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**Facility-Wide Human Health Cleanup Goals for the  
Ravenna Army Ammunition Plant (RVAAP),  
Ravenna, Ohio**

**Ravenna Army Ammunition Plant  
Ravenna, Ohio**

**September 2008**

**Contract No. W912QR-04-D-0019  
Delivery Order No. 008**

**Prepared for:**



**US Army Corps  
of Engineers®**  
Louisville District

**Prepared by:**



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REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188		
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1. REPORT DATE (DD MM YYYY) 19-09-2008		2. REPORT TYPE Technical		3. DATES COVERED (From - To) May 2008 to September 2008	
4. TITLE AND SUBTITLE Draft Facility-Wide Human Health Cleanup Goals at the Ravenna Army Ammunition Plant, Ravenna, Ohio			5a. CONTRACT NUMBER W912QR-04-D-0019		
			5b. GRANT NUMBER NA		
			5c. PROGRAM ELEMENT NUMBER NA		
6. AUTHOR(S) Science Applications International Corporation, Inc.			5d. PROJECT NUMBER Delivery Order 008		
			5e. TASK NUMBER NA		
			5f. WORK UNIT NUMBER NA		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Science Applications International Corporation, Inc. 151 Lafayette Drive Oak Ridge, TN 37831			8. PERFORMING ORGANIZATION REPORT NUMBER 08-016NE		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) USACE - Louisville District U.S. Army Corps of Engineers, Louisville District 600 Martin Luther King, Jr. Place P.O. Box 59 Louisville, Kentucky 40202-0059			10. SPONSOR/MONITOR'S ACRONYM(S) CELRL-ED-EE		
			11. SPONSOR/MONITOR'S REPORT NUMBER(S) NA		
12. DISTRIBUTION/AVAILABILITY STATEMENT Reference Distribution Page					
13. SUPPLEMENTARY NOTES None.					
14. ABSTRACT This draft report presents the technical basis, calculations, and results for developing facility-wide, risk-based cleanup goals for environmental media and human receptors at the Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio. This draft version incorporates USACE-Louisville District technical review of the material and is being distributed for RVAAP stakeholder team review and comment.					
15. SUBJECT TERMS Remediation, human health risk, cleanup goals					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
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Ohio EPA-NEDO = Ohio Environmental Protection Agency – Northeast District Office.  
Ohio EPA-SWDO = Ohio Environmental Protection Agency – Southwest District Office.  
REIMS = Ravenna Environmental Information Management System.  
RTLS-ENV = Ravenna Training and Logistics Site Environmental Specialists.  
RVAAP = Ravenna Army Ammunition Plant.  
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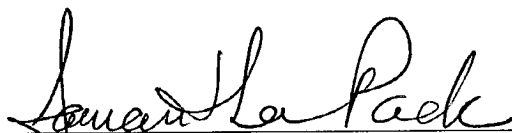
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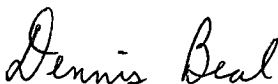
Science Applications International Corporation (SAIC) has completed the Draft Facility-Wide Human Health Cleanup Goals at the Ravenna Army Ammunition Plant (RVAAP), Ravenna, Ohio. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of data quality objectives; technical assumptions; methods, procedures, and materials to be used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing Corps policy.



Samantha Pack  
Study/Design Team Leader

September 18, 2008

Date



Dennis Beal  
Independent Technical Review Team Leader

September 18, 2008

Date

Significant concerns and the explanation of the resolution are as follows:

Internal SAIC Independent Technical Review comments are recorded on a Document Review Record per SAIC quality assurance procedure QAAP 3.1. This Document Review Record is maintained in the project file. Changes to the report addressing the comments have been verified by the Study/Design Team Leader. As noted above, all concerns resulting from independent technical review of the project have been considered.



Principal w/ A-E firm

September 12, 2008

Date

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## ACRONYMS

AOC	area of concern
BGS	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chemical of concern
COPC	chemical of potential concern
CSF	cancer slope factor
CUG	cleanup goal
EPA	U. S. Environmental Protection Agency
EPC	exposure point concentration
EU	exposure unit
FS	Feasibility Study
GAF	gastrointestinal absorption factor
HHBRA	human health baseline risk assessment
HI	hazard index
HQ	hazard quotient
IAP	Installation Action Plan
ILCR	incremental lifetime cancer risk
IRIS	Integrated Risk Information System
IRP	Installation Restoration Program
NGB	National Guard Bureau
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
PRG	preliminary remediation goal
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
REIMS	Ravenna Environmental Information Management System
RfC	reference concentration
RfD	reference dose
ROD	Record of Decision
RI	remedial investigation
RTLS	Ravenna Training and Logistics Site
RVAAP	Ravenna Army Ammunition Plant
TOC	total organic carbon
USACE	U. S. Army Corps of Engineers

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## 1.0 INTRODUCTION

The Ravenna Army Ammunition Plant (RVAAP) began operations in the early 1940s to provide munitions during World War II. In the early 1990s the plant ceased operations. In May 1999, over 90% of the land area that comprised RVAAP was transferred from the Department of Defense to the administrative control of the National Guard Bureau (NGB), who licensed the Ohio Army National Guard (OHARNG) to use the property as a long-term training facility. In March 2002, the U.S. Army and OHARNG agreed to the terms for the eventual transfer of the remaining 1,481 acres. The remaining land encompasses munitions storage areas and areas of the property that must proceed through environmental characterization, possible remediation, and closure under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or the Resource Conservation and Recovery Act (RCRA). These areas are referred to as areas of concern (AOCs). Environmental remediation has been completed at several of the AOCs, but work continues at additional AOCs.

This document has been developed to support the environmental remediation of the remaining AOCs to complete final transfer of the land to OHARNG. The document contains calculated cleanup goals (CUGs) that can accelerate the decision-making process for the remaining AOCs, taking advantage of the fact that many of the risk assessment inputs and decisions for the facility have already been agreed to by stakeholders through the application of the CERCLA and RCRA processes over the past 10 years. Most of the agreed-to risk assessment methodology has been documented in the *Ravenna Army Ammunition Plant Facility-Wide Human Health Risk Assessor Manual, Amendment 1* (USACE 2005), herein referred to as the Risk Manual. The Risk Manual, along with a supplemental White Paper (Appendix A), provides the framework for the CUGs presented herein.

### 1.1 BACKGROUND

RVAAP utilizes an Installation Action Plan (IAP) to manage remedial investigations (RIs) needed for cleanup of RVAAP. The purpose of the IAP is to outline the total multi-year restoration program for an Installation. The IAP defines Installation Restoration Program (IRP) requirements and proposes a comprehensive approach to investigation and cleanup of each AOC at the Installation. In June 2004, the Ohio Environmental Protection Agency (Ohio EPA) Director's Final Findings and Orders for RVAAP laid out the formal regulatory authority for Ohio EPA to oversee and regulate the environmental remediation at RVAAP. This effort to develop facility-wide CUGs is part of the path forward for identifying cleanup requirements for the remaining AOCs. These goals will not be used to re-evaluate past decisions.

In 1996, the U. S. Army Corps of Engineers (USACE) performed a facility-wide preliminary assessment and a relative risk site evaluation to evaluate and prioritize the entire scope of CERCLA environmental work at the site. From that study, stakeholders identified priority AOCs and began Phase I RIs at high priority sites. In 1998, the first full-scale RI was performed at the Winklepeck Burning Ground, one of the high priority AOCs, including the first full-scale human health baseline risk assessment (HHBRA). This risk assessment established many of the risk assessment processes and parameters developed specifically for RVAAP. Over years of performing additional risk assessments at the RVAAP AOCs, USACE has developed a facility-wide risk assessment model through many interactions and negotiations with stakeholders, primarily OHARNG and Ohio EPA. In 2003, many of these risk assessment processes and parameters were documented and expanded upon in the Risk Manual (USACE 2005). The Risk Manual was updated in 2005.

