,4'-DDE	3.30E-04	9.37E-03	0.00E+00	3.38E-08	1.26E+00	2.03E-04	1.11E-05	2.14E-04
Aldrin	1.20E-03	1.04E-02	0.00E+00	1.36E-07	4.10E-04	2.40E-07	4.03E-05	4.07E-05
Dieldrin	1.17E-03	3.49E-02	0.00E+00	4.45E-07	3.54E-04	2.02E-07	3.93E-05	4.00E-05
Endrin aldehyde	8.50E-04	6.51E-02	0.00E+00	6.04E-07	3.28E-04	1.36E-07	2.86E-05	2.93E-05
Heptachlor	7.90E-04	4.89E-02	0.00E+00	4.22E-07	1.40E+00	5.39E-04	2.65E-05	5.66E-04
Lindane	9.30E-04	2.74E-01	0.00E+00	2.78E-06	2.76E-04	1.25E-07	3.12E-05	3.42E-05

PBT = persistent, bioaccumulative, and toxic
COPEC = contaminant of potential ecological concern
ESV = ecological screening value
RME = reasonable maximum concenetration
SP_r = Soil-to-plant; reproductive
SP_v = Soil-to-plant; vegetative
I_P (kg/kgBW/d) = Plant ingestion rate for red-tailed hawks = 0.00
ADD_P = Average daily dose; plant
CF_v = correction factor [0.15 kg dry wt vegetative plant part/kg wet wt]
CF_i = correction factor (earthworms) [0.13 for As, Cd, Cr, Cu, Hg, Mn, Ni, Pb, Zn, PCBs, and 1 for all other COPECs - fraction dry wt worm/kg wet wet]

Cs (mg/kg) = Concentration in the prey
IR_f (kg/kgBW/d)= Ingestion rate of food for shrews = 0.56
BAF_{-TP} = Animal-to-mammal transfer factor (Ba_{cow} x $BW_{receptor}$ x lipid ratio) where lipid ratio = 1 for inorganics, 0.8 for organics; mammal Ba = biotransfer food to cow, and $BW_{receptor}$ = body wt (kg) of the receptor
I_A (kg/kgBW/d) = Animal ingestion rate for red-tailed hawks = 0.11
I_S (kg/kgBW/d) = Soil ingestion rate for red-tailed hawks = 0.00

Appendix Table C-23. 40 mm Range Hazard Quotients for Red-Tailed Hawks Exposed to Shallow Surface Soil (0-1 ft) PBT COPECs at Ravenna, Ohio (cont'd)

PBT COPECs remaining after the ESV Screen	Cs (mg/kg) ADD_{total}/IR_f	BAF_{-TP}	ADD_A (mg/kgBW/d) $Cs \times BAF_{-TP} \times I_A \times AUF_{-H}$	ADD_S (mg/kgBW/d) RME $\times I_S \times AUF_{-H}$	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	NOAEL TRV (mg/kgBW/d)	Site HQ ADD_{total} / TRV	COEC?
Inorganics								
Cadmium	3.57E-01	3.86E-03	1.40E-07	0.00E+00	1.40E-07	1.45E-02	9.65E-06	no
Lead	8.12E+00	3.40E-04	2.81E-07	0.00E+00	2.81E-07	1.13E-02	2.48E-05	no
Mercury	9.10E-03	5.90E-03	5.46E-09	0.00E+00	5.46E-09	4.50E-03	1.21E-06	no
Zinc	4.74E+01	1.13E-01	5.46E-04	0.00E+00	5.46E-04	1.45E-01	3.77E-03	no
Organics-Semivolatiles								
Bis(2-ethylhexyl)phthalate	9.16E-03	3.65E-03	3.39E-09	0.00E+00	3.39E-09	1.10E-02	3.09E-07	no
1,2-Dimethylbenzene	1.44E-04	3.08E-05	4.50E-13	0.00E+00	4.50E-13	No TRV	No TRV	yes
3,3'-Dichlorobenzidine	2.67E-02	8.57E-05	2.32E-10	0.00E+00	2.32E-10	No TRV	No TRV	yes
Organics-Pesticides								
4,4'-DDE	3.82E-04	4.12E-02	1.60E-09	0.00E+00	1.60E-09	8.45E-03	1.89E-07	no
Aldrin	7.27E-05	3.44E-02	2.54E-10	0.00E+00	2.54E-10	No TRV	No TRV	yes
Dieldrin	7.14E-05	4.24E-03	3.07E-11	0.00E+00	3.07E-11	7.70E-04	3.99E-08	no
Endrin aldehyde	5.23E-05	1.44E-03	7.65E-12	0.00E+00	7.65E-12	No TRV	No TRV	yes
Heptachlor	1.01E-03	2.36E-03	2.42E-10	0.00E+00	2.42E-10	6.50E-04	3.73E-07	no
Lindane	6.10E-05	1.20E-04	7.41E-13	0.00E+00	7.41E-13	2.00E-02	3.71E-11	no

I_{P-s} (kg/kgBW/d) = Plant ingestion rate for shrews (0.0728)
AUF_s = Area use factor for shrew (1.0)
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_{A-s} (kg/kgBW/d) = Animal ingestion rate for shrews (0.487)
ADD_S = Average daily dose; soil
AUF_{-H} = Area use factor hawk 0.000924

I_{S-s} (kg/kgBW/d) = Soil ingestion rate for shrews (0.0336)
ADD_{total} = Average daily dose; total
TRV (mg/kgBW/d) = toxicity reference value
HQ = Hazard quotient
COEC = contaminant of ecological concern
"yes" = HQ > 1 or "No TRV"
"no" = HQ less than or equal to 1
HQs in bold font are > 1

Appendix Table C-24. 40 mm Range Hazard Quotients for Plants and Earthworms Exposed to Subsurface Soil (1-3 ft) COPECs at Ravenna, Ohio

	Plants				Earthworms		
COPECs inputted from ESV media screen	**Subsurface Soil RME Concentrations** (mg/kg)	**Plant TRV**[a] (mg/kg)	**Plant HQ Plant RME/TRV**	**COEC?**	**Earthworm TRV**[b] (mg/kg)	**Earthworm HQ Earthworm RME/TRV**	**COEC?**
Inorganics							
Aluminum	1.36E+04	5.00E+01	**2.72E+02**	**yes**	No TRV	No TRV	**yes**
Arsenic	1.90E+01	1.00E+01	**1.90E+00**	**yes**	6.00E+01	3.17E-01	no
Cadmium	4.24E-02	4.00E+00	1.06E-02	no	2.00E+01	2.12E-03	no
Chromium	1.92E+01	1.00E+00	**1.92E+01**	**yes**	4.00E-01	**4.80E+01**	**yes**
Chromium, hexavalent	3.15E+00	No TRV	No TRV	**yes**	No TRV	No TRV	**yes**
Cobalt	1.25E+01	2.00E+01	6.25E-01	no	No TRV	No TRV	**yes**
Copper	2.32E+01	1.00E+02	2.32E-01	no	6.00E+01	3.87E-01	no
Lead	1.63E+01	5.00E+01	3.26E-01	no	5.00E+02	3.26E-02	no
Thallium	1.08E+00	1.00E+00	**1.08E+00**	**yes**	No TRV	No TRV	**yes**
Vanadium	2.36E+01	2.00E+00	**1.18E+01**	**yes**	No TRV	No TRV	**yes**
Organics-Explosives							
2,6-Dinitrotoluene	5.00E-02	No TRV	No TRV	**yes**	No TRV	No TRV	**yes**
Organics-Semivolatiles							
3,3'-Dichlorobenzidine	4.00E-01	No TRV	No TRV	**yes**	No TRV	No TRV	**yes**
Organics-Volatiles							
1,2-Dimethylbenzene	2.00E-03	No TRV	No TRV	**yes**	No TRV	No TRV	**yes**

COPEC = chemical of potential ecological concern
EU = exposure unit
ESV = ecological screening value
RME = Reasonable maximum exposure (lower of maximum and 95% upper confidence limit of mean)
[a]Plant TRV reference from Efroymson et al. (1997a)
TRV = toxicity reference value
HQ = Hazard quotient
COEC = chemical of ecological concern
"**yes**" = HQ > 1 or "No TRV"

[b]Earthworm TRV reference from Efroymson et al. (1997b)
HQs in **bold font** are > 1

"no" = HQ less than or equal to 1

Appendix Table C-25. 40 mm Range Hazard Quotients for Cottontail Rabbits Exposed to Subsurface Soil (1-3 ft) COPECs at Ravanna, Ohio

COPECs inputted from ESV media screen	RME Concentration (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME x SP_v x CF x I_P x AUF	BAF_i	ADD_A (mg/kgBW/d) RME x BAF_i x CF_i x I_A x AUF	ADD_S (mg/kgBW/d) RME x I_S x AUF	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	NOAEL TRV (mg/kgBW/d)	HQ ADD_{total} / TRV	COEC?
Inorganics										
Aluminum	1.36E+04	4.00E-03	4.00E-01	2.20E-01	0.00E+00	4.47E+01	4.51E+01	7.64E-01	**5.90E+01**	yes
Arsenic	1.90E+01	4.00E-02	5.59E-03	2.58E-01	0.00E+00	6.25E-02	6.81E-02	4.99E-02	**1.36E+00**	yes
Cadmium	4.24E-02	5.50E-01	1.72E-04	1.71E+01	0.00E+00	1.39E-04	3.11E-04	7.06E-01	4.41E-04	no
Chromium	1.92E+01	7.50E-03	1.06E-03	1.10E+00	0.00E+00	6.31E-02	6.42E-02	2.00E+03	3.21E-05	no
Chromium, hexavalent	3.15E+00	7.50E-03	1.74E-04	1.10E+00	0.00E+00	1.04E-02	1.05E-02	9.62E-01	1.10E-02	no
Cobalt	1.25E+01	2.00E-02	1.84E-03	3.21E-01	0.00E+00	4.11E-02	4.29E-02	No TRV	No TRV	yes
Copper	2.32E+01	4.00E-01	6.83E-02	4.00E-02	0.00E+00	7.63E-02	1.45E-01	1.11E+01	1.30E-02	no
Lead	1.63E+01	4.50E-02	5.40E-03	3.34E+00	0.00E+00	5.36E-02	5.90E-02	5.85E+00	1.01E-02	no
Thallium	1.08E+00	4.00E-03	3.18E-05	2.20E-01	0.00E+00	3.55E-03	3.58E-03	5.47E-03	6.55E-01	no
Vanadium	2.36E+01	5.50E-03	9.55E-04	3.21E-01	0.00E+00	7.76E-02	7.86E-02	1.43E-01	5.51E-01	no
Organics-Explosives										
2,6-Dinitrotoluene	5.00E-02	3.15E+00	1.16E-03	2.05E-04	0.00E+00	1.64E-04	1.32E-03	5.12E-01	2.58E-03	no
Organics-Semivolatiles										
3,3'-Dichlorobenzidine	4.00E-01	3.30E-01	9.72E-04	2.70E-04	0.00E+00	1.32E-03	2.29E-03	No TRV	No TRV	yes
Organics-Volatiles										
1,2-Dimethylbenzene	2.00E-03	6.01E-01	8.84E-06	2.51E-04	0.00E+00	6.58E-06	1.54E-05	8.16E-01	1.89E-05	no

COPEC = Constituents of potential ecological concern
ESV = ecological screening value
CF = correction factor dry wt to wet wt [0.15 kd dry plant/kg wet plant]
RME = Reasonable maximum exposure (lower of maximum or 95% UCL of mean)
SP_v = Soil-to-plant uptake factor; vegetative
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = Plant ingestion rate for cottontails = 1.88E-01
AUF = Area use factor = 2.61E-01
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
CF_i = correction factor (earthworms) [0.13 for As, Cd, Cr, Cu, Hg, Mn, Ni, Pb, Zn, PCBs, and 1 for all other COPECs - fraction dry wt worm/kg wet wet]

I_A (kg/kgBW/d) = Animal ingestion rate for cottontails = 0.00E+00
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = Soil ingestion rate for cottontails = 1.26E-02
ADDtotal = Average daily dose; total
NOAEL = lowest observed adverse effect level
TRV (mg/kgBW/d) = toxicity reference value
HQ = hazard quotient
COEC = contaminant of ecological concern
"**yes**" = HQ > 1 or "No TRV"
"no" = HQ less than or equal to 1
HQs in **bold font** are > 1