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1 Recently, USACE proposed an expedited approach for performing future risk-based decision making,  
2 taking advantage of the experience gained through the completed work and the well-documented  
3 approaches in the Risk Manual. For future decisions, USACE is proposing to compare AOC contaminant  
4 levels to pre-approved facility-wide CUGs to determine the need for remediation. Figure 1-1;  
5 Appendix A, *White Paper, Ravenna Army Ammunition Plant (RVAAP) Facility-Wide Human Health*  
6 *Cleanup Goal Development*; and Section 1.2 discuss this proposed process.

### 7 **1.2 USE OF FACILITY-WIDE HUMAN HEALTH CLEANUP GOALS**

8 To date, 26 AOCs at RVAAP have preceded through an HHBRA, conducted as part of RIs or Feasibility  
9 Studies (FSs) under CERCLA. Figure 1-1 shows the risk assessment input that was used to support the  
10 remediation decisions at RVAAP to date. Most AOCs have proceeded through a Phase I and Phase II RI.  
11 As part of Phase II, data representing all relevant environmental media at an AOC were screened to  
12 identify chemicals of potential concern (COPCs). All COPCs were evaluated in the HHBRA. COPCs that  
13 were estimated to pose a potential risk in the HHBRA were identified as chemicals of concern (COCs). In  
14 preparation of the AOC FS, remedial action objectives (RAOs) and CUGs were developed to address the  
15 COCs.

16 A RAO is a statement that specifies (EPA 1991)

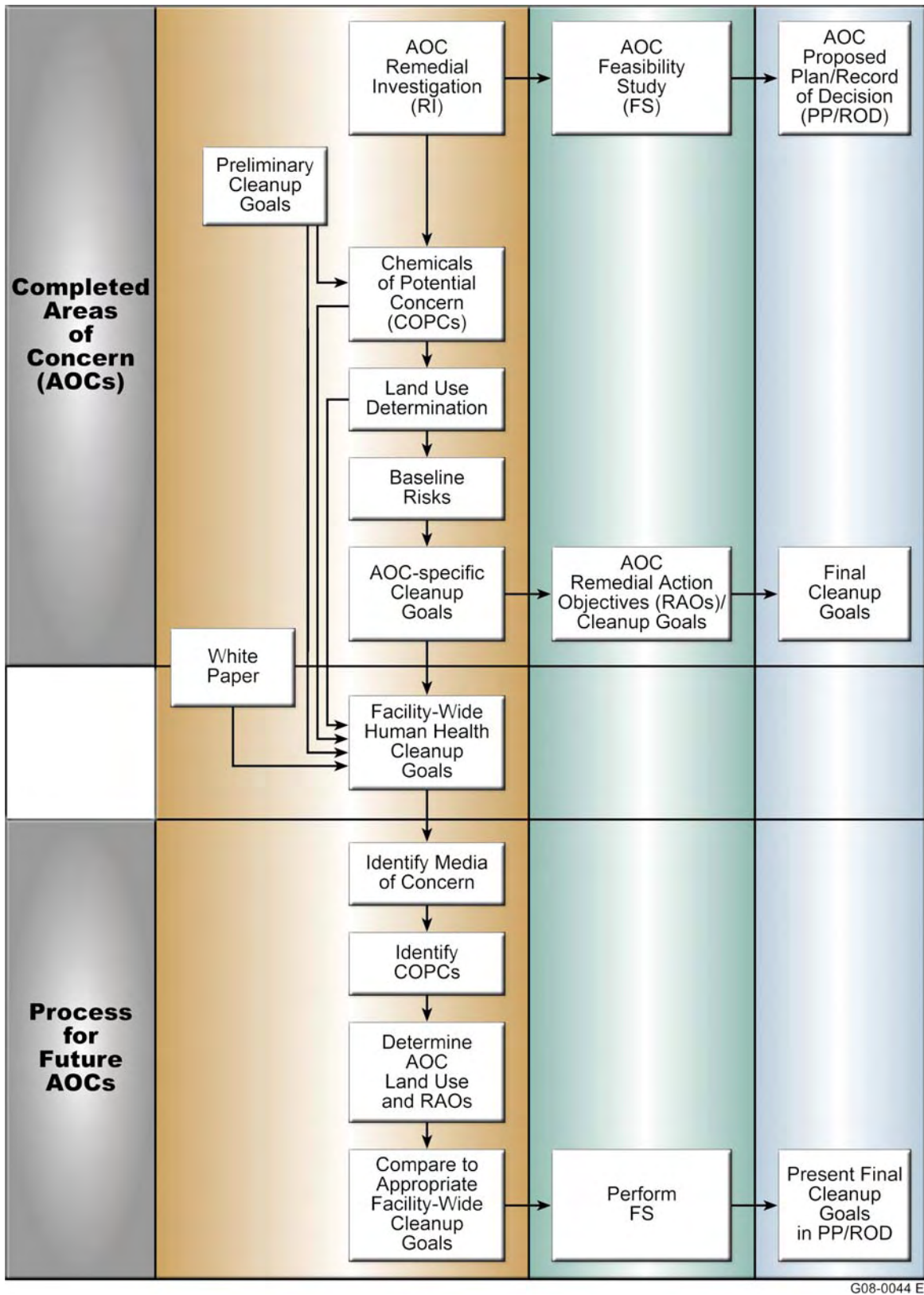
- 17 1. Contaminants and media of concern.
- 18 2. Pathways through which the HHBRA has identified humans may be exposed to unacceptable  
19 concentrations of a COC.
- 20 3. CUGs, which are acceptable exposure levels of COCs that are protective of human health.

21 CUGs are either calculated, risk-based numbers, or based on applicable or relevant and appropriate  
22 requirements. This document addresses only the method for identifying risk-based CUGs.

23 As indicated in Figure 1-1, the expedited approach to risk decision-making is as follows:

- 24 1. Using the risk assessment process presented in the Risk Manual (and appended by information in the  
25 Final White Paper), develop facility-wide CUGs for all chemicals likely to be found at RVAAP.
- 26 2. Perform RI characterization sampling and analysis to establish the baseline chemical concentrations  
27 within an AOC.
- 28 3. Perform mapping and data analysis to determine exposure units (EUs) and to identify COPCs and  
29 their related exposure point concentrations (EPCs), following the requirements for performing these  
30 tasks as spelled out in the Risk Manual.
- 31 4. Compare AOC-specific EPCs to the facility-wide CUGs to determine AOC-specific COCs.
- 32 5. Perform the FS, Proposed Plan, and Record of Decision (ROD) to address any identified COCs.





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Figure 1-1. Risk Assessment Input to Support Remediation Decisions

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1 This proposed process makes use of the fact that most of the steps of the HHBRA process (i.e.,  
2 identifying future land use, exposure pathways, and toxicity information) are manifested in the  
3 facility-wide CUGs, as long as cumulative effects of multiple chemicals are considered when selecting a  
4 target risk range/hazard index (HI) level. Comparing these goals to site-related EPCs alleviates the need  
5 to perform additional HHBRAs.

6 Cumulative effects are accounted for in various ways when applying the facility-wide CUGs. For  
7 non-carcinogenic toxicants, the typical target HI for a chemical = 1. In cases where there are two or more  
8 chemicals at a single site that effect the same target, a target HI <1 should be used to account for the  
9 cumulative effect of multiple chemicals affecting the same organ; hence, this document also provides  
10 CUGs based on an HI = 0.1. For carcinogens, a target risk =  $10^{-5}$  has been selected by Ohio EPA that  
11 allows for multiple environmental exposures less than a  $10^{-4}$  risk, which is the highest end of the U. S.  
12 Environmental Protection Agency (EPA) allowable risk range.

13 The facility-wide human health CUGs presented in this document should be applied in conjunction with  
14 the *Facility-Wide Sampling and Analysis Plan for the Ravenna Army Ammunition Plant* (USACE 2001)  
15 to ensure data are collected and analyzed to meet the requirements of the risk assessment process.

### 16 **1.3 REPORT ORGANIZATION**

17 This document is organized in the following manner:

18 Chapter 1 – Introduction – provides the basis for developing facility-wide CUGs.

19 Chapter 2 – Facility-Wide Chemicals of Potential Concern – identifies all chemicals for which  
20 facility-wide CUGs will need to be developed.

21 Chapter 3 – Exposure Assessment Considerations in Cleanup Goal Development – summarizes the full  
22 set of exposure considerations that are used to develop the facility-wide CUGs, including future land use,  
23 future receptors, exposure pathways, and detailed exposure parameters.

24 Chapter 4 – Chemical-Specific Information for Chemicals of Potential Concern – provides the most up-  
25 to-date toxicity information for all facility-wide COPCs. These toxicity data are used to develop the  
26 facility-wide CUGs.

27 Chapter 5 – Facility-Wide Cleanup Goals Calculation Methods and Results – provides the calculation  
28 methods and resulting facility-wide CUGs.

29 Chapter 6 – References – lists the references used in this report.

## 2.0 FACILITY-WIDE CHEMICALS OF POTENTIAL CONCERN

The first step in developing facility-wide CUGs is to define the comprehensive list of chemicals at RVAAP that may be encountered at the remaining AOC and may require a numeric CUG. Two possible methods for identifying the complete contaminant list at RVAAP were evaluated:

1. Consolidate the lists of COPCs from completed RI reports.
2. Perform a new COPC screen for all chemicals in the Ravenna Environmental Information Management System (REIMS).

Option 2 was selected as the best option for identifying a facility-wide list of COPCs because risk assessment requirements for RVAAP and risk model information (e.g., toxicity factors, chemical-specific factors, etc.) may have changed since the earliest RIs, and a new COPC screen accommodates any guidance updates and information changes.

The facility-wide COPC screen followed the general guidance of the Risk Manual (Sections 3.4 and 3.5) with the following clarifications:

1. **Frequency of Detection Screen** – Because the facility-wide data set is large, chemicals meeting the <5% detection rule were not screened out per Section 3.4.1 of the Risk Manual (5% of the large data set could represent a valid contamination issue). Chemicals that were never detected are eliminated as COPCs.
2. **Background Screen** – A background screen will be used to eliminate a chemical from the facility-wide COPC list as described in the Risk Manual.
3. **Risk-based Screen** – Chemicals were screened against EPA Region 9 preliminary CUGs [preliminary remediation goals (PRGs)] (EPA 2004b). These PRGs correspond to a cancer risk level of  $10^{-6}$  or a non-cancer hazard quotient (HQ) of 1.0. Because Ohio EPA calls for using PRGs at a cancer risk level of  $10^{-6}$  and an HQ level of 0.1, the Region 9 PRGs at an HQ level of 1.0 are adjusted downward to a level of 0.1. The smaller PRG between a cancer risk level of  $10^{-6}$  and an HQ level of 0.1 is used as the ultimate screening level. Any chemical for which the maximum detected value exceeds the PRG will be retained as a facility-wide COPC unless there is evidence that a single detection is a true anomaly. Chemicals detected below the screening levels were screened from further consideration (i.e., eliminated from the COPC list). Detected chemicals that do not have existing PRGs were not eliminated from the COPC list in this phase of the screening.
4. **Essential Nutrients** – Consistent with the Risk Manual, chemicals identified as essential nutrients were screened out. Chemicals that are considered essential nutrients (e.g., calcium, chloride, iodine, iron, magnesium, potassium, phosphorous, 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 are: (1) present at low concentrations (i.e., only slightly elevated above naturally occurring levels), and (2) toxic at very high doses (i.e., much higher than those that could be associated with contact at an AOC).

Results of the facility-wide COPC screen for soil/dry sediment, groundwater, surface water, and wet sediment are presented in this section.

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1 In developing the facility-wide COPC lists, the goal was to be inclusive in identifying any chemicals that  
2 could possibly require a CUG as additional AOCs are addressed. For this reason, conservative  
3 assumptions were made in selecting data sets to review (e.g., storm sewer sample results were included in  
4 the surface water COPC screen because this water may discharge into surface water or become comingled  
5 with groundwater). The only sample types that were not included in any of the summaries were: floor  
6 sweepings, other liquid, other solid, waste material, and waste water. The rationale for excluding these  
7 media is that they are specific waste samples or other matrices that do not represent the general  
8 environmental media. In addition, these media are transient and past data do not represent the current  
9 conditions of the AOCs.

10 If additional COPCs are detected in future AOC RIs, a CUG will need to be developed using the methods  
11 provided in this document prior to proceeding through an FS.

### 12 2.1 SOIL

13 Table 2-1 presents all chemicals detected at least once in the soil at RVAAP. The table includes summary  
14 statistics, background values, and the COPC screening criteria (EPA Region 9 PRGs). Background soil  
15 values in Table 2-1 were developed as part of the facility-wide background sampling effort and are  
16 available in REIMS and in the Risk Manual.

17 Different RVAAP receptor/exposure scenarios define surface and subsurface soil EUs in different ways:

	<u>Surface Soil</u>	<u>Subsurface Soil</u>
18		
19	• Resident: 0 to 1 ft below ground surface (BGS)	1 to 13 ft BGS
20	• National Guard Trainee 0 to 4 ft BGS	4 to 7 ft BGS
21		(with digging)
22	• Engineering School Instructor 0 to 13 ft BGS (surface and subsurface combined)	
23		

24 Because of these differences, it was determined that all soil data would be aggregated to identify the full  
25 list of chemicals for which both surface and subsurface CUGs would be developed. For each AOC, the  
26 appropriate RAOs will be developed during the RI/FS process, including media and receptor/exposure  
27 scenarios and the AOC-specific data that may be evaluated against the proper set of facility-wide CUGs.

28 In addition, for this effort, we identified dry sediment that should be treated as soil for the purpose of risk  
29 assessment and remediation (a discussion on wet sediment is presented in Section 3.4.). There are samples  
30 in REIMS labeled as either dry sediment, drainage sediment, pond/stream sediment, or just plain  
31 “sediment.” All samples labeled as dry sediment and drainage sediment were aggregated with the soil  
32 results, and all samples labeled as pond/stream sediment were summarized and handled as wet sediment  
33 (Section 3.4).