Appendix Table C-26. 40 mm Range Hazard Quotients for Shrews Exposed to Subsurface Soil (1-3 ft) COPECs at Ravanna, Ohio

COPECs following ESV screen	RME Concentration (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME x SP_v x CF x I_P x AUF	BAF_i	ADD_A (mg/kgBW/d) RME x BAF_i x CF_i x I_A x AUF	ADD_S (mg/kgBW/d) RME x I_S x AUF	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	NOAEL TRV (mg/kgBW/d)	HQ ADD_{total} / TRV	COEC?
Inorganics										
Aluminum	1.36E+04	4.00E-03	5.94E-01	2.20E-01	1.46E+03	4.57E+02	1.92E+03	2.22E+00	**8.61E+02**	**yes**
Arsenic	1.90E+01	4.00E-02	8.30E-03	2.58E-01	3.10E-01	6.38E-01	9.57E-01	1.45E-01	**6.59E+00**	**yes**
Cadmium	4.24E-02	5.50E-01	2.55E-04	1.71E+01	4.59E-02	1.42E-03	4.76E-02	2.05E+00	2.32E-02	no
Chromium	1.92E+01	7.50E-03	1.57E-03	1.10E+00	1.34E+00	6.45E-01	1.98E+00	5.83E+03	3.40E-04	no
Chromium, hexavalent	3.15E+00	7.50E-03	2.58E-04	1.10E+00	2.19E-01	1.06E-01	3.25E-01	2.80E+00	1.16E-01	no
Cobalt	1.25E+01	2.00E-02	2.73E-03	3.21E-01	1.95E+00	4.20E-01	2.38E+00	No TRV	No TRV	**yes**
Copper	2.32E+01	4.00E-01	1.01E-01	4.00E-02	5.88E-02	7.80E-01	9.40E-01	3.24E+01	2.90E-02	no
Lead	1.63E+01	4.50E-02	8.01E-03	3.34E+00	3.45E+00	5.48E-01	4.01E+00	1.70E+01	2.35E-01	no
Thallium	1.08E+00	4.00E-03	4.72E-05	2.20E-01	1.16E-01	3.63E-02	1.52E-01	1.59E-02	**9.55E+00**	**yes**
Vanadium	2.36E+01	5.50E-03	1.42E-03	3.21E-01	3.69E+00	7.93E-01	4.49E+00	4.15E-01	**1.08E+01**	**yes**
Organics-Explosives										
2,6-Dinitrotoluene	5.00E-02	3.15E+00	1.72E-03	2.05E-04	5.00E-06	1.68E-03	3.40E-03	1.49E+00	2.28E-03	no
Organics-Semivolatiles										
3,3'-Dichlorobenzidine	4.00E-01	3.30E-01	1.44E-03	2.70E-04	5.25E-05	1.34E-02	1.49E-02	No TRV	No TRV	**yes**
Organics-Volatiles										
1,2-Dimethylbenzene	2.00E-03	6.01E-01	1.31E-05	2.51E-04	2.45E-07	6.72E-05	8.06E-05	2.37E+00	3.39E-05	no

COPEC = Constituents of potential ecological concern

ESV = ecological screening value

CF = correction factor dry wt to wet wt [0.15 kd dry plant/kg wet plant]

RME = Reasonable maximum exposure (lower of maximum or 95% UCL of mean)

SP_v = Soil-to-plant uptake factor; vegetative

ADD_P = Average daily dose; plant

I_P (kg/kgBW/d) = Plant ingestion rate for shrews = 7.28E-02

AUF = Area use factor (1.0)

BAF_i = Soil-to-animal; invertebrates

ADD_A = Average daily dose; animal

CF_i = correction factor (earthworms) [0.13 for As, Cd, Cr, Cu, Hg, Mn, Ni, Pb, Zn, PCBs, and 1 for all other COPECs - fraction dry wt worm/kg wet wet]

I_A (kg/kgBW/d) = Animal ingestion rate for shrews = 4.87E-01

ADD_S = Average daily dose; soil

I_S (kg/kgBW/d) = Soil ingestion rate for shrews = 3.36E-02

ADDtotal = Average daily dose; total

NOAEL = lowest observed adverse effect level

TRV (mg/kgBW/d) = toxicity reference value

HQ = hazard quotient

COEC = contaminant of ecological concern

"**yes**" = HQ > 1 or "No TRV"

"no" = HQ less than or equal to 1

HQs in **bold font** are >1

Appendix Table C-27. 40 mm Range Hazard Quotients for Red Foxes Exposed to Subsurface Soil (1-3 ft) PBT COPECs at Ravenna, Ohio

PBT COPECs remaining after ESV screen	RME Concentration (mg/kg)	SPr	ADD_P (mg/kgBW/d) RME x SP_r x CF_r x I_P x AUF_{-F}	SP_v	Prey ADD_P (mg/kgBW/d) RME x SP_v x CFv x I_{P-s} x AUF-s	BAF_i	Prey ADD_A (mg/kgBW/d) RME x BAF_i x CF_i x I_{A-s} x AUF-s	Prey ADD_S (mg/kgBW/d) RME x I_{S-s} x AUF-s	Prey ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S
Inorganics									
Cadmium	4.24E-02	1.50E-01	4.46E-09	5.50E-01	2.55E-04	1.71E+01	4.59E-02	1.42E-03	4.76E-02
Lead	1.63E+01	9.00E-03	1.03E-07	4.50E-02	8.01E-03	3.34E+00	3.45E+00	5.48E-01	4.01E+00
Organics-Semivolatiles									
3,3'-Dichlorobenzidine	4.00E-01	3.30E-01	9.26E-08	3.30E-01	1.44E-03	2.70E-04	6.83E-06	1.34E-02	1.49E-02
Organics-Volatiles									
1,2-Dimethylbenzene	2.00E-03	6.01E-01	8.43E-10	6.01E-01	1.31E-05	2.51E-04	3.18E-08	6.72E-05	8.04E-05

PBT = persistent, bioaccumulative, and toxic
RME = Reasonable maximum exposure (lower of maximum or 95% UCL of mean)
SP_r = Soil-to-plant; reproductive
SP_v = Soil-to-plant; vegetative
I_P (kg/kgBW/d) = Plant ingestion rate for red foxes = 0.00437
ADD_P = Average daily dose; plant
I_{P-s} (kg/kgBW/d) = Plant ingestion rate for shrews = 0.0728
AUF_{-F} = Area use factor for red fox = 1.61E-03
AUF_{-s} = Area use factor for shrews = 1.0
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_{A-s} (kg/kgBW/d) = Animal ingestion rate for shrews = 0.487
ADD_S = Average daily dose; soil
I_{S-s} (kg/kgBW/d) = Soil ingestion rate for shrews = 0.0336
Cs (mg/kg) = Concentration in the prey
IR_f (kg/kg body wt/d) = Ingestion rate of food for shrews = 0.56
CF_r = correction factor dry wt to wet wt [(0.1) 0.1 kg dry wt reproductive part plant/kg wet wt]
CF_v = correction factor dry wt to wet wt [0.15 kg dry wt vegetative part plant/kg wet wt]
CF_i = correction factor dry wt to wet wt [0.13 kg dry wt earthworm/kg wet wt]

COPEC = chemical of potential ecological concern
ESV = ecological screening value
BAF_{-TP} = Animal-to-animal; fox
I_A (kg/kgBW/d) = Animal ingestion rate for red foxes = 0.0906
I_S (kg/kgBW/d) = Soil ingestion rate for red foxes = 0.00266
ADD_{total} = Average daily dose; total
TRV (mg/kgBW/d) = toxicity reference value
COEC = contaminant of ecological concern
"yes" = HQ is >1 or there is "No TRV"
"no" = HQ less than or equal to 1
HQ = Hazard quotient
HQ > 1 in **bold font**

Appendix Table C-27. 40 mm Range Hazard Quotients for Red Foxes Exposed to Subsurface Soil (1-3 ft) PBT COPECs for Red Foxes at Ravenna, Ohio (cont'd)

PBT COPECs remaining after ESV screen	Cs (mg/kg) Prey ADD_{total}/IR_f	BAF_{-TP}	ADD_A (mg/kgBW/d) Cs x BAF_{TP} x I_A x AUF_{-F}	ADD_S (mg/kgBW/d) RME x I_S x AUF_{-F}	ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S	NOAEL TRV (mg/kgBW/d)	Site HQ ADD_{total}/TRV	COEC?
Inorganics								
Cadmium	8.50E-02	1.54E-02	1.91E-07	1.81E-07	3.76E-07	5.08E-01	7.40E-07	no
Lead	7.15E+00	1.36E-03	1.42E-06	6.96E-05	7.11E-05	4.22E+00	1.69E-05	no
Organics-Semivolatiles								
3,3'-Dichlorobenzidine	2.66E-02	3.43E-04	1.33E-09	1.71E-06	1.80E-06	No TRV	No TRV	yes
Organics-Volatiles								
1,2-Dimethylbenzene	1.43E-04	1.23E-04	2.57E-12	8.54E-09	9.39E-09	5.87E-01	1.60E-08	no

Appendix Table C-28. 40 mm Range Hazard Quotients for Red-Tailed Hawks Exposed to Subsurface Soil (1-3 ft) PBT COPECs at Ravenna, Ohio

PBT COPECs remaining after the ESV Media Screen	RME Concentration (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME *x* SP_v *x* *CFv x* I_P *x* AUFH	Prey ADD_P (mg/kgBW/d) RME *x* SP_v *x* *CFv x* $I_{P\text{-}s}$ *x* AUF-s	BAF_i	Prey ADD_A (mg/kgBW/d) RME *x* BAF_i *x* CF_i *x* $I_{A\text{-}s}$ *x* AUF-s	Prey ADD_S (mg/kgBW/d) RME *x* $I_{S\text{-}s}$ *x* AUF-s	Prey ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$
Inorganics								
Cadmium	4.24E-02	5.50E-01	0.00E+00	2.55E-04	1.71E+01	4.59E-02	1.42E-03	4.76E-02
Lead	1.63E+01	4.50E-02	0.00E+00	8.01E-03	3.34E+00	3.45E+00	5.48E-01	4.01E+00
Organics-Semivolatiles								
3,3'-Dichlorobenzidine	4.00E-01	3.30E-01	0.00E+00	1.44E-03	2.70E-04	6.83E-06	1.34E-02	1.49E-02
Organics-Volatiles								
1,2-Dimethylbenzene	2.00E-03	6.01E-01	0.00E+00	1.31E-05	2.51E-04	3.18E-08	6.72E-05	8.04E-05

PBT = persistent, bioaccumulative, and toxic
COPEC = contaminant of potential ecological concern
ESV = ecological screening value
RME = reasonable maximum concenetration
SP_r = Soil-to-plant; reproductive
SP_v = Soil-to-plant; vegetative
I_P (kg/kgBW/d) = Plant ingestion rate for red-tailed hawks = 0.00
ADD_P = Average daily dose; plant
CF_v = correction factor [0.15 kg dry wt vegetative plant part/kg wet wt]
CF_i = correction factor (earthworms) [0.13 for As, Cd, Cr, Cu, Hg, Mn, Ni, Pb, Zn, PCBs, and 1 for all other COPECs - fraction dry wt worm/kg wet wet]

Cs (mg/kg) = Concentration in the prey
IR_f (kg/kgBW/d)= Ingestion rate of food for shrews = 0.56
BAF_{TP} = Animal-to-mammal transfer factor (Ba_{cow} x $BW_{receptor}$ x lipid ratio) where lipid ratio = 1 for inorganics, 0.8 for organics; mammal Ba = biotransfer food to cow, and $BW_{receptor}$ = body wt (kg) of the receptor
I_A (kg/kgBW/d) = Animal ingestion rate for red-tailed hawks = 0.11
I_S (kg/kgBW/d) = Soil ingestion rate for red-tailed hawks = 0.00

Appendix Table C-28. 40 mm Range Hazard Quotients for Red-Tailed Hawks Exposed to Subsurface Soil (1-3 ft) PBT COPECs at Ravenna, Ohio (cont'd)