34 For the samples that were just labeled as sediment, the report that described the sampling event was  
35 reviewed and, based on the descriptions and maps in the report, the samples were assigned to one of three  
36 groups: wet, dry, or sewer. The samples assigned to the wet category are summarized with the wet  
37 sediment (Section 3.4). The samples assigned to the dry or sewer categories were summarized with the  
38 soil. The sewer group included sumps, basins, and storm and sanitary sewers. Sewer samples are included  
39 in the soil group because when sumps and sewers are remediated or demolished, the underlying soil will  
40 be tested for residual contamination. Besides the soil and dry sediment, the media included in the soil

Table 2-1. Facility-Wide Chemicals of Potential Concern in Soil

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria - Surface	Background Criteria - Subsurface	EPA Region 9 Res. Soil PRG (HQ=.1,10E-6)	PRG Type	COPC?	Justification
<i>Inorganics</i>											
Aluminum	7429905	mg/kg	4196/4196	214	252,000	17,700	19,500	7,600	nc	Yes	Max Detect >PRG
Antimony	7440360	mg/kg	1084/3650	0.0037	8,910	0.96	0.96	3.1	nc	Yes	Max Detect >PRG
Arsenic	7440382	mg/kg	4190/4207	0.28	418	15.4	19.8	0.39	ca	Yes	Max Detect >PRG
Barium	7440393	mg/kg	4206/4207	6.4	17,500	88.4	124	540	nc	Yes	Max Detect >PRG
Beryllium	7440417	mg/kg	2816/3763	0.064	10.9	0.88	0.88	15	nc	No	Max Detect < Risk Criteria
Cadmium	7440439	mg/kg	2422/4207	0.018	4,910	0	0	3.7	nc	Yes	Max Detect >PRG
Calcium	7440702	mg/kg	3722/3770	88.6	273,000	15,800	35,500	1,000,000		No	Max Detect < Risk Criteria
Chromium	7440473	mg/kg	4208/4209	1.5	4,000	17.4	27.2	22	nc	Yes	Max Detect >PRG
Chromium, hexavalent	18540299	mg/kg	97/425	1	81.9			22	nc	Yes	Max Detect >PRG
Cobalt	7440484	mg/kg	3756/3771	0.47	507	10.4	23.2	140	nc	Yes	Max Detect >PRG
Copper	7440508	mg/kg	3768/3771	0.85	74,200	17.7	32.3	310	nc	Yes	Max Detect >PRG
Cyanide	57125	mg/kg	218/1620	0.0097	112	0	0	120	nc	No	Max Detect < Risk Criteria
Iron	7439896	mg/kg	3770/3771	964	401,000	23,100	35,200	2,300	nc	Yes	Max Detect >PRG
Lead	7439921	mg/kg	4196/4208	0.32	39,000	26.1	19.1	400	nc	Yes	Max Detect >PRG
Magnesium	7439954	mg/kg	3770/3771	95.6	58,000	3,030	8,790	1,000,000		No	Max Detect < Risk Criteria
Manganese	7439965	mg/kg	4206/4207	13.4	34,000	1,450	3,030	180	nc	Yes	Max Detect >PRG
Mercury	7439976	mg/kg	2961/4192	0.0057	882	0.036	0.044	2.3	nc	Yes	Max Detect >PRG
Nickel	7440020	mg/kg	3762/3771	0.61	463	21.1	60.7	160	nc	Yes	Max Detect >PRG
Selenium	7782492	mg/kg	2046/4208	0.15	14	1.4	1.5	39	nc	No	Max Detect < Risk Criteria
Silver	7440224	mg/kg	437/4199	0.045	630	0	0	39	nc	Yes	Max Detect >PRG
Thallium	7440280	mg/kg	1798/3607	0.054	13.3	0	0.91	0.52	nc	Yes	Max Detect >PRG
Vanadium	7440622	mg/kg	3761/3763	1.2	245	31.1	37.6	7.8	nc	Yes	Max Detect >PRG
Zinc	7440666	mg/kg	4183/4207	5.3	32,100	61.8	93.3	2,300	nc	Yes	Max Detect >PRG
Nitrate	14797558	mg/kg	122/316	0.14	71.5					Yes	No Screening Criteria
<i>Organics</i>											
<i>Explosives/Propellants</i>											
1,3,5-Trinitrobenzene	99354	mg/kg	177/2887	0.017	490	0	0	180	nc	Yes	Max Detect >PRG
1,3-Dinitrobenzene	99650	mg/kg	48/2900	0.017	110	0	0	0.61	nc	Yes	Max Detect >PRG
2,4,6-Trinitrotoluene	118967	mg/kg	680/2900	0.021	390,000	0	0	3.1	nc	Yes	Max Detect >PRG
2,4-Dinitrotoluene	121142	mg/kg	169/2900	0.032	13	0	0	0.72	ca	Yes	Max Detect >PRG
2,6-Dinitrotoluene	606202	mg/kg	67/2900	0.047	11	0	0	0.72	ca	Yes	Max Detect >PRG
2-Amino-4,6-Dinitrotoluene	35572782	mg/kg	26/607	0.04	30.5	0	0			Yes	No Screening Criteria
2-Amino-4,6-dinitrotoluene	35572782	mg/kg	212/858	0.027	180	0	0			Yes	No Screening Criteria
2-Nitrotoluene	88722	mg/kg	24/2900	0.033	4.8	0	0	0.88	ca	Yes	Max Detect >PRG
3-Nitrotoluene	99081	mg/kg	39/2900	0.049	21	0	0	73	nc	No	Max Detect < Risk Criteria
4-Amino-2,6-Dinitrotoluene	19406510	mg/kg	17/607	0.03	24.7	0	0			Yes	No Screening Criteria
4-Amino-2,6-dinitrotoluene	19406510	mg/kg	149/ 859	0.054	260	0	0			Yes	No Screening Criteria
4-Nitrotoluene	99990	mg/kg	44/2900	0.046	20	0	0	12	ca	Yes	Max Detect >PRG
HMX	2691410	mg/kg	165/2900	0.1	1,700	0	0	310	nc	Yes	Max Detect >PRG
Nitrobenzene	98953	mg/kg	111/2900	0.02	0.65	0	0	2	nc	No	Max Detect < Risk Criteria

Table 2-1. Facility-Wide Chemicals of Potential Concern in Soil (continued)