PBT COPECs remaining after the ESV Media Screen	Cs (mg/kg) ADD_{total}/IR_f	BAF_{-TP}	ADD_A (mg/kgBW/d) Cs x BAF_{-TP} x I_A x AUF_{-H}	ADD_S (mg/kgBW/d) RME x I_S x AUF_{-H}	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	NOAEL TRV (mg/kgBW/d)	Site HQ ADD_{total}/ TRV	COEC?
Inorganics								
Cadmium	8.50E-02	3.86E-03	3.33E-08	0.00E+00	3.33E-08	1.45E-02	2.30E-06	no
Lead	7.15E+00	3.40E-04	2.47E-07	0.00E+00	2.47E-07	1.13E-02	2.19E-05	no
Organics-Semivolatiles								
3,3'-Dichlorobenzidine	2.66E-02	8.57E-05	2.32E-10	0.00E+00	2.32E-10	No TRV	No TRV	**yes**
Organics-Volatiles								
1,2-Dimethylbenzene	1.43E-04	3.08E-05	4.49E-13	0.00E+00	4.49E-13	No TRV	No TRV	**yes**

I_{P-s} (kg/kgBW/d) = Plant ingestion rate for shrews (0.0728)
AUF_s = Area use factor for shrew (1.0)
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_{A-s} (kg/kgBW/d) = Animal ingestion rate for shrews (0.487)
ADD_S = Average daily dose; soil
AUF_{-H} = Area use factor hawk 0.000924

I_{S-s} (kg/kgBW/d) = Soil ingestion rate for shrews (0.0336)
ADD_{total} = Average daily dose; total
TRV (mg/kgBW/d) = toxicity reference value
HQ = Hazard quotient
COEC = contaminant of ecological concern
"**yes**" = HQ > 1 or "No TRV"
"no" = HQ less than or equal to 1

Appendix Table C-29. 40 mm Range Hazard Quotients for Plants and Earthworms Exposed to Deep Surface (0-3 ft) Soil COPECs at Ravenna, Ohio

COPECs inputted from ESV media screen	Subsurface Soil RME Concentrations (mg/kg)	Plants: Plant TRV[a] (mg/kg)	Plants: Plant HQ Plant RME/TRV	Plants: COEC?	Earthworms: Earthworm TRV[b] (mg/kg)	Earthworms: Earthworm HQ Earthworm RME/TRV	Earthworms: COEC?
Inorganics							
Aluminum	1.26E+04	5.00E+01	**2.52E+02**	**yes**	No TRV	No TRV	**yes**
Arsenic	1.50E+01	1.00E+01	**1.50E+00**	**yes**	6.00E+01	2.50E-01	no
Cadmium	1.21E-01	4.00E+00	3.03E-02	no	2.00E+01	6.05E-03	no
Chromium	3.36E+01	1.00E+00	**3.36E+01**	**yes**	4.00E-01	**8.40E+01**	**yes**
Chromium, hexavalent	2.50E+00	No TRV	No TRV	**yes**	No TRV	No TRV	**yes**
Cobalt	1.04E+01	2.00E+01	5.20E-01	no	No TRV	No TRV	**yes**
Copper	2.10E+01	1.00E+02	2.10E-01	no	6.00E+01	3.50E-01	no
Lead	1.72E+01	5.00E+01	3.44E-01	no	5.00E+02	3.44E-02	no
Nickel	2.01E+01	3.00E+01	6.70E-01	no	2.00E+02	1.01E-01	no
Thallium	8.38E-01	1.00E+00	8.38E-01	no	No TRV	No TRV	**yes**
Vanadium	2.25E+01	2.00E+00	**1.13E+01**	**yes**	No TRV	No TRV	**yes**
Zinc	6.29E+01	5.00E+01	**1.26E+00**	**yes**	2.00E+02	3.15E-01	no
Organics-Explosives							
2,6-Dinitrotoluene	5.00E-02	No TRV	No TRV	**yes**	No TRV	No TRV	**yes**
Organics-Semivolatiles							
3,3'-Dichlorobenzidine	4.00E-01	No TRV	No TRV	**yes**	No TRV	No TRV	**yes**
Bis(2-ethylhexyl)phthalate	1.50E-01	No TRV	No TRV	**yes**	No TRV	No TRV	**yes**
Organics-Volatiles							
1,2-Dimethylbenzene	2.00E-03	No TRV	No TRV	**yes**	No TRV	No TRV	**yes**
Organics-Pesticides							
4,4'-DDE	3.30E-04	No TRV	No TRV	**yes**	No TRV	No TRV	**yes**
Aldrin	1.13E-03	No TRV	No TRV	**yes**	No TRV	No TRV	**yes**
Dieldrin	1.09E-03	No TRV	No TRV	**yes**	No TRV	No TRV	**yes**
Endrin aldehyde	8.50E-04	No TRV	No TRV	**yes**	No TRV	No TRV	**yes**
Heptachlor	7.90E-04	No TRV	No TRV	**yes**	No TRV	No TRV	**yes**
Lindane	9.30E-04	No TRV	No TRV	**yes**	No TRV	No TRV	**yes**

COPEC = chemical of potential ecological concern
EU = exposure unit
ESV = ecological screening value
RME = Reasonable maximum exposure (lower of maximum and 95% upper confidence limit of mean)
[a]Plant TRV reference from Efroymson et al. (1997a)
TRV = toxicity reference value
HQ = Hazard quotient
COEC = chemical of ecological concern
"**yes**" = HQ > 1 or "No TRV"
"no" = HQ less than or equal to 1
[b]Earthworm TRV reference from Efroymson et al. (1997b)
HQs in **bold font** are > 1

Appendix Table C-30. 40 mm Range Hazard Quotients for Cottontail Rabbits Exposed to Deep Surface Soil (0-3 ft) COPECs at Ravanna, Ohio

COPECs inputted from ESV media screen	RME Concentration (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME x SP_v x CF x I_P x AUF	BAF_i	ADD_A (mg/kgBW/d) RME x BAF_i x CF_i x I_A x AUF	ADD_S (mg/kgBW/d) RME x I_S x AUF	ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S	NOAEL TRV (mg/kgBW/d)	HQ ADD_{total} / TRV	COEC?
Inorganics										
Aluminum	1.26E+04	4.00E-03	3.71E-01	2.20E-01	0.00E+00	4.14E+01	4.18E+01	7.64E-01	**5.47E+01**	**yes**
Arsenic	1.50E+01	4.00E-02	4.42E-03	2.58E-01	0.00E+00	4.93E-02	5.37E-02	4.99E-02	**1.08E+00**	**yes**
Cadmium	1.21E-01	5.50E-01	4.90E-04	1.71E+01	0.00E+00	3.98E-04	8.88E-04	7.06E-01	1.26E-03	no
Chromium	3.36E+01	7.50E-03	1.85E-03	1.10E+00	0.00E+00	1.10E-01	1.12E-01	2.00E+03	5.61E-05	no
Chromium, hexavalent	2.50E+00	7.50E-03	1.38E-04	1.10E+00	0.00E+00	8.22E-03	8.36E-03	9.62E-01	8.69E-03	no
Cobalt	1.04E+01	2.00E-02	1.53E-03	3.21E-01	0.00E+00	3.42E-02	3.57E-02	No TRV	No TRV	**yes**
Copper	2.10E+01	4.00E-01	6.18E-02	4.00E-02	0.00E+00	6.91E-02	1.31E-01	1.11E+01	1.17E-02	no
Lead	1.72E+01	4.50E-02	5.70E-03	3.34E+00	0.00E+00	5.66E-02	6.23E-02	5.85E+00	1.06E-02	no
Nickel	2.01E+01	6.00E-02	8.88E-03	1.66E+00	0.00E+00	6.61E-02	7.50E-02	2.93E+01	2.56E-03	no
Thallium	8.38E-01	4.00E-03	2.47E-05	2.20E-01	0.00E+00	2.76E-03	2.78E-03	5.47E-03	5.08E-01	no
Vanadium	2.25E+01	5.50E-03	9.11E-04	3.21E-01	0.00E+00	7.40E-02	7.49E-02	1.43E-01	5.25E-01	no
Zinc	6.29E+01	1.50E+00	6.94E-01	5.77E+00	0.00E+00	2.07E-01	9.01E-01	1.17E+02	7.70E-03	no
Organics-Explosives										
2,6-Dinitrotoluene	5.00E-02	3.15E+00	1.16E-03	2.05E-04	0.00E+00	1.64E-04	1.32E-03	5.12E-01	2.58E-03	no
Organics-Semivolatiles										
3,3'-Dichlorobenzidine	4.00E-01	3.30E-01	9.72E-04	2.70E-04	0.00E+00	1.32E-03	2.29E-03	No TRV	No TRV	**yes**
Bis(2-ethylhexyl)phthalate	1.50E-01	3.80E-02	4.20E-05	3.51E-04	0.00E+00	4.93E-04	5.35E-04	7.25E+00	7.39E-05	no
Organics-Volatiles										
1,2-Dimethylbenzene	2.00E-03	6.01E-01	8.84E-06	2.51E-04	0.00E+00	6.58E-06	1.54E-05	8.16E-01	1.89E-05	no
Organics-Pesticides										
4,4'-DDE	3.30E-04	9.37E-03	2.28E-08	1.26E+00	0.00E+00	1.09E-06	1.11E-06	7.32E-01	1.51E-06	no
Aldrin	1.13E-03	1.04E-02	8.64E-08	4.10E-04	0.00E+00	3.72E-06	3.80E-06	1.46E-01	2.60E-05	no
Dieldrin	1.09E-03	3.49E-02	2.80E-07	3.54E-04	0.00E+00	3.58E-06	3.86E-06	1.46E-02	2.64E-04	no
Endrin aldehyde	8.50E-04	6.51E-02	4.07E-07	3.28E-04	0.00E+00	2.80E-06	3.20E-06	No TRV	No TRV	**yes**
Heptachlor	7.90E-04	4.89E-02	2.84E-07	1.40E+00	0.00E+00	2.60E-06	2.88E-06	9.52E-02	3.03E-05	no
Lindane	9.30E-04	2.74E-01	1.88E-06	2.76E-04	0.00E+00	3.06E-06	4.93E-06	5.85E+00	8.43E-07	no

COPEC = Constituents of potential ecological concern
ESV = ecological screening value
CF = correction factor dry wt to wet wt [0.15 kd dry plant/kg wet plant]
RME = Reasonable maximum exposure (lower of maximum or 95% UCL of mean)
SP_v = Soil-to-plant uptake factor; vegetative
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = Plant ingestion rate for cottontails = 1.88E-01
AUF = Area use factor = 2.61E-01
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal

I_A (kg/kgBW/d) = Animal ingestion rate for cottontails = 0.00E+00
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = Soil ingestion rate for cottontails = 1.26E-02
ADDtotal = Average daily dose; total
NOAEL = lowest observed adverse effect level
TRV (mg/kgBW/d) = toxicity reference value
HQ = hazard quotient
COEC = contaminant of ecological concern
"yes" = HQ > 1 or "No TRV"

CF_i = correction factor (earthworms) [0.13 for As, Cd, Cr, Cu, Hg, Mn, Ni, Pb, Zn, PCBs, and 1 for all other COPECs - fraction dry wt worm/kg wet wet]

"no" = HQ less than or equal to 1
HQs in **bold font** are > 1

Appendix Table C-31. 40 mm Range Hazard Quotients for Shrews Exposed to Deep Surface Soil (0-3 ft) COPECs at Ravanna, Ohio