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria - Surface	Background Criteria - Subsurface	EPA Region 9 Res. Soil PRG (HQ=.1,10E-6)	PRG Type	COPC?	Justification
Nitrocellulose	9004700	mg/kg	324/787	0.3	4,190	0	0			Yes	No Screening Criteria
Nitroglycerin	55630	mg/kg	14/1472	1.5	140	0	0	35	ca	Yes	Max Detect >PRG
Nitroguanidine	556887	mg/kg	37/792	0.034	5.1	0	0	610	nc	No	Max Detect < Risk Criteria
RDX	121824	mg/kg	170/2900	0.057	9,800	0	0	4.4	ca	Yes	Max Detect >PRG
Tetryl	479458	mg/kg	62/2837	0.01	22	0	0	61	nc	No	Max Detect < Risk Criteria
<i>Semivolatile Organic Compounds</i>											
1,2,4-Trichlorobenzene	120821	mg/kg	5/1224	0.063	2.9	0	0	6.2	nc	No	Max Detect < Risk Criteria
1,2-Dichlorobenzene	95501	mg/kg	8/1207	0.043	2.9	0	0	110	nc	No	Max Detect < Risk Criteria
1,3-Dichlorobenzene	541731	mg/kg	3/1224	0.12	0.76	0	0	53	nc	No	Max Detect < Risk Criteria
1,4-Dichlorobenzene	106467	mg/kg	8/1224	0.061	1.4	0	0	3.4	ca	No	Max Detect < Risk Criteria
2,4,5-Trichlorophenol	95954	mg/kg	2/1286	0.087	0.088	0	0	610	nc	No	Max Detect < Risk Criteria
2,4,6-Trichlorophenol	88062	mg/kg	2/1276	0.088	0.089	0	0	0.61	nc	No	Max Detect < Risk Criteria
2,4-Dichlorophenol	120832	mg/kg	2/1286	0.074	0.075	0	0	18	nc	No	Max Detect < Risk Criteria
2,4-Dimethylphenol	105679	mg/kg	4/1286	0.29	2	0	0	120	nc	No	Max Detect < Risk Criteria
2,4-Dinitrophenol	51285	mg/kg	2/1214	0.25	0.26	0	0	12	nc	No	Max Detect < Risk Criteria
2-Chloronaphthalene	91587	mg/kg	2/1290	0.07	0.071	0	0	490	nc	No	Max Detect < Risk Criteria
2-Chlorophenol	95578	mg/kg	2/1286	0.089	0.09	0	0	6.3	nc	No	Max Detect < Risk Criteria
2-Methyl-4,6-dinitrophenol	534521	mg/kg	2/1262	0.18	0.18	0	0	0.61	nc	No	Max Detect < Risk Criteria
2-Methylnaphthalene	91576	mg/kg	154/1290	0.004	61	0	0	5.6	nc	Yes	Max Detect >PRG
2-Methylphenol	95487	mg/kg	3/1286	0.056	0.16	0	0	310	nc	No	Max Detect < Risk Criteria
2-Nitrobenzamine	88744	mg/kg	2/1290	0.14	0.14	0	0	18	nc	No	Max Detect < Risk Criteria
2-Nitrophenol	88755	mg/kg	2/1285	0.1	0.1	0	0			Yes	No Screening Criteria
3,3'-Dichlorobenzidine	91941	mg/kg	2/1244	0.15	0.15	0	0	1.1	ca	No	Max Detect < Risk Criteria
3-Nitrobenzamine	99092	mg/kg	2/1280	0.18	0.18	0	0	1.8	nc	No	Max Detect < Risk Criteria
4-Bromophenyl phenyl ether	101553	mg/kg	2/1290	0.12	0.12	0	0			Yes	No Screening Criteria
4-Chloro-3-methylphenol	59507	mg/kg	2/1286	0.11	0.11	0	0			Yes	No Screening Criteria
4-Chlorobenzenamine	106478	mg/kg	2/1272	0.16	0.17	0	0	24	nc	No	Max Detect < Risk Criteria
4-Chlorophenyl phenyl ether	7005723	mg/kg	2/1290	0.11	0.11	0	0			Yes	No Screening Criteria
4-Methylphenol	106445	mg/kg	19/1287	0.014	0.51	0	0	31	nc	No	Max Detect < Risk Criteria
4-Nitrobenzamine	100016	mg/kg	2/1282	0.17	0.18	0	0	18	nc	No	Max Detect < Risk Criteria
4-Nitrophenol	100027	mg/kg	2/1270	0.47	0.48	0	0			Yes	No Screening Criteria
Acenaphthene	83329	mg/kg	81/1290	0.0046	360	0	0	370	nc	No	Max Detect < Risk Criteria
Acenaphthylene	208968	mg/kg	41/1283	0.0018	7.9	0	0	370	nc	No	Max Detect < Risk Criteria
Anthracene	120127	mg/kg	160/1290	0.0017	1,000	0	0	2,200	nc	No	Max Detect < Risk Criteria
Benz(a)anthracene	56553	mg/kg	378/1290	0.0031	1,400	0	0	0.62	ca	Yes	Max Detect >PRG
Benzenemethanol	100516	mg/kg	11/326	0.25	2.1	0	0	1,800	nc	No	Max Detect < Risk Criteria
Benzo(a)pyrene	50328	mg/kg	386/1289	0.0037	960	0	0	0.062	ca	Yes	Max Detect >PRG
Benzo(b)fluoranthene	205992	mg/kg	436/1289	0.004	1,200	0	0	0.62	ca	Yes	Max Detect >PRG
Benzo(g,h,i)perylene	191242	mg/kg	292/1289	0.0033	650	0	0	6.2	ca	Yes	Max Detect >PRG
Benzo(k)fluoranthene	207089	mg/kg	295/1289	0.0042	580	0	0	6.2	ca	Yes	Max Detect >PRG
Benzoic Acid	65850	mg/kg	20/252	0.15	2.4	0	0	24,000	nc	No	Max Detect < Risk Criteria

Table 2-1. Facility-Wide Chemicals of Potential Concern in Soil (continued)

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria - Surface	Background Criteria - Subsurface	EPA Region 9 Res. Soil PRG (HQ=.1,10E-6)	PRG Type	COPC?	Justification
Bis(2-chloroethoxy)methane	111911	mg/kg	2/1001	0.076	0.077	0	0			Yes	No Screening Criteria
Bis(2-chloroethyl) ether	111444	mg/kg	2/ 994	0.12	0.12	0	0	0.22	ca	No	Max Detect < Risk Criteria
Bis(2-chloroisopropyl) ether	108601	mg/kg	2/1290	0.22	0.23	0	0	2.9	ca	No	Max Detect < Risk Criteria
Bis(2-ethylhexyl)phthalate	117817	mg/kg	250/1290	0.014	12	0	0	35	ca	No	Max Detect < Risk Criteria
Butyl benzyl phthalate	85687	mg/kg	15/1290	0.0088	6.1	0	0	1,200	nc	No	Max Detect < Risk Criteria
Carbazole	86748	mg/kg	109/1290	0.017	460	0	0	24	ca	Yes	Max Detect >PRG
Chrysene	218019	mg/kg	426/1290	0.0031	1,000	0	0	62	ca	Yes	Max Detect >PRG
Di-n-butyl phthalate	84742	mg/kg	77/1285	0.032	26	0	0	610	nc	No	Max Detect < Risk Criteria
Di-n-octylphthalate	117840	mg/kg	4/1278	0.017	0.35	0	0	240	nc	No	Max Detect < Risk Criteria
Dibenz(a,h)anthracene	53703	mg/kg	134/1289	0.0064	180	0	0	0.062	ca	Yes	Max Detect >PRG
Dibenzofuran	132649	mg/kg	102/1290	0.0064	270	0	0	15	nc	Yes	Max Detect >PRG
Diethyl phthalate	84662	mg/kg	4/1290	0.0093	5.6	0	0	4,900	nc	No	Max Detect < Risk Criteria
Dimethyl phthalate	131113	mg/kg	4/1290	0.097	1.9	0	0	61,000	nc	No	Max Detect < Risk Criteria
Fluoranthene	206440	mg/kg	494/1290	0.0064	3,100	0	0	230	nc	Yes	Max Detect >PRG
Fluorene	86737	mg/kg	99/1290	0.0085	450	0	0	270	nc	Yes	Max Detect >PRG
Hexachlorobenzene	118741	mg/kg	2/1290	0.092	0.093	0	0	0.3	ca	No	Max Detect < Risk Criteria
Hexachlorobutadiene	87683	mg/kg	2/1283	0.089	0.09	0	0	1.8	nc	No	Max Detect < Risk Criteria
Hexachlorocyclopentadiene	77474	mg/kg	2/1250	0.16	0.16	0	0	37	nc	No	Max Detect < Risk Criteria
Hexachloroethane	67721	mg/kg	2/1290	0.1	0.1	0	0	6.1	nc	No	Max Detect < Risk Criteria
Indeno(1,2,3-cd)pyrene	193395	mg/kg	285/1290	0.0039	630	0	0	0.62	ca	Yes	Max Detect >PRG
Isophorone	78591	mg/kg	2/1290	0.065	0.065	0	0	510	ca	No	Max Detect < Risk Criteria
N-Nitroso-di-n-propylamine	621647	mg/kg	2/1290	0.13	0.13	0	0	0.069	ca	Yes	Max Detect >PRG
N-Nitrosodiphenylamine	86306	mg/kg	15/1285	0.026	2	0	0	99	ca	No	Max Detect < Risk Criteria
Naphthalene	91203	mg/kg	130/1290	0.0092	100	0	0	5.6	nc	Yes	Max Detect >PRG
Pentachlorophenol	87865	mg/kg	9/1271	0.083	3.9	0	0	3	ca	Yes	Max Detect >PRG
Phenanthrene	85018	mg/kg	350/1290	0.0049	3,200	0	0	230	nc	Yes	Max Detect >PRG
Phenol	108952	mg/kg	18/1286	0.0083	0.27	0	0	1,800	nc	No	Max Detect < Risk Criteria
Pyrene	129000	mg/kg	439/1290	0.004	3,000	0	0	230	nc	Yes	Max Detect >PRG
<b>Pesticides/Herbicides</b>											
4,4'-DDD	72548	mg/kg	24/665	0.0005	0.25	0	0	2.4	ca	No	Max Detect < Risk Criteria
4,4'-DDE	72559	mg/kg	120/668	0.0002	230	0	0	1.7	ca	Yes	Max Detect >PRG
4,4'-DDT	50293	mg/kg	51/654	0.0005	0.45	0	0	1.7	ca	No	Max Detect < Risk Criteria
Aldrin	309002	mg/kg	9/667	0.0002	0.091	0	0	0.029	ca	Yes	Max Detect >PRG
Dieldrin	60571	mg/kg	46/666	0.0004	9.5	0	0	0.03	ca	Yes	Max Detect >PRG
Endosulfan I	959988	mg/kg	7/666	0.0004	0.04	0	0	37	nc	No	Max Detect < Risk Criteria
Endosulfan II	33213659	mg/kg	9/666	0.0004	0.037	0	0	37	nc	No	Max Detect < Risk Criteria
Endosulfan Sulfate	1031078	mg/kg	6/665	0.0004	12	0	0	37	nc	No	Max Detect < Risk Criteria
Endrin	72208	mg/kg	28/649	0.0006	3.2	0	0	1.8	nc	Yes	Max Detect >PRG
Endrin Aldehyde	7421934	mg/kg	78/667	0.0004	200	0	0	1.8	nc	Yes	Max Detect >PRG
Endrin Ketone	53494705	mg/kg	20/667	0.0003	0.081	0	0	1.8	nc	No	Max Detect < Risk Criteria
Heptachlor	76448	mg/kg	23/666	0.0002	0.67	0	0	0.11	ca	Yes	Max Detect >PRG
Heptachlor Epoxide	1024573	mg/kg	20/666	0.0002	1.1	0	0	0.053	ca	Yes	Max Detect >PRG