COPECs following ESV screen	RME Concentration (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME *x* SP_v *x* *CF* *x* I_P *x* AUF	BAF_i	ADD_A (mg/kgBW/d) RME *x* BAF_i *x* CF_i *x* I_A *x* AUF	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	NOAEL TRV (mg/kgBW/d)	HQ ADD_{total}/TRV	COEC?
Inorganics										
Aluminum	1.26E+04	4.00E-03	5.50E-01	2.20E-01	1.35E+03	4.23E+02	1.77E+03	2.22E+00	**7.98E+02**	yes
Arsenic	1.50E+01	4.00E-02	6.55E-03	2.58E-01	2.45E-01	5.04E-01	7.56E-01	1.45E-01	**5.20E+00**	yes
Cadmium	1.21E-01	5.50E-01	7.27E-04	1.71E+01	1.31E-01	4.07E-03	1.36E-01	2.05E+00	6.61E-02	no
Chromium	3.36E+01	7.50E-03	2.75E-03	1.10E+00	2.34E+00	1.13E+00	3.47E+00	5.83E+03	5.95E-04	no
Chromium, hexavalent	2.50E+00	7.50E-03	2.05E-04	1.10E+00	1.74E-01	8.40E-02	2.58E-01	2.80E+00	9.23E-02	no
Cobalt	1.04E+01	2.00E-02	2.27E-03	3.21E-01	1.63E+00	3.49E-01	1.98E+00	No TRV	No TRV	yes
Copper	2.10E+01	4.00E-01	9.17E-02	4.00E-02	5.32E-02	7.06E-01	8.51E-01	3.24E+01	2.62E-02	no
Lead	1.72E+01	4.50E-02	8.45E-03	3.34E+00	3.64E+00	5.78E-01	4.23E+00	1.70E+01	2.48E-01	no
Nickel	2.01E+01	6.00E-02	1.32E-02	1.66E+00	2.11E+00	6.75E-01	2.80E+00	8.52E+01	3.28E-02	no
Thallium	8.38E-01	4.00E-03	3.66E-05	2.20E-01	8.98E-02	2.82E-02	1.18E-01	1.59E-02	**7.41E+00**	yes
Vanadium	2.25E+01	5.50E-03	1.35E-03	3.21E-01	3.52E+00	7.56E-01	4.28E+00	4.15E-01	**1.03E+01**	yes
Zinc	6.29E+01	1.50E+00	1.03E+00	5.77E+00	2.30E+01	2.11E+00	2.61E+01	3.41E+02	7.66E-02	no
Organics-Explosives										
2,6-Dinitrotoluene	5.00E-02	3.15E+00	1.72E-03	2.05E-04	5.00E-06	1.68E-03	3.40E-03	1.49E+00	2.28E-03	no
Organics-Semivolatiles										
3,3'-Dichlorobenzidine	4.00E-01	3.30E-01	1.44E-03	2.70E-04	5.25E-05	1.34E-02	1.49E-02	No TRV	No TRV	yes
Bis(2-ethylhexyl)phthalate	1.50E-01	3.80E-02	6.22E-05	3.51E-04	2.56E-05	5.04E-03	5.13E-03	2.11E+01	2.43E-04	no
Organics-Volatiles										
1,2-Dimethylbenzene	2.00E-03	6.01E-01	1.31E-05	2.51E-04	2.45E-07	6.72E-05	8.06E-05	2.37E+00	3.39E-05	no
Organics-Pesticides										
4,4'-DDE	3.30E-04	9.37E-03	3.38E-08	1.26E+00	2.03E-04	1.11E-05	2.14E-04	2.13E+00	1.00E-04	no
Aldrin	1.13E-03	1.04E-02	1.28E-07	4.10E-04	2.26E-07	3.80E-05	3.83E-05	4.26E-01	9.00E-05	no
Dieldrin	1.09E-03	3.49E-02	4.15E-07	3.54E-04	1.88E-07	3.66E-05	3.72E-05	4.26E-02	8.74E-04	no
Endrin aldehyde	8.50E-04	6.51E-02	6.04E-07	3.28E-04	1.36E-07	2.86E-05	2.93E-05	No TRV	No TRV	yes
Heptachlor	7.90E-04	4.89E-02	4.22E-07	1.40E+00	5.39E-04	2.65E-05	5.66E-04	2.77E-01	2.04E-03	no
Lindane	9.30E-04	2.74E-01	2.78E-06	2.76E-04	1.25E-07	3.12E-05	3.42E-05	1.70E+01	2.00E-06	no

COPEC = Constituents of potential ecological concern
ESV = ecological screening value
CF = correction factor dry wt to wet wt [0.15 kd dry plant/kg wet plant]
RME = Reasonable maximum exposure (lower of maximum or 95% UCL of mean)
SP_v = Soil-to-plant uptake factor; vegetative
ADD_P = Average daily dose; plant
I_P (kg/kgBW/d) = Plant ingestion rate for shrews = 7.28E-02
AUF = Area use factor (1.0)
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal

I_A (kg/kgBW/d) = Animal ingestion rate for shrews = 4.87E-01
ADD_S = Average daily dose; soil
I_S (kg/kgBW/d) = Soil ingestion rate for shrews = 3.36E-02
ADDtotal = Average daily dose; total
NOAEL = lowest observed adverse effect level
TRV (mg/kgBW/d) = toxicity reference value
HQ = hazard quotient
COEC = contaminant of ecological concern
"**yes**" = HQ > 1 or "No TRV"

CF_i = correction factor (earthworms) [0.13 for As, Cd, Cr, Cu, Hg, Mn, Ni, Pb, Zn, PCBs, and 1 for all other COPECs - fraction dry wt worm/kg wet wet]

"no" = HQ less than or equal to 1
HQs in **bold font** are >1

Appendix Table C-32. 40 mm Range Hazard Quotients for Red Foxes Exposed to Deep Surface Soil (0-3 ft) PBT COPECs at Ravenna, Ohio

PBT COPECs remaining after ESV screen	RME Concentration (mg/kg)	SPr	ADD_P (mg/kgBW/d) RME *x* SP_r *x* CF_r *x* I_P *x* AUF_{-F}	SP_v	Prey ADD_P (mg/kgBW/d) RME *x* SP_v *x* CFv *x* I_{P-s} *x* AUF-s	BAF_i	Prey ADD_A (mg/kgBW/d) RME *x* BAF_i *x* CF_i *x* I_{A-s} *x* AUF-s	Prey ADD_S (mg/kgBW/d) RME *x* I_{S-s} *x* AUF-s	Prey ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$
Inorganics									
Cadmium	1.21E-01	1.50E-01	1.27E-08	5.50E-01	7.27E-04	1.71E+01	1.31E-01	4.07E-03	1.36E-01
Lead	1.72E+01	9.00E-03	1.09E-07	4.50E-02	8.45E-03	3.34E+00	3.64E+00	5.78E-01	4.23E+00
Zinc	6.29E+01	9.00E-01	3.97E-05	1.50E+00	1.03E+00	5.77E+00	2.30E+01	2.11E+00	2.61E+01
Organics-Semivolatiles									
Bis(2-ethylhexyl)phthalate	1.50E-01	3.80E-02	4.00E-09	3.80E-02	6.22E-05	3.51E-04	2.56E-05	5.04E-03	5.13E-03
3,3'-Dichlorobenzidine	4.00E-01	3.30E-01	9.26E-08	3.30E-01	1.44E-03	2.70E-04	5.25E-05	1.34E-02	1.49E-02
Organics-Volatiles									
1,2-Dimethylbenzene	2.00E-03	6.01E-01	8.43E-10	6.01E-01	1.31E-05	2.51E-04	2.45E-07	6.72E-05	8.06E-05
Organics-Pesticides									
4,4'-DDE	3.30E-04	9.37E-03	2.17E-12	9.37E-03	3.38E-08	1.26E+00	2.03E-04	1.11E-05	2.14E-04
Aldrin	1.13E-03	1.04E-02	8.24E-12	1.04E-02	1.28E-07	4.10E-04	2.26E-07	3.80E-05	3.83E-05
Dieldrin	1.09E-03	3.49E-02	2.67E-11	3.49E-02	4.15E-07	3.54E-04	1.88E-07	3.66E-05	3.72E-05
Endrin aldehyde	8.50E-04	6.51E-02	3.88E-11	6.51E-02	6.04E-07	3.28E-04	1.36E-07	2.86E-05	2.93E-05
Heptachlor	7.90E-04	4.89E-02	2.71E-11	4.89E-02	4.22E-07	1.40E+00	5.39E-04	2.65E-05	5.66E-04
Lindane	9.30E-04	2.74E-01	1.79E-10	2.74E-01	2.78E-06	2.76E-04	1.25E-07	3.12E-05	3.42E-05

PBT = persistent, bioaccumulative, and toxic
RME = Reasonable maximum exposure (lower of 95% UCL of mean or maximum detection)
SP_r = Soil-to-plant; reproductive
SP_v = Soil-to-plant; vegetative
I_P (kg/kgBW/d) = Plant ingestion rate for red foxes = 0.00437
ADD_P = Average daily dose; plant
I_{P-s} (kg/kgBW/d) = Plant ingestion rate for shrews = 0.0728
AUF_{-F} = Area use factor for red fox = 1.61E-03
AUF_{-s} = Area use factor for shrews = 1.0
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_{A-s} (kg/kgBW/d) = Animal ingestion rate for shrews = 0.487
ADD_S = Average daily dose; soil
I_{S-s} (kg/kgBW/d) = Soil ingestion rate for shrews = 0.0336
Cs (mg/kg) = Concentration in the prey
IR_f (kg/kg BW/d) = Ingestion rate of food for shrews = 0.56
CF_r = correction factor dry wt to wet wt [0.1 kg dry wt reproductive part plant/kg wet wt]

COPEC = chemical of potential ecological concern
ESV = ecological screening value
BAF_{-TP} = Animal-to-animal; fox
I_A (kg/kgBW/d) = Animal ingestion rate for red foxes = 0.0906
I_S (kg/kgBW/d) = Soil ingestion rate for red foxes = 0.00266
ADD_{total} = Average daily dose; total
TRV (mg/kgBW/d) = toxicity reference value
COEC = contaminant of ecological concern
"**yes**" = HQ is >1 or there is "No TRV"
"no" = HQ less than or equal to 1
HQ = Hazard quotient
HQ > 1 in **bold font**

Appendix Table C-32. 40 mm Range Hazard Quotients for Red Foxes Exposed to Deep Surface Soil (0-3 ft) PBT COPECs at Ravenna, Ohio

PBT COPECs remaining after ESV screen	RME Concentration (mg/kg)	SPr	ADD_P (mg/kgBW/d) RME x SP_r x CF_r x I_P x AUF-F	SP_v	Prey ADD_P (mg/kgBW/d) RME x SP_v x CFv x $I_{P\text{-}s}$ x AUF-s	BAF_i	Prey ADD_A (mg/kgBW/d) RME x BAF_i x CF_i x $I_{A\text{-}s}$ x AUF-s	Prey ADD_S (mg/kgBW/d) RME x $I_{S\text{-}s}$ x AUF-s	Prey ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S

CF_v = correction factor dry wt to wet wt [0.15 kg dry wt vegetative part plant/kg wet wt]

CF_i = correction factor dry wt to wet wt [0.13 kg dry wt earthworm/kg wet wt]

Appendix Table C-32. 40 mm Range Hazard Quotients for Red Foxes Exposed to Deep Surface Soil (0-3 ft) PBT COPECs at Ravenna, Ohio (cont'd)

PBT COPECs remaining after ESV screen	**Cs** (mg/kg) Prey ADD_{total}/IR_f	**BAF-TP**	**ADD_A** (mg/kgBW/d) Cs *x* BAF_{TP} *x* I_A *x* AUF_{-F}	**ADD_S** (mg/kgBW/d) RME *x* I_S *x* AUF_{-F}	**ADD_{total}** (mg/kgBW/d) ADD_P + ADD_A + ADD_S	**NOAEL TRV** (mg/kgBW/d)	**Site HQ** ADD_{total}/ TRV	**COEC?**
Inorganics								
Cadmium	2.43E-01	1.54E-02	5.45E-07	5.17E-07	1.07E-06	5.08E-01	2.11E-06	no
Lead	7.55E+00	1.36E-03	1.49E-06	7.35E-05	7.51E-05	4.22E+00	1.78E-05	no
Zinc	4.66E+01	4.54E-01	3.08E-03	2.69E-04	3.39E-03	8.43E+01	4.02E-05	no
Organics-Semivolatiles								
Bis(2-ethylhexyl)phthalate	9.16E-03	1.46E-02	1.94E-08	6.41E-07	6.64E-07	5.22E+00	1.27E-07	no
3,3'-Dichlorobenzidine	2.67E-02	3.43E-04	1.33E-09	1.71E-06	1.80E-06	No TRV	No TRV	**yes**
Organics-Volatiles								
1,2-Dimethylbenzene	1.44E-04	1.23E-04	2.58E-12	8.54E-09	9.39E-09	5.87E-01	1.60E-08	no
Organics-Pesticides								
4,4'-DDE	3.82E-04	1.65E-01	9.14E-09	1.41E-09	1.06E-08	5.27E-01	2.00E-08	no
Aldrin	6.84E-05	1.38E-01	1.37E-09	4.83E-09	6.21E-09	1.05E-01	5.89E-08	no
Dieldrin	6.65E-05	1.70E-02	1.64E-10	4.66E-09	4.85E-09	1.05E-02	4.60E-07	no
Endrin aldehyde	5.23E-05	5.75E-03	4.38E-11	3.63E-09	3.71E-09	No TRV	No TRV	**yes**
Heptachlor	1.01E-03	9.44E-03	1.39E-09	3.37E-09	4.79E-09	6.85E-02	6.99E-08	no
Lindane	6.10E-05	4.78E-04	4.25E-12	3.97E-09	4.16E-09	4.22E+00	9.86E-10	no

Appendix Table C-32. 40 mm Range Hazard Quotients for Red Foxes Exposed to Deep Surface Soil (0-3 ft) PBT COPECs at Ravenna, Ohio (cont'd)

PBT COPECs remaining after ESV screen	Cs (mg/kg) Prey ADD_{total}/IR_f	BAF-TP	ADD_A (mg/kgBW/d) Cs *x* BAF_{TP} *x* I_A *x* AUF_{-F}	ADD_S (mg/kgBW/d) RME *x* I_S *x* AUF_{-F}	ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S	NOAEL TRV (mg/kgBW/d)	Site HQ ADD_{total}/ TRV	COEC?

Appendix Table C-33. 40 mm Range Hazard Quotients for Red-Tailed Hawks Exposed to Deep Surface Soil (0-3 ft) PBT COPECs at Ravenna, Ohio

PBT COPECs remaining after the ESV Screen	RME Concentration (mg/kg)	SP_v	ADD_P (mg/kgBW/d) RME x SP_v x CFv x I_P x AUF_{-H}	Prey ADD_P (mg/kgBW/d) RME x SP_v x CFv x $I_{P\text{-}s}$ x AUF-s	BAF_i	Prey ADD_A (mg/kgBW/d) RME x BAF_i x CF_i x $I_{A\text{-}s}$ x AUF-s	Prey ADD_S (mg/kgBW/d) RME x $I_{S\text{-}s}$ x AUF-s	Prey ADD_{total} (mg/kgBW/d) ADD_P + ADD_A + ADD_S
Inorganics								
Cadmium	1.21E-01	5.50E-01	0.00E+00	7.27E-04	1.71E+01	1.31E-01	4.07E-03	1.36E-01
Lead	1.72E+01	4.50E-02	0.00E+00	8.45E-03	3.34E+00	3.64E+00	5.78E-01	4.23E+00
Zinc	6.29E+01	1.50E+00	0.00E+00	1.03E+00	5.77E+00	2.30E+01	2.11E+00	2.61E+01
Organics-Semivolatiles								
Bis(2-ethylhexyl)phthalate	1.50E-01	3.80E-02	0.00E+00	6.22E-05	3.51E-04	2.56E-05	5.04E-03	5.13E-03
1,2-Dimethylbenzene	2.00E-03	6.01E-01	0.00E+00	1.31E-05	2.51E-04	2.45E-07	6.72E-05	8.06E-05
3,3'-Dichlorobenzidine	4.00E-01	3.30E-01	0.00E+00	1.44E-03	2.70E-04	5.25E-05	1.34E-02	1.49E-02
Organics-Pesticides								
4,4'-DDE	3.30E-04	9.37E-03	0.00E+00	3.38E-08	1.26E+00	2.03E-04	1.11E-05	2.14E-04
Aldrin	1.13E-03	1.04E-02	0.00E+00	1.28E-07	4.10E-04	2.26E-07	3.80E-05	3.83E-05
Dieldrin	1.09E-03	3.49E-02	0.00E+00	4.15E-07	3.54E-04	1.88E-07	3.66E-05	3.72E-05
Endrin aldehyde	8.50E-04	6.51E-02	0.00E+00	6.04E-07	3.28E-04	1.36E-07	2.86E-05	2.93E-05
Heptachlor	7.90E-04	4.89E-02	0.00E+00	4.22E-07	1.40E+00	5.39E-04	2.65E-05	5.66E-04
Lindane	9.30E-04	2.74E-01	0.00E+00	2.78E-06	2.76E-04	1.25E-07	3.12E-05	3.42E-05

PBT = persistent, bioaccumulative, and toxic
COPEC = contaminant of potential ecological concern
ESV = ecological screening value
RME = reasonable maximum concenetration
SP_r = Soil-to-plant; reproductive
SP_v = Soil-to-plant; vegetative
I_P (kg/kgBW/d) = Plant ingestion rate for red-tailed hawks = 0.00
ADD_P = Average daily dose; plant
CF_v = correction factor [0.15 kg dry wt vegetative plant part/kg wet wt]
CF_i = correction factor (earthworms) [0.13 for As, Cd, Cr, Cu, Hg, Mn, Ni, Pb, Zn, PCBs, and 1 for all other COPECs - fraction dry wt worm/kg wet wet]

Cs (mg/kg) = Concentration in the prey
IR_f (kg/kgBW/d)= Ingestion rate of food for shrews = 0.56
BAF_{-TP} = Animal-to-mammal transfer factor (Ba_{cow} x $BW_{receptor}$ x lipid ratio) where lipid ratio = 1 for inorganics, 0.8 for organics; mammal Ba = biotransfer food to cow, and $BW_{receptor}$ = body wt (kg) of the receptor
I_A (kg/kgBW/d) = Animal ingestion rate for red-tailed hawks = 0.11
I_S (kg/kgBW/d) = Soil ingestion rate for red-tailed hawks = 0.00

Appendix Table C-33. 40 mm Range Hazard Quotients for Red-Tailed Hawks Exposed to Deep Surface Soil (0-3 ft) PBT COPECs at Ravenna, Ohio (cont'd)

PBT COPECs remaining after the ESV Screen	Cs (mg/kg) ADD_{total}/IR_f	BAF_{-TP}	ADD_A (mg/kgBW/d) $Cs \times BAF_{-TP} \times I_A \times AUF_{-H}$	ADD_S (mg/kgBW/d) RME $\times I_S \times AUF_{-H}$	ADD_{total} (mg/kgBW/d) $ADD_P + ADD_A + ADD_S$	NOAEL TRV (mg/kgBW/d)	Site HQ ADD_{total} / TRV	COEC?
Inorganics								
Cadmium	2.43E-01	3.86E-03	9.51E-08	0.00E+00	9.51E-08	1.45E-02	6.56E-06	no
Lead	7.55E+00	3.40E-04	2.61E-07	0.00E+00	2.61E-07	1.13E-02	2.31E-05	no
Zinc	4.66E+01	1.13E-01	5.37E-04	0.00E+00	5.37E-04	1.45E-01	3.71E-03	no
Organics-Semivolatiles								
Bis(2-ethylhexyl)phthalate	9.16E-03	3.65E-03	3.39E-09	0.00E+00	3.39E-09	1.10E-02	3.09E-07	no
1,2-Dimethylbenzene	1.44E-04	3.08E-05	4.50E-13	0.00E+00	4.50E-13	No TRV	No TRV	yes
3,3'-Dichlorobenzidine	2.67E-02	8.57E-05	2.32E-10	0.00E+00	2.32E-10	No TRV	No TRV	yes
Organics-Pesticides								
4,4'-DDE	3.82E-04	4.12E-02	1.60E-09	0.00E+00	1.60E-09	8.45E-03	1.89E-07	no
Aldrin	6.84E-05	3.44E-02	2.39E-10	0.00E+00	2.39E-10	No TRV	No TRV	yes
Dieldrin	6.65E-05	4.24E-03	2.86E-11	0.00E+00	2.86E-11	7.70E-04	3.72E-08	no
Endrin aldehyde	5.23E-05	1.44E-03	7.65E-12	0.00E+00	7.65E-12	No TRV	No TRV	yes
Heptachlor	1.01E-03	2.36E-03	2.42E-10	0.00E+00	2.42E-10	6.50E-04	3.73E-07	no
Lindane	6.10E-05	1.20E-04	7.41E-13	0.00E+00	7.41E-13	2.00E-02	3.71E-11	no

I_{P-s} (kg/kgBW/d) = Plant ingestion rate for shrews (0.0728)
AUF_s = Area use factor for shrew (1.0)
BAF_i = Soil-to-animal; invertebrates
ADD_A = Average daily dose; animal
I_{A-s} (kg/kgBW/d) = Animal ingestion rate for shrews (0.487)
ADD_S = Average daily dose; soil
AUF_{-H} = Area use factor hawk 0.000924

I_{S-s} (kg/kgBW/d) = Soil ingestion rate for shrews (0.0336)
ADD_{total} = Average daily dose; total
TRV (mg/kgBW/d) = toxicity reference value
HQ = Hazard quotient
COEC = contaminant of ecological concern
"yes" = HQ > 1 or "No TRV"
"no" = HQ less than or equal to 1
HQs in bold font are > 1

APPENDIX D

TRESPASSER SCENARIO

RISK CHARACTERIZATION FOR JUVENILE TRESPASSER SCENARIO: 40MM RANGE AOC

INTRODUCTION

The HHRA provided in the *Analytical Evaluation Of Chemical Residuum at the 40 mm Range* evaluates the potential health risks to humans resulting from exposure to contaminated soil at the 40mm Range AOC. The HHRA is based on the methods outlined in the RVAAP FWHHRAM which addresses five receptors to be evaluated at RVAAP [National Guard Trainee, National Guard Dust/Fire Control Worker, Security Guard/Maintenance Worker, Hunter/Trapper/Fisher, and Resident Subsistence Farmer (adult and child)].

In addition to the receptors in the FWHHRAM a Juvenile Trespasser is evaluated in this appendix to supplement the HHRA to provide risk managers with information to support determination of the need for continued security at the facility (i.e., maintenance of the perimeter fence to mitigate trespassing onto RTLS/RVAAP).

This supplemental risk characterization provides exposure assessment results of the risk characterization. The data evaluation, COPCs, and toxicity assessment are provided in the HHRA presented in the *Analytical Evaluation Of Chemical Residuum at the 40 mm Range* and do not change for this evaluation of the Juvenile Trespasser.

EXPOSURE ASSESSMENT

One receptor (Juvenile Trespasser) is evaluated in this supplemental HHRA. RVAAP/ RTLS is a controlled access facility (it is fenced, gated, and patrolled by security guards); however, if the perimeter fence is not maintained a trespasser could enter the property and be exposed to contaminants in surface soil, sediment, and surface water at the 40 mm Range AOC. The most likely adult trespassers are hunters or National Guard trainees entering unauthorized areas. These adult trespassers will have similar exposures, but with a much lower frequency, to the Hunter and National Guard Trainee receptors that are included in the baseline HHRA. Therefore, a separate adult trespasser is not evaluated quantitatively in this risk assessment. A Juvenile Trespasser (ages 8 to 18) is evaluated quantitatively for exposure to contaminated surface soil (0-1 ft bgs) via incidental ingestion, inhalation of VOCs and particulates, and dermal contact.

Exposure equations for each of these pathways are provided in the FWHHRAM (USACE 2004b). Exposure parameters used to calculate potential chemical intakes by the Juvenile Trespasser are provided in Table 1. Chemical-specific exposure parameters are provided for all COPCs in Table 2.

Table 1. Exposure Parameters for Juvenile Trespasser Scenario: Exposure to Surface Soil[a]

Exposure Pathway and Parameter	Units	Value
Incidental Ingestion		
Soil ingestion rate	kg/day	0.0002[b]
Exposure time	hours/day	2[c]
Exposure frequency	days/year	50[c]
Exposure duration	years	10[c]
Body weight	kg	45[c]
Carcinogen averaging time	days	25,550[b]
Non-carcinogen averaging time	days	3,650[b]
Fraction ingested	Unitless	1
Conversion factor	days/hour	0.042
Dermal Contact		
Skin area	m^2/event	0.46[d]
Adherence factor	mg/cm^2	0.2[e]
Absorption fraction	Unitless	Chemical Specific – Table A-2
Exposure frequency	events/year	50[c]
Exposure duration	years	10[c]
Body weight	kg	45[c]
Carcinogen averaging time	days	25,550[b]
Non-carcinogen averaging time	days	3,650[b]
Conversion factor	(kg-cm2)/(mg-m2)	0.01
Inhalation of VOCs and Dust		
Inhalation rate	m3/day	20[b]
Exposure time	hours/day	2[c]
Exposure frequency	days/year	50[c]
Exposure duration	years	10[c]
Body weight	kg	45[c]
Volitilization factor	m3/kg	Chemical Specific – Table A-2
Particulate emission factor	m3/kg	9.24E+08[f]
Carcinogen averaging time	days	25,550[b]
Non-carcinogen averaging time	days	3,650[b]
Conversion factor	days/hour	0.042

[a] Surface soil is defined as 0-1 ft bgs (shallow surface soil).
[b] Default exposure parameter from RAGS, Part B (EPA 1989).
[c] Per Ohio EPA personal communication (EPA 1999), conservatively assumes a trespasser (age 8-18) visits the site every weekend they are home (i.e., minus 2 weeks away) and spends 2 hours each day at the site.
[d] Value is 25% of the total 95th percentile skin surface area of males age 9-18 (EPA 1997). This is consistent with the source of the skin surface area for the adult farmer (i.e., 0.57 is 25% of the 95th percentile total skin surface are for adult male from EPA 1997).
[e] Value is child default and teen soccor (95th percentile) RAGS, Vol. 1 Part E, Supplemental Guidance for Dermal Risk Assessment, Interim, EPA/540/R/99/005).
[f] Default value for Cleveland Ohio from EPA Soil Screening Guidance per FWHHRAM (USACE 2004b) for other receptors.
[g] Trespasser is assumed to ingest 0.05 L/hour [per RAGS Part A (EPA 1998)] for the two hours/day spent on site for a total ingestion rate of 0.1 L/day.