Table 2-1. Facility-Wide Chemicals of Potential Concern in Soil (continued)

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria - Surface	Background Criteria - Subsurface	EPA Region 9 Res. Soil PRG (HQ=1,10E-6)	PRG Type	COPC?	Justification
Lindane	58899	mg/kg	8/666	0.0003	0.029	0	0	0.44	ca	No	Max Detect < Risk Criteria
Methoxychlor	72435	mg/kg	24/664	0.0009	0.49	0	0	31	nc	No	Max Detect < Risk Criteria
Toxaphene	8001352	mg/kg	2/668	0.006	0.006	0	0	0.44	ca	No	Max Detect < Risk Criteria
alpha-BHC	319846	mg/kg	2/666	0.0002	0.00021	0	0	0.09	ca	No	Max Detect < Risk Criteria
alpha-Chlordane	5103719	mg/kg	28/667	0.0002	11	0	0	1.6	ca	Yes	Max Detect >PRG
beta-BHC	319857	mg/kg	32/666	0.0002	0.36	0	0	0.32	ca	Yes	Max Detect >PRG
delta-BHC	319868	mg/kg	4/638	0.0001	0.0049	0	0			Yes	No Screening Criteria
gamma-Chlordane	5103742	mg/kg	70/667	0.0002	320	0	0	1.6	ca	Yes	Max Detect >PRG
<i>Polychlorinated Biphenyls</i>											
PCB-1016	12674112	mg/kg	6/1133	0.0031	3.3	0	0	0.39	nc	Yes	Max Detect >PRG
PCB-1221	11104282	mg/kg	2/1136	0.009	0.009	0	0	0.11	nc	No	Max Detect < Risk Criteria
PCB-1232	11141165	mg/kg	2/1136	0.0051	0.0051	0	0	0.11	nc	No	Max Detect < Risk Criteria
PCB-1242	53469219	mg/kg	2/1136	0.0074	0.0074	0	0	0.11	nc	No	Max Detect < Risk Criteria
PCB-1248	12672296	mg/kg	6/1136	0.0051	2	0	0	0.11	nc	Yes	Max Detect >PRG
PCB-1254	11097691	mg/kg	307/1136	0.0026	3200	0	0	0.11	nc	Yes	Max Detect >PRG
PCB-1260	11096825	mg/kg	85/1123	0.0021	29	0	0	0.11	nc	Yes	Max Detect >PRG
<i>Volatile Organic Compounds</i>											
1,1,1-Trichloroethane	71556	mg/kg	3/974	0.0008	0.013	0	0	200	nc	No	Max Detect < Risk Criteria
1,1,2,2-Tetrachloroethane	79345	mg/kg	2/971	0.0008	0.0008	0	0	0.41	ca	No	Max Detect < Risk Criteria
1,1,2-Trichloroethane	79005	mg/kg	2/962	0.0009	0.0009	0	0	0.73	ca	No	Max Detect < Risk Criteria
1,1-Dichloroethane	75343	mg/kg	2/974	0.001	0.001	0	0	51	nc	No	Max Detect < Risk Criteria
1,1-Dichloroethene	75354	mg/kg	3/971	0.001	0.0074	0	0	12	nc	No	Max Detect < Risk Criteria
1,2-Dichloroethane	107062	mg/kg	2/974	0.0008	0.0008	0	0	0.28	ca	No	Max Detect < Risk Criteria
1,2-Dichloroethene	540590	mg/kg	50/781	0.0007	0.018	0	0	4.3	nc	No	Max Detect < Risk Criteria
1,2-Dichloropropane	78875	mg/kg	2/974	0.001	0.001	0	0	0.34	ca	No	Max Detect < Risk Criteria
1,2-Dimethylbenzene	95476	mg/kg	2/245	0.002	0.02	0	0	27	nc	No	Max Detect < Risk Criteria
2-Butanone	78933	mg/kg	76/969	0.0036	0.44	0	0	2,200	nc	No	Max Detect < Risk Criteria
2-Hexanone	591786	mg/kg	2/955	0.002	0.002	0	0			Yes	No Screening Criteria
4-Methyl-2-pentanone	108101	mg/kg	2/961	0.004	0.004	0	0	530	nc	No	Max Detect < Risk Criteria
Acetone	67641	mg/kg	174/940	0.0029	0.87	0	0	1,400	nc	No	Max Detect < Risk Criteria
Benzene	71432	mg/kg	13/974	0.0009	0.066	0	0	0.64	ca	No	Max Detect < Risk Criteria
Bromodichloromethane	75274	mg/kg	2/974	0.0009	0.0009	0	0	0.82	ca	No	Max Detect < Risk Criteria
Bromoform	75252	mg/kg	2/953	0.001	0.001	0	0	62	ca	No	Max Detect < Risk Criteria
Bromomethane	74839	mg/kg	2/939	0.004	0.004	0	0	0.39	nc	No	Max Detect < Risk Criteria
Carbon Disulfide	75150	mg/kg	16/954	0.0023	0.18	0	0	36	nc	No	Max Detect < Risk Criteria
Carbon Tetrachloride	56235	mg/kg	3/974	0.001	0.001	0	0	0.22	nc	No	Max Detect < Risk Criteria
Chlorobenzene	108907	mg/kg	5/974	0.001	0.26	0	0	15	nc	No	Max Detect < Risk Criteria
Chloroethane	75003	mg/kg	3/962	0.002	0.091	0	0	3	ca	No	Max Detect < Risk Criteria
Chloroform	67663	mg/kg	20/974	0.0008	0.023	0	0	0.22	ca	No	Max Detect < Risk Criteria
Chloromethane	74873	mg/kg	5/971	0.001	0.0051	0	0	4.7	nc	No	Max Detect < Risk Criteria
Dibromochloromethane	124481	mg/kg	2/957	0.0009	0.0009	0	0	1.1	ca	No	Max Detect < Risk Criteria
Dimethylbenzene	1330207	mg/kg	35/883	0.0012	0.61	0	0	27	nc	No	Max Detect < Risk Criteria