Table 2. Chemical-specific Exposure Parameters for 40 mm Range COPCs

COPC	Dermal Absorption Factor[a] (unitless)	Volatilization Factor[b] (m^3/kg)
Inorganics		
Aluminum	1.0E-03	--
Arsenic	3.0E-02	--
Chromium (as Chromium III)	1.0E-03	--
Thallium (as Thallium carbonate)	1.0E-03	--
Vanadium	1.0E-03	--
Organics		
2-Methyl-4,6-dinitrophenol	1.0E-01	--
Benzo(a)pyrene	1.3E-01	--
Bis(2-chloroethyl) ether	1.0E-01	4.0E+04
Dibenz(a,h)anthracene	1.3E-01	--
Hexachlorobenzene	1.0E-01	--
N-Nitroso-di-n-propylamine	1.0E-01	--

[a] Chemical-specific absorption factor values from EPA Region V (EPA, 2000). When chemical-specific values are not available the following default values are used: SVOCs = 0.1, VOCs = 0.01, inorganics = 0.001 per USEPA Region 4 Supplemental Guidance to RAGS.
[b] Volatilization factors (VFs) calculated using the 1996 EPA Soil Screening Guidance Methodology, using site-specific parameter values for Cleveland, Ohio.
COPC = Chemical of potential concern.
RAGS = Risk Assessment Guidance for Superfund.
SVOC = Semivolatile organic compound.
VOC = Volatile organic compound.
-- = No value available.

RISK CHARACTERIZATION

Risk characterization integrates the findings of the exposure and toxicity assessments to estimate the potential for receptors to experience adverse effects as a result of exposure to contaminated media. Risk characterization for the Juvenile Trespasser follows the same methodology used for risk characterization for the other receptors evaluated in the baseline HHRA.

Toxicity values used in the risk characterization are provided in Tables 3 and 4. Detailed hazard and risk results for direct contact with COPCs in surface soil are presented in Tables 5 and 6. Direct contact includes incidental ingestion of soil, inhalation of VOCs and particulates (i.e., dust) from soil, and dermal contact with soil.

The total HI for the Juvenile Trespasser exposed to shallow surface soil is 0.009. The total risk across all COPCs for the Juvenile Trespasser exposed to shallow surface soil is 6.5E-07. Both of these results are s below the threshold levels of 1.0 (HI) and 1E-06 (ILCR); thus, no surface soil COCs are identified for this receptor.

Table 3. Non-carcinogenic Reference Doses for 40 mm Range COPCs

COPC	Oral Chronic RFD (mg/kg-day)	Confidence Level	% GI absorption[a]	Dermal Chronic RfD (mg/kg-day)	Inhalation Chronic RfD (mg/kg-day)	RfD Basis (vehicle)	Critical Effect	Uncertainty/ Modifying Factor
Inorganics								
Aluminum								
	1.0E+00	NA	1	1.0E+00	1.4E-03	NA	NA	(O) UF=10
Arsenic								
	3.0E-04	Medium (O)	0.95	3.0E-04	--	Oral, oral-water	Hyperpigmentation, keritosis and possible vascular complication	(O) UF=3
Chromium (as Chromium III)								
	1.5E+00	Low (O)	0.013	2.0E-02	--	Oral (rat)	Reduced liver/spleen weight	(O) UF=100
Thallium								
	8.0E-05	Low (O)	1	8.0E-05	--	Oral	Nervous system, lungs, heart, liver, and kidneys	(O) MF=1 (O) UF=3000
Vanadium								
	7.0E-03	NA	0.026	1.8E-04	--	Inhalation	(I) respiratory system	(O) MF=1 (O) UF=100
Organics								
2-Methyl-4,6-dinitrophenol								
	1.0E-04	NA	1	1.0E-04	--	Oral	Increased basal metabolic rate	NA
Hexachlorobenzene								
	8.0E-04	NA	1	8.0E-04	--	Oral	Liver, kidneys, and thyroid	NA

[a] % GI absorption values from EPA 2000.
(O) indicates oral, (I) indicates inhalation.
MF = Modifying factor (the default modifying factor is 1).
NA = Not available.
RfD = Reference dose.
UF = Uncertainty factor.
-- = No value available.

Table 4. Cancer Slope Factors for 40 mm Range COPCs

COPC	Oral Slope Factor $(mg/kg\text{-}day)^{-1}$	% GI absorption[a]	Dermal Slope Factor $(mg/kg\text{-}day)^{-1}$	Inhalation Slope Factor $(mg/kg\text{-}day)^{-1}$	EPA Class	TEF	Type of Cancer
Inorganics							
Arsenic	1.5E+00	0.95	1.5E+00	1.5E+01	A	--	Respiratory system tumors
Organics							
Benzo(a)pyrene	7.3E+00	0.58	7.3E+00	3.1E+00	B2	1	Stomach, nasal cavity, larynx, trachea, pharnyx
Bis(2-chloroethyl) ether	1.1E+00	1	1.1E+00	1.2E+00	B2	--	NA
Dibenz(a,h)anthracene	7.3E+00	0.58	7.3E+00	3.1E+00	B2	1	Immunodepressive effects (mouse)
Hexachlorobenzene	1.6E+00	1	1.6E+00	1.6E+00	B2	--	Liver, kidneys, and thyroid
N-Nitroso-di-n-propylamine	7.0E+00	1	7.0E+00	--	B2	--	Liver, nose, and stomach (animals)

[a] % GI absorption values from EPA 2000.

TEF = Toxicity Equivalency Factor is based on the relative potency of each carcinogenic polycyclic aromatic hydrocarbon (PAH) relative to that of benzo(a)pyrene.

-- = No value available.

Table 5. 40 mm Range Shallow Surface Soil Carcinogenic Risks for the Juvenile Trespasser - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Risk			Total Risk across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
Aluminum	1.2E+04	9.0E-05	5.0E-06	9.7E-09					
Arsenic	1.3E+01	9.1E-08	1.5E-07	9.8E-12	1.4E-07	2.3E-07	1.5E-10	3.6E-07	
Chromium	4.4E+01	3.2E-07	1.8E-08	3.4E-11					
Thallium	8.0E-01	5.8E-09	3.2E-10	6.3E-13					
Vanadium	2.3E+01	1.6E-07	9.1E-09	1.8E-11					
Inorganics Pathway Total					1.4E-07	2.3E-07	1.5E-10	3.6E-07	
2-Methyl-4,6-dinitrophenol	4.6E-01	3.3E-09	1.8E-08	3.6E-13					
Benzo(a)pyrene	2.3E-01	1.7E-09	1.2E-08	1.8E-13	1.2E-08	8.7E-08	5.6E-13	9.9E-08	
Dibenz(a,h)anthracene	2.3E-01	1.7E-09	1.2E-08	1.8E-13	1.2E-08	8.7E-08	5.6E-13	9.9E-08	
Hexachlorobenzene	2.3E-01	1.7E-09	9.2E-09	1.8E-13	2.7E-09	1.5E-08	2.9E-13	1.7E-08	
N-Nitroso-di-n-propylamine	2.3E-01	1.7E-09	9.2E-09	1.8E-13	1.2E-08	6.4E-08		7.6E-08	
Organics Pathway Total					3.9E-08	2.5E-07	1.4E-12	2.9E-07	
Pathway Total - Chemicals					1.7E-07	4.8E-07	1.5E-10	6.5E-07	

[a] COPCs are identified as chemicals of concern (COCs) if the total ILCR across all pathways is > 1E-06 (R).
COPC = Chemical of Potential Concern.
EPC = Exposure Point Concentration.
ILCR = Incremental Lifetime Cancer Risk.

Table 6. 40 mm Range Shallow Surface Soil Non-carcinogenic Hazards for the Juvenile Trespasser - Direct Contact

COPC	EPC (mg/kg)	Daily Intake (mg/kg-d)			Hazard Quotient (HQ)			Total HI across all pathways	COC[a]
		Ingestion	Dermal	Inhalation	Ingestion	Dermal	Inhalation		
Aluminum	1.2E+04	6.3E-04	3.5E-05	6.8E-08	6.3E-04	3.5E-05	4.8E-05	7.1E-04	
Arsenic	1.3E+01	6.3E-07	1.1E-06	6.9E-11	2.1E-03	3.5E-03		5.6E-03	
Chromium	4.4E+01	2.2E-06	1.2E-07	2.4E-10	1.5E-06	6.3E-06		7.8E-06	
Thallium	8.0E-01	4.1E-08	2.3E-09	4.4E-12	5.1E-04	2.8E-05		5.4E-04	
Vanadium	2.3E+01	1.2E-06	6.4E-08	1.2E-10	1.6E-04	3.5E-04		5.1E-04	
Inorganics Pathway Total					3.4E-03	3.9E-03	4.8E-05	7.4E-03	
2-Methyl-4,6-dinitrophenol	4.6E-01	2.3E-08	1.3E-07	2.5E-12	2.3E-04	1.3E-03		1.5E-03	
Benzo(a)pyrene	2.3E-01	1.2E-08	8.4E-08	1.3E-12					
Dibenz(a,h)anthracene	2.3E-01	1.2E-08	8.4E-08	1.3E-12					
Hexachlorobenzene	2.3E-01	1.2E-08	6.4E-08	1.3E-12	1.5E-05	8.1E-05		9.5E-05	
N-Nitroso-di-n-propylamine	2.3E-01	1.2E-08	6.4E-08	1.3E-12					
Organics Pathway Total					2.5E-04	1.4E-03		1.6E-03	
Pathway Total - Chemicals					3.7E-03	5.3E-03	4.8E-05	9.0E-03	

[a] COPCs are identified as chemicals of concern (COCs) if the total HI across all pathways is > 1 (H).
COPC = Chemical of Potential Concern.
EPC = Exposure Point Concentration.
HI = Hazard Index.

DRAFT REPORT, EVALUATION OF CHEMICAL RESIDUUM AT THE 40 mm RANGE, RAVENNA ARMY AMMUNITION PLANT
RESPONSE TO REVIEWERS: EILEEN T. MOHR, OHIO EPA, NEDO, DERR; and LAURIE MOORE, OHIO EPA, SWDO, OFFO
DATE: MARCH 22nd , 2006

Cmt. #	Pg/ Line #	Comment	Recommendation	Response
1	iii/5	Change requested.	Change acronym to read: Agency for Toxic Substances Disease Registry.	Corrected. Added Substances on line 5, p iv
2	Iii/41	Change requested.	Change to "munitions and explosives of concern." Check entire text for this (for example, it appears on page 11 incorrectly.)	Corrected line 41 p iii; p 11 line 6. Global revealed no other locations
3	General	Text revision.	Do search and replace for the correct acronym for USACE in the document.	USACE identified in acronym list, p 4 line 36…P 11 line 34 text corrected to spell acronym.
4	General	Text addition.	Add the 40 mm data to the revised report. A summary table showing all the data (with indications of the detection limits) would be acceptable.	Data Summaries are now included in App A3 and App A4 has been added: Quality Control Summary Report
5	General	Text revision.	At an appropriate page in the report, indicate where the chain of custody reports for the 40 mm data can be found.	Appendix A1 has been added to provide 'Chain of Custody'. Appendix A2 has been added: Fuze and Booster/40 MM Soil Sample Logs
6	General	The Executive Summary contains information that is not needed, such as tables, detailed discussion of the results of the human health and ecological risk assessments, etc. It is our opinion that all this information does not need to be in the ES.	This section should be reduced in length. Cover <u>briefly</u> the main highlights of the text. All the detailed information of the risk assessments and "arguments" regarding why HQs are overestimated (as well as bioavailability, toxic validity "issues", etc.) should not appear in the ES.	Removed lines 10-18 on p 6. Removed risk tables in ES. Removed lines 4-17 and 22 to 29 and added lines18-22.5 on p 7. Removed Table on p 8. Deleted lines 2-6; 7.5 -8, 13-14.5 and added lines 23-31 on p 9.