Table 2-1. Facility-Wide Chemicals of Potential Concern in Soil (continued)

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria - Surface	Background Criteria - Subsurface	EPA Region 9 Res. Soil PRG (HQ=.1,10E-6)	PRG Type	COPC?	Justification
Ethylbenzene	100414	mg/kg	11/974	0.0008	0.16	0	0	190	nc	No	Max Detect < Risk Criteria
M + P Xylene	136777612	mg/kg	1/145	0.0051	0.0051	0	0	27	nc	No	Max Detect < Risk Criteria
Methylene Chloride	75092	mg/kg	134/956	0.0006	0.26	0	0	9.1	ca	No	Max Detect < Risk Criteria
Naphthalene	91203	mg/kg	1/1	0.0046	0.00458	0	0	5.6	nc	No	Max Detect < Risk Criteria
Styrene	100425	mg/kg	18/974	0.0007	0.036	0	0	440	nc	No	Max Detect < Risk Criteria
Tetrachloroethene	127184	mg/kg	9/974	0.0009	0.0048	0	0	0.48	ca	No	Max Detect < Risk Criteria
Toluene	108883	mg/kg	175/974	0.0004	3.7	0	0	66	nc	No	Max Detect < Risk Criteria
Trichloroethene	79016	mg/kg	33/963	0.0008	0.012	0	0	0.053	ca	No	Max Detect < Risk Criteria
Vinyl Chloride	75014	mg/kg	2/974	0.001	0.001	0	0	0.079	ca	No	Max Detect < Risk Criteria
<i>cis</i> -1,3-Dichloropropene	10061015	mg/kg	2/949	0.001	0.001	0	0	0.78	ca	No	Max Detect < Risk Criteria
<i>trans</i> -1,3-Dichloropropene	10061026	mg/kg	2/939	0.001	0.001	0	0	0.78	ca	No	Max Detect < Risk Criteria

1 ca = Carcinogenic.

2 CAS = Chemical Abstracts Service.

3 COPC = Chemical of potential concern.

4 EPA = U. S. Environmental Protection Agency.

5 HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.

6 HQ = Hazard quotient.

7 nc = Non-carcinogenic.

8 PCB = Polychlorinated biphenyl.

9 PRG = Preliminary remediation goal.

10 RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

11 Res. = Residential.

1 summary are ballast (fill materials under the train tracks that, from an assessment and remediation point  
2 of view, must be treated similar to soil) and trench soil.

3 Several anion and miscellaneous results that are found in REIMS are not included in the soil table [e.g.,  
4 chloride, alkalinity, and total organic carbon (TOC)]; however, one anion, nitrate, for which there are  
5 toxicity data, is included.

## 6 **2.2 GROUNDWATER**

7 The groundwater data set in REIMS is quite extensive, containing over 800 sampling results for many  
8 chemicals. These results come from both CERCLA and RCRA characterization and permit efforts, as  
9 well as the facility-wide groundwater sampling that takes place semiannually. For this exercise, we  
10 evaluated over 800 filtered groundwater samples, which represent the actual dissolved-phase of a  
11 chemical in the groundwater, but did not include unfiltered data and well point results. Well point  
12 sampling was intended for Phase I reconnaissance. Because the well points were not installed and  
13 sampled using standard groundwater sampling requirements (e.g., filter pack, surface casings, etc.), the  
14 sample quality is questionable.

15 Table 2-2 provides the complete list of facility-wide COPCs for groundwater for which CUGs were  
16 developed. Anions and miscellaneous analytes for which no toxicity data exist are eliminated from  
17 consideration (e.g., nitrite, sulfate, sulfide, sulfite, alkalinity, ammonia, phenols, total petroleum  
18 hydrocarbons-diesel-range organics, total dissolved solids, and TOC).

## 19 **2.3 SURFACE WATER**

20 Table 2-3 provides the facility-wide COPCs for surface water. For this evaluation, only unfiltered water  
21 samples were used because they represent the natural state of surface water at the time of exposure. All  
22 samples labeled as surface water samples were included in this evaluation. Several “special” sample types  
23 that were designated in REIMS as surface water were included in this evaluation to cover not only ponds  
24 and streams, but also water that could flow into the environment (e.g., samples collected from storm  
25 sewers, sanitary sewers, or manholes). Inclusion of these samples ensures that CUGs are developed for  
26 chemicals that may be present under current and potential future conditions.

27 As with the other media, some anions and miscellaneous analytes were eliminated for the set.

## 28 **2.4 SEDIMENT**

29 As indicated in Section 3.1, the REIMS database contained many sediment entries that represent various  
30 media types (e.g., dry sediment actually represents floodplain and other types of soil). Database entries  
31 that were actually evaluated in the sediment COPC screen are those that represent soil/sediment that are  
32 covered by water (e.g., pond and stream sediment) and thus are part of an aquatic environment. Table 2-4  
33 provides the facility-wide sediment COPCs for which CUGs are developed. Dry sediment samples were  
34 assigned to the soil media dataset.

Table 2-2. Facility-Wide Chemicals of Potential Concern in Groundwater

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria - Unconsolidated	Background Criteria - Bedrock	EPA Tap Water PRG=10E-6, HQ=0.1	PRG Type	COPC?	Justification
<i>Inorganics</i>											
Aluminum	7429905	mg/L	186/ 772	0.0028	11.4			3.6	nc	Yes	Exceeds PRG
Antimony	7440360	mg/L	88/ 805	0.000066	0.0129	0	0	0.0015	nc	Yes	Exceeds PRG
Arsenic	7440382	mg/L	300/ 805	0.00054	0.1	0.0117	0	0.000045	ca	Yes	Exceeds PRG
Barium	7440393	mg/L	789/ 805	0.0016	1.2	0.0821	0.256	0.26	nc	Yes	Exceeds PRG
Beryllium	7440417	mg/L	47/ 805	0.000029	0.0027	0	0	0.0073	nc	No	Max < PRG
Cadmium	7440439	mg/L	60/ 805	0.00009	0.0125	0	0	0.0018	nc	Yes	Exceeds PRG
Calcium	7440702	mg/L	805/ 805	3.2	940	115	53.1	500		Yes	Exceeds PRG
Chromium	7440473	mg/L	30/ 784	0.0014	0.083	0.0073	0	0.011	nc	Yes	Exceeds PRG
Chromium, hexavalent	18540299	mg/L	10/ 16	0	0.01			0.011	nc	No	Max < PRG
Cobalt	7440484	mg/L	230/ 805	0.00054	0.438	0	0	0.073	nc	Yes	Exceeds PRG
Copper	7440508	mg/L	156/ 786	0.00093	0.0272	0	0	0.15	nc	No	Max < PRG
Cyanide	57125	mg/L	2/ 33	0.015	0.019	0	0	0.073	nc	No	Max < PRG
Iron	7439896	mg/L	539/ 805	0.0082	177	0.279	1.43	1.1	nc	Yes	Exceeds PRG
Lead	7439921	mg/L	47/ 805	0.0002	0.012	0	0			Yes	No PRG
Magnesium	7439954	mg/L	804/ 805	1.5	420	43.3	15	200		Yes	Exceeds PRG
Manganese	7439965	mg/L	770/ 805	0.00026	7.72	1.02	1.34	0.088	nc	Yes	Exceeds PRG
Mercury	7439976	mg/L	36/ 806	0.00003	0.0004	0	0	0.0011	nc	No	Max < PRG
Nickel	7440020	mg/L	372/ 805	0.00035	1.47	0	0.0834	0.073	nc	Yes	Exceeds PRG
Selenium	7782492	mg/L	38/ 805	0.00047	0.01	0	0	0.018	nc	No	Max < PRG
Silver	7440224	mg/L	6/ 805	0.00078	0.0014	0	0	0.018	nc	No	Max < PRG
Thallium	7440280	mg/L	72/ 804	0.000023	0.0029	0	0	0.00024	nc	Yes	Exceeds PRG
Vanadium	7440622	mg/L	18/ 804	0.0008	0.0135	0	0	0.0036	nc	Yes	Exceeds PRG
Zinc	7440666	mg/L	358/ 802	0.0017	1.91	0.0609	0.0523	1.1	nc	Yes	Exceeds PRG
Chloride	16887006	mg/L	22/ 22	1.3	18.4			1,700		No	Max < PRG
Nitrate	14797558	mg/L	27/ 120	0.02	1,200			1	nc	Yes	Exceeds PRG
Phosphorous	7723140	mg/L	1/ 3	0.1	0.1			500		No	Max < PRG
<i>Organics</i>											
<i>Explosives/Propellants</i>											
1,3,5-Trinitrobenzene	99354	mg/L	91/ 776	0.000015	0.065			0.11	nc	No	Max < PRG
1,3-Dinitrobenzene	99650	mg/L	43/ 777	0.000019	0.0013			0.00036	nc	Yes	Exceeds PRG
2,4,6-Trinitrotoluene	118967	mg/L	73/ 782	0.000025	0.13			0.0018	nc	Yes	Exceeds PRG
2,4-Dinitrotoluene	121142	mg/L	74/ 782	0.000033	0.0079			0.000099	ca	Yes	Exceeds PRG
2,6-Dinitrotoluene	606202	mg/L	33/ 780	0.000053	0.0038			0.000099	ca	Yes	Exceeds PRG
2-Amino-4,6-Dinitrotoluene	35572782	mg/L	46/ 519	0.00017	0.022					Yes	No PRG
2-Amino-4,6-dinitrotoluene	35572782	mg/L	27/ 142	0.00012	0.032					Yes	No PRG