7	General	General comment.	This report does not follow the standard format of RI reports that are prepared for RVAAP. For example, there is no description of the installation as a whole (ex location within NE Ohio, boundaries etc.), no sampling information, no discussion of refusal depths (which could put to rest questions of why didn't sampling occur at depths greater than 3 ' bgs,) no evaluation of the data in this report, etc. These are standard sections of any RI report. Please cross reference previous RI reports and add pertinent sections to the revision.	Discussion. This analytical evaluation was never intended to be an RI. The DQO of this effort was established during IAP of 2005. DQO was to evaluate the data that characterized 40 MM AOC, specific to the end-user, to determine protectiveness to human health and environment.
8	General	General comment.	All changes in the text of the report must match the ES.	Noted
9	5/3-4	Text change requested.	Change text to read: "Chemical characterization of the soil at the 40 mm range was completed by obtaining and analyzing 40 soil samples."	Text changed p5/3-4: Chemical characterization of the 40 mm Range at RVAAP was completed ~~with~~ by obtaining and analyzing 40 soil samples ~~locations~~.
10	5/4-6	Text change requested.	Remove the sentence. It is too confusing.	Concur. P5/6-10 now read: Concentrations of chemical constituents identified in each of the 40 samples were similar. Concentrations of organics were low (at or below detection limit). Concentrations of metals were greater than those detected for organic compounds, but were similar in each sample.

11	5/13	Text change requested.	Deep surface at RVAAP is represented by the 0-4' interval.	While you are correct data was only taken at 40 mm AOC up to 3 ft bgs as field screening did not evidence a need to go deeper. Therefore for this AOC deep surface is 0-3 ft bgs.
12	5/22 - 29	Clarification requested.	The text seemingly indicates that various constituents were considered if their concentrations exceed the Region 9 PRG. The text must clarify that there is more to the process of COC selection than is what is presented in the ES.	These sentences refer to just COPC or COPEC selection which is in accordance to Section 3.5.2 of the Risk Manual.. Please refer to added text in Section 3.1.1; P15/8-29. The full explanation is on pp 13-14.
13	5/22	Revision requested.	Revise the text to indicate that it is the Region 9 residential PRG that is used.	P5/25, 30 now reads: the Region 9 residential PRG (arsenic) or 1/10th the Region 9 residential PRG. Also a global search was made to add residential before PRG.
14	5/25	Revision requested.	Revise the text to indicate that it is the Region 9 residential PRG that is used. (2 places)	P5/30 now reads: residential PRG [benzo(a)pyrene, bis(2-chloroethyl)ether (deep surface and
15	5/28	Revision requested.	Revise the text to indicate that it is the Region 9 residential PRG that is used. (2 places)	P5/32 now reads: propylene] or 1/10th the USEPA Region 9 residential PRG (2-methyl-4,6-dinitrophenol). All
16	5/table	Revision requested.	Add a title to the table, if it remains in the report.	Table deleted in ES.
17	5/table	Revision requested.	Add the definitions of the acronyms to the table, if it remains in the revised report.	Table deleted in ES.
18	6/table	Revision requested.	Add a title to the table, if it remains in the report.	Table deleted in ES.

19	6/table	Revision requested.	Add the definitions of the acronyms to the table, if it remains in the revised report.	Table deleted in ES.
20	Pg 5/16-20 and pg 6/13-16	Clarification and revision requested.	This appears to be duplicative text. If this text remains in the revised ES, it should only appear in one place.	pg 6/10-18 is deleted.
21	Pg 8	Revision requested.	On the table, put the soil depth in parentheses for each soil category (surface, subsurface, deep surface).	Table deleted in ES
22	Pg 9/line 18	Text clarification requested.	The text should indicate that the figures are located in the main body of the text.	P9/33 reads: Figures 1 through 4 (pp 62-65 in text) show that detected COPCs and COPECs (and, be
23	Pg 9/line 18	Text change requested.	Change "be" to "by."	P9/34 corrected.
24	Pg 9/lines 38-39	The text indicates that the animal life "looks healthy and functioning."	The meaning of this portion of the text is not only unclear, but it is not supported by data. If this remains in the text, please add in additional scientific data which supports the observation.	The phrase was deleted. See P10/7-9.5.
25	Pg 9, line 46	Revision requested.	Move the 4 metals (in parentheses) to after "4 metals" in line # 45. As currently written, it appears that the 4 metals are part of the uncertainty analysis.	P10/16-17 read: The rest of the few HQs were below one hundred and the 4 metals (arsenic, chromium, thallium, and zinc) remaining after the first four steps of the
26	Pg 11/line 1	Text revision requested.	Change site to area of concern.	P11/2: The 40 mm Range area of concern (AOC),....
27	Pg 11/line 6	Text revision requested.	Change text to: "Munitions and explosives of concern are suspected at this ~2acre AOC."	P11/6: operation. Munitions and Explosives of Concern (MEC) is suspected at this ~2-acre site.

28	Pg 11/lines 21-22	Delete current text.	Insert the following: "Surface water flow, based upon the existing topographic maps, is expected to be radial in nature."	P11/24-27: Specifically, surface water flow, based upon the existing topographic maps, is expected to be radial in nature.~~surface water drainage at the 40 mm Range flows radially~~ toward the southern pond, the ditch south of the AOC, after which drainage occurs at Hinkley Creek.
29	Pg 11/lines 32-34	The text indicates that the data for the 40 mm AOC can be found in the FBQ report.	Add an appendix to this report which contains the 40 mm data. As previously discussed, this needs to be a stand-alone document.	App A-3 has been added to include 40 mm data.
30	Pg 11/lines 40-41	Text revision requested.	At RVAAP, deep surface is defined as 0-4' bgs.	While you are correct data was only taken at 40 mm AOC up to 3 ft bgs as field screening did not evidence a need to go deeper. Therefore for this AOC deep surface is 0-3 ft bgs.
31	Pgs 13-16	AOC maps.	The maps on these pages are out of place as they present data, COPCs, COPECS, etc. They need to be moved to the appropriate section of the report. This area would be better served by having a site map with the AOC marked on it, as well as an AOC map that details the sampling locations.	Maps now placed after risk characterization. Refer to pp 62-65.
32	Pg 17/ lines 18-19	Text revision requested.	Drilling was not conducted at this AOC, as such, remove this reference from the text. Only hand augering was conducted.	Hand augers were terminated at refusal depth. No machine drilling performed.

33	Pg 18/lines 9-10	Text revision requested.	Change text to read: "Deep surface soil is defined as 0-4' bgs for the National Guard Trainee...."	Please note that analytical for this investigation was up to 3 ft bgs. P18/7-10 now read: Because tracked and wheeled operations may result in maneuver damage up to 4-ft bgs. Because of this maneuver damage, as deep as 4 ft bgs, the National Guard Trainee is assumed to be exposed to deep surface soil defined as 0-to 3-ft bgs.
34	Pg 18/lines 18 and 26	Revision requested.	Add the soil depths in parentheses when using the terms shallow and deep surface soil and subsurface soil throughout this report.	Noted: Global edit performed. Changes made on PPs 18, 33, 34 and the like..
35	Pg 19/line 13	Revision requested.	Spell out "MDC" with the acronym following in parentheses the first time it appears in the report.	P19/11 reads: Instances where the UCL_{95} exceeds the maximum detected concentration (MDC) is used as an estimate of the RME
36	Pg 19/line 25	Revision requested.	Replace "available" with "site specific background levels."	P14/25 reads: 40 mm Range samples are screened against site specific background levels, naturally
37	Pg 19/line 26	Revision requested.	Add "naturally occurring" in front of "inorganics".	P14/26-27 reads: This screening step, which applies only to the naturally occurring inorganics,
38	Pg 19/line 34	Text revision requested.	Please check the WBG Phase II RI regarding background concentrations. It is our recollection that the subsurface soil samples for that effort were collected from a 1-3' bgs depth interval.	P14/33-35 now reads: Final Phase II RI Report for WBG (USACE 2001). Background values for soil are available for two soil depths: shallow surface (0-to 1-ft bgs) and subsurface (>1 ft bgs).
39	Pg 19/lines 35-36	Text revision requested.	Deep surface soil at RVAAP is defined as being from 0-4' bgs.	While you are correct data was only taken at 40 mm AOC up to 3 ft bgs as field screening did not evidence a need to go deeper. Therefore for this AOC deep surface is 0-3 ft bgs.

40	Pg 19/line 41	Text revision requested.	Deep surface soil at RVAAP is defined as being from 0-4' bgs.	While you are correct data was only taken at 40 mm AOC up to 3 ft bgs as field screening did not evidence a need to go deeper. Therefore for this AOC deep surface is 0-3 ft bgs.
41	Pg 20/line 2	Text revision requested.	Please check the WBG Phase II RI regarding background concentrations. It is our recollection that the subsurface soil samples for that effort were collected from a 1-3' bgs depth interval.	Refer to response provided for comment 38. In the WBG Phase II Report, Section 4 subsurface is defined as greater than 1 ft bgs (> 1 ft bgs).
42	Pg 20/lines 3-4	Text revision requested.	Revise text to read: "... EPA Region 9 residential PRG..."	Text has changed. Corrections made on PP14,15 and 16; lines 18 and 22; 4; 9 and 16, respectively.
43	Pg 20/lines 25-30	Text revision requested.	Please include the Child and Adult Trespasser receptors to the human health risk assessment evaluation. Also, include a written narrative regarding exposure assumptions for these receptors (similar to the narrative that is found on page 21).	Please refer to AppD for the requested analysis of the juvenile trespasser. The RTLS is a controlled access facility (it is fences, gated and patrolled). The most likely adult trespasser are hunters or National Guard Trainees entering unauthorized areas. A separate adult trespasser evaluation is unwarranted because of lower equivalency to hunters or NG trainees.
44	Pg 20/lines 31-33	Clarification requested.	Confirm that hunters are not allowed in areas that have environmental contamination. It is our recollection that hunters were allowed in certain AOCs.	This AOC is under MMRP and until the SI is done the site can not be cleared for hunting.
45	Pg 21/line 16	Text revision requested.	Deep surface soil at RVAAP is defined as being from 0-4' bgs.	While you are correct data was only taken at 40 mm AOC up to 3 ft bgs as field screening did not evidence a need to go deeper. Therefore for this AOC deep surface is 0-3 ft bgs.

46	Pg 21/line 24	Confirmation requested.	Please confirm that there are still daily security patrols. This may have been reduced.	Security patrols do occur daily.
47	Pg 22/line 4	Text revision requested.	Please revise text to read: "...constraints (e.g., potential MEC)...."	P18/41 reads: (e.g., potential MEC)
48	Pg 27/line 9	Text revision requested.	Deep surface soil at RVAAP is defined as being from 0-4' bgs.	While you are correct data was only taken at 40 mm AOC up to 3 ft bgs as field screening did not evidence a need to go deeper. Therefore for this AOC deep surface is 0-3 ft bgs.
49	Pgs 36-39	Text revision requested.	This section should be moved, so that the ecological risk screening and results are discussed together, but separate from the human health screening and results. This will help the report focus on human health risk information all together, rather than the screening steps and the results being separated by a discussion of the ecological risk screening process.	Agree. Format changed. Human Health and Ecological Risk Analysis are separate. See Table of Contents on Pii
50	Pg 36/lines 40-41	Point of information.	Please note that the Eco Truthing study conducted at the WBG still has not been finalized. This needs to be done.	Acknowledged. We are working on finalizing the comments of the Dec 2003 letter. The letter was lost when Dr. Elizabeth left.
51	Pg 37/lines 17-18	Text revision requested.	Deep surface soil at RVAAP is defined as being from 0-4' bgs.	While you are correct data was only taken at 40 mm AOC up to 3 ft bgs as field screening did not evidence a need to go deeper. Therefore for this AOC deep surface is 0-3 ft bgs.

52	Pg 37/line 26	Text revision requested.	Deep surface soil at RVAAP is defined as being from 0-4' bgs.	While you are correct data was only taken at 40 mm AOC up to 3 ft bgs as field screening did not evidence a need to go deeper. Therefore for this AOC deep surface is 0-3 ft bgs.
53	Pg 37/lines 32-34	Text clarification and revision requested.	The text references certain compounds that are not SRCs per Army usage as based upon Army records. Given that a number of records were disposed of by the Army, and that some of these compounds may be linked to activities conducted by the Army, please revise this section to be less definitive. Additionally, if these are considered SRCs, does this change the results of the risk assessments and the conclusions?	P40/14-22 corrected to read: The non-SRCs per Army usage include the following: metals – iron; organics-semivolatiles – 2,4-dimethylphenol, 2-chloronaphthalene, benzo(a)pyrene, dibenzo(a,h)anthracene, and hexachloro-butadiene. The concentrations of organic compounds were less than instrument detection limits. Likewise 2,4-dimethylphenol, 2-chloronaphthalene and hexachloro-butadiene are commonly found in transformer and hydraulic fluids so if these chemicals were released at the site, their concentrations in soil sample would be expected to exceed low instrument detection limits. Concentrations of two chemicals, benzo(a)pyrene, and dibenzo(a,h)anthracene were less than those commonly reported as anthropogenic levels.
54	Pg 38/line1	Text revision requested.	Deep surface soil at RVAAP is defined as being from 0-4' bgs.	While you are correct data was only taken at 40 mm AOC up to 3 ft bgs as field screening did not evidence a need to go deeper. Therefore for this AOC deep surface is 0-3 ft bgs.

55	After pg 40	Maps.	Move the maps that appear on pages 13 - 16 to this section of the text.	Good suggestion. Maps now placed after risk characterization. Maps found on pp 63-66.
56	Pg 40/line 18	Text revision requested.	Deep surface soil at RVAAP is defined as being from 0-4' bgs.	While you are correct data was only taken at 40 mm AOC up to 3 ft bgs as field screening did not evidence a need to go deeper. Therefore for this AOC deep surface is 0-3 ft bgs.
57	Pg 41/line 9 - 2 places	Text revision requested.	Revise text to read: "... EPA Region 9 residential PRG..."	All text has been corrected. A global command was introduced to add residential to EPA Region 9 PRG.
58	Pg 41/line 13	Text revision requested.	Revise text to read: "... EPA Region 9 residential PRG..."	All text has been corrected. A global command was introduced to add residential to EPA Region 9 PRG.
59	Pg 41/line 16	Text revision requested.	Revise text to read: "... EPA Region 9 residential PRG..."	All text has been corrected. A global command was introduced to add residential to EPA Region 9 PRG.
60	Pg 42, Table 3	Text revision requested.	Explain the "Note" that appears in the footnote section of Table 3. This should be removed, since it is not discussed in the text and only appears as a footnote without any further information or discussion of how this value was calculated for the resident farmer.	P33/15-24: The footnote reads: Note: The estimated risks from exposure of these receptors to the background concentration of arsenic (15.4 mg/kg) in surface soil are: National Guard Trainee 9E-06 Security Guard/Maintenance Worker 6E-06 On-Site Resident Farmer: Adult 2E-05 On-Site Resident Farmer: Child 3E-05 Risks to these receptors from arsenic at 40 MM AOC are below the risks associated with the background concentration of this metal.

61	Pg 42/ line 10	Clarification requested.	Please clarify what is meant by the "Ohio EPA's level of concern." Specify that Ohio EPA's level of concern is cumulative value of 1E-5. Add cumulative in parentheses after 1E-5 in line 10. The point of departure for an individual chemical is still 1E-6, per the NCP. Please revise all appropriate sections to reflect this distinction and to help the average reader understand why these two levels are used in this discussion. This comment may apply to all subsections (i.e., direct contact, indirect contact, etc.) of the risk characterization section.	P33/26-34: The calculated ILCRs were compared to the range specified in the National Oil and Hazardous Substances Pollution Contingency Plan of 1E-06 to 1E-04, or 1 in 1 million to 1 in 10,000 exposed person's chance of developing cancer if exposed as assumed in the HHRA (EPA 1990). The ILCRs below 1E-04 are considered acceptable. ILCRs above 1E-04 are considered unacceptable. The range between 1E-06 and 1E-04 is of concern, and any decisions to address ILCRs further in this range, either through additional study or engineered control measures, should account for the uncertainty in the risk estimates. Ohio EPA Division of Emergency and Remedial Response (DERR), uses 1 E-05 as the official target risk goal for development of cleanup goals (Ohio EPA 2004).

62	Pg 42/lines 21-22	Text revision requested.	Add a sentence that clearly states whether or not arsenic is a COC. Lines 21-22 attempt to say this, but don't come out and make a definitive determination that arsenic is not a COC, because the exposure point concentration is less than the site specific background. Also, add text to address whether or not the other chemicals that are listed in Table 3 are COCs. This comment may apply to all subsections of the risk characterization section.	P34/17-20 reads: This indicates, the calculated cancer risk related to arsenic at the 40 mm Range does not exceed the cancer risk for arsenic estimated for facility-wide background and will not be considered a Constituent of Concern. P34/10-13 changed to read: The total risk for Resident Farmer exceeds 1E-05 due to arsenic and 3 SVOCs [benzo(a)pyrene, dibenz(a,h)anthracene, and n-nitroso-di-n-propylamine). Individual ILCRs for these SVOCs are each less than 1E-05 and all three of these SVOCs were non-detect in all soil samples, removing them from further consideration.
63	Pg 43/line 12	Clarification and revision requested.	Please clarify in the revised text that background was set to zero, if there was no data available.	P35/4-5; 44-45 has been changed to read: Thallium background criterion for shallow surface (0-1 ft bgs) soil was set to zero (0) because it was not detected in background.

64	Pg 43/line 27	Text clarification and revision requested.	The text references certain compounds that are not SRCs, per Army usage as based upon Army records. Given that a number of records were disposed of by the Army, and that some of these compounds may be linked to activities conducted by the Army, please revise this section to be less definitive. Additionally, if these are considered SRCs, does this change the results of the risk assessments and the conclusions?	All organics were Below Detection Level. If there was a usage, spillage, disposal it would follow that detects would be other than BDL. Likewise protocol is adhered to as found on p 51 of the Facility Wide Ecological Risk Work Plan, specifically step 4 of the flow chart directs evaluation on whether a contaminant correlates to site usage. P40/14-22 corrected to read: The non-SRCs per Army usage include the following: metals – iron; organics-semivolatiles – 2,4-dimethylphenol, 2-chloronaphthalene, benzo(a)pyrene, dibenzo(a,h)anthracene, and hexachloro-butadiene. The concentrations of organic compounds were less than instrument detection limits. Likewise 2,4-dimethylphenol, 2-chloronaphthalene and hexachloro-butadiene are commonly found in transformer and hydraulic fluids so if these chemicals were released at the site, their concentrations in soil sample would be expected to exceed low instrument detection limits. Concentrations of two chemicals, benzo(a)pyrene, and dibenzo(a,h)anthracene were less than those commonly reported as anthropogenic levels.

65	Pg 47/lines 13-39	Clarification requested.	This portion of the text is confusing. It makes broad statements as to why certain constituents were eliminated from consideration. For example, the explosives section indicates that 16 explosives compounds were eliminated from further consideration. In comparing this information to the page 44, it looks as if the only compound being considered is 2,6-dinitrotoluene. However, this is not the only explosive compound detected at this AOC, and explosives are definitely Army related. Please clarify.	Analytical screening conditions for COPECs are read on PP37-39. P40/29-31 corrected to read: Results of the screening for SRCs and identification of the COPECs for shallow surface (0 to 1 ft bgs), subsurface (1 to 3 ft bgs), and deep surface (0 to 3 ft bgs) are presented in Appendix Tables C-3 through C-5, respectively. What may help is reference to Tables C-3, C-4 and C-5 where the empirical results of screening are identified. For clarification the text in question seems redundant and is removed. Refer to P43/1-28
66	Pg 53/line 14	Text revision requested.	Change "be" to "by."	P62/26 corrected to read: show that detected COPCs and COPECs (and, ~~be~~ by inclusion, COCs and COECs) are
67	Pg 54/lines 1-2	Text revision requested.	Change the text to read: "There are no documented sources for these six chemicals at the 40 mm range. However, in addition to being ubiquitous in the environment, there is also the possibility that they are site-related due to previous Army activities."	P35/37-39 removed and replaced with: However, in addition to being ubiquitous in the environment, there is also the possibility that they are site-related due to previous Army activities.
68	Pg 55/line 14	Text revision requested.	Revise text to read: ".... a trespasser could enter the property; land uses could change, etc.).	P37/10-13 corrected to read: While a land-use plan has been drafted for the RTLS, and OHARNG will control the property, there is uncertainty in the details of the future land-use (e.g., ~~if the~~ perimeter fence ~~is~~ not maintained, land uses could change, a trespasser could enter the property, and the like).

69	Pg 66/line 29	Text change requested	Revised text to read: "Lead and zinc..."	P62/10 corrected to read: ~~Although~~ Water and sediment quality (lead and zinc); (iron, lead, zinc, or chromium),
70	Pg 67/line 31	Text clarification.	In this sentence, clarify to which receptor there would be no unacceptable health risk. The National Guard Trainee? The Resident Farmer-Adult?	P67/1-10 corrected to read: The estimated human health non-cancer HIs for direct contact exposure pathways are less than 1 for all human health receptors. Calculated ILCRs are less than or equal to 1E-05 for the representative National Guard Receptors (National Guard Trainee and Security Guard/Maintenance Worker) and the Recreational Hunter. Calculated ILCRs exceed 1E-05 for the Resident Farmer scenario; however, risks are the result of background concentrations of arsenic and the analytical detection limits for 3 SVOCs not detected in any soil sample at the 40 mm Range. As discussed in the uncertainty analysis, these estimated risks are more likely to be overestimates than underestimates of actual risk at the site.

71	Pg 67/line 32	Text clarification.	There is no groundwater data available for this AOC. Therefore, the text needs to clarify what is being proposed for no further action - the surface soil and subsurface soil? And then does that leave us in the position again of having a partial answer to what can be done with this AOC?	P67/32-46 corrected to read:. In summary the 40 mm Range is recommended as a "no further action location". This recommendation is based on the following: • Land Use Controls (e.g., no digging nor use of groundwater) will be institutionalized for the site and will reduce the potential for contact with low levels of chemicals identified at the site. • Results of the human health and ecological risk characterization performed on the relatively low concentrations of chemicals present, and the depth at which these analytes were found (0-3 ft bgs), indicate that there is no unacceptable risk likely to occur. o Initial sampling evidenced no subsurface action from prior use (such as soil discoloration, trenches, buried debris that made its way to the surface, foul odors once surface was broken, and the like). Shallow rock is close to the surface with refusal (0-1 ft bgs) occurring at sample locations 69, 70, 72, 76, 78, 80, 81, 84, 89, 90, 91, 92, 93, and 99. Further surface detects did not evidence residuum, nor source release to subsurface (below 3').

72	General	Text clarification.	It would be helpful to have summary tables from the risk assessments in the main text of the report rather than presented as an appendix.	Pertinent tables have been excerpted and placed in the text. Specifically 3.3 has the applicable tables. The computation Tables for HH and Eco are found in App B and C, respectively.
73	Section 3	Text revision requested.	A discussion needs to be added that points out that even though this site is proposed for NFA, the subsurface soils below 3 feet were not evaluated. Therefore, there is no knowledge of soil contaminants/exposure below 3' bgs. This point should not get lost when proposing NFA or even unrestricted reuse of an AOC.	Proving the negative is balanced by the following facts: See response to comment 71
74	Pg 67/lines 37-38	Text clarification.	Add more detail to the text as to how it was determined that the vegetation and animal life are healthy and functioning.	Documentation as required by Level I eco-assessment as defined by Ohio EPA is not available. What is available is the professional biologist's assessment. In the absence of this information it would be best to omit P10/7-8 and P66/13-14 corrected to omit phrase and now reads: ~~This later assumption about low to no risk is supported by the facts that the terrestrial ecosystem has abundant vegetation and animal life.~~
75	App. A	Revision requested.	Add the data from the 40 mm range into this report. The report needs more than the summary statistics.	Concur. Appendix A-1 has been added to provide 'Chain of Custody'. Appendix A-2 has been added: Fuze and Booster/40 MM Soil Sample Logs – App A-3 has been added: Laboratory Analytical Data; and App A-4 has been added: Quality Control Summary Report.

76	Several apps.	Revision requested.	Deep surface soil at RVAAP is defined as being from 0-4' bgs.	While you are correct data was only taken at 40 mm AOC up to 3 ft bgs as field screening did not evidence a need to go deeper. Therefore for this AOC deep surface is 0-3 ft bgs.