Table 2-2. Facility-Wide Chemicals of Potential Concern in Groundwater (continued)

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria - Unconsolidated	Background Criteria - Bedrock	EPA Tap Water PRG=10E-6, HQ=0.1	PRG Type	COPC?	Justification
2-Nitrotoluene	88722	mg/L	39/ 777	0.000089	0.0065			0.000049	ca	Yes	Exceeds PRG
3-Nitrotoluene	99081	mg/L	11/ 777	0.000076	0.00078			0.012	nc	No	Max < PRG
4-Amino-2,6-Dinitrotoluene	19406510	mg/L	45/ 519	0.00016	0.041					Yes	No PRG
4-Amino-2,6-dinitrotoluene	19406510	mg/L	25/ 142	0.000092	0.054					Yes	No PRG
4-Nitrotoluene	99990	mg/L	30/ 777	0.00005	0.0037			0.00066	ca	Yes	Exceeds PRG
HMX	2691410	mg/L	79/ 784	0.000038	0.018			0.18	nc	No	Max < PRG
Nitrobenzene	98953	mg/L	31/ 783	0.000044	0.0015			0.00034	nc	Yes	Exceeds PRG
Nitrocellulose	9004700	mg/L	93/ 704	0.085	9.4					Yes	No PRG
Nitroglycerin	55630	mg/L	6/ 369	0.00018	0.027			0.0048	ca	Yes	Exceeds PRG
Nitroguanidine	556887	mg/L	1/ 709	0.014	0.014			0.36	nc	No	Max < PRG
PETN	78115	mg/L	9/ 81	0.00032	0.00094					Yes	No PRG
RDX	121824	mg/L	106/ 781	0.000042	0.088			0.00061	ca	Yes	Exceeds PRG
Tetryl	479458	mg/L	32/ 775	0.000025	0.002			0.036	nc	No	Max < PRG
<i>Semivolatile Organic Compounds</i>											
2,4-Dinitrotoluene	121142	mg/L	16/ 712	0.00063	0.0035			0.000099	ca	Yes	Exceeds PRG
2,6-Dinitrotoluene	606202	mg/L	11/ 716	0.00064	0.0046			0.000099	ca	Yes	Exceeds PRG
2-Methylnaphthalene	91576	mg/L	1/ 774	0.00025	0.00025			0.00062	nc	No	Max < PRG
4-Methylphenol	106445	mg/L	1/ 761	0.0029	0.0029			0.018	nc	No	Max < PRG
4-Nitrobenzenamine	100016	mg/L	1/ 772	0.0041	0.0041			0.0032	ca	Yes	Exceeds PRG
Benz(a)anthracene	56553	mg/L	4/ 774	0.00014	0.00027			0.000092	ca	Yes	Exceeds PRG
Benzo(a)pyrene	50328	mg/L	4/ 774	0.00012	0.00029			0.000092	ca	Yes	Exceeds PRG
Benzo(b)fluoranthene	205992	mg/L	3/ 774	0.0001	0.0002			0.000092	ca	Yes	Exceeds PRG
Benzo(g,h,i)perylene	191242	mg/L	3/ 757	0.00025	0.00081					Yes	No PRG
Benzo(k)fluoranthene	207089	mg/L	4/ 774	0.00011	0.00024			0.00092	ca	No	Max < PRG
Benzoic Acid	65850	mg/L	30/ 445	0.0013	0.015			15	nc	No	Max < PRG
Bis(2-ethylhexyl)phthalate	117817	mg/L	133/ 778	0.00088	0.4			0.0048	ca	Yes	Exceeds PRG
Butyl benzyl phthalate	85687	mg/L	5/ 774	0.0015	0.014			0.73	nc	No	Max < PRG
Caprolactam	105602	mg/L	11/ 14	0.014	0.39			1.8	nc	No	Max < PRG
Chrysene	218019	mg/L	5/ 774	0.0001	0.00025			0.0092	ca	No	Max < PRG
Di-n-butyl phthalate	84742	mg/L	22/ 764	0.00036	0.0078			0.36	nc	No	Max < PRG
Di-n-octylphthalate	117840	mg/L	18/ 773	0.00045	0.0021			0.15	nc	No	Max < PRG
Dibenz(a,h)anthracene	53703	mg/L	3/ 757	0.00024	0.00095			0.000092	ca	Yes	Exceeds PRG
Diethyl phthalate	84662	mg/L	24/ 774	0.00033	0.0013			2.9	nc	No	Max < PRG
Fluoranthene	206440	mg/L	2/ 764	0.00023	0.00032			0.15	nc	No	Max < PRG
Fluorene	86737	mg/L	1/ 766	0.00066	0.00066			0.024	nc	No	Max < PRG
Indeno(1,2,3-cd)pyrene	193395	mg/L	5/ 757	0.00009	0.00081			0.000092	ca	Yes	Exceeds PRG

Table 2-2. Facility-Wide Chemicals of Potential Concern in Groundwater (continued)

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria - Unconsolidated	Background Criteria - Bedrock	EPA Tap Water PRG=10E-6, HQ=0.1	PRG Type	COPC?	Justification
Pentachlorophenol	87865	mg/L	1/ 751	0.003	0.003			0.00056	ca	Yes	Exceeds PRG
Phenanthrene	85018	mg/L	3/ 764	0.00018	0.0028					Yes	No PRG
Phenol	108952	mg/L	9/ 741	0.0011	0.028			1.1	nc	No	Max < PRG
Phenols	64743039	mg/L	1/ 3	0.067	0.067					Yes	No PRG
Pyrene	129000	mg/L	3/ 766	0.00013	0.0004			0.018	nc	No	Max < PRG
<i>Pesticides/Herbicides</i>											
4,4'-DDD	72548	mg/L	3/ 739	0.000019	0.00035			0.00028	ca	Yes	Exceeds PRG
4,4'-DDE	72559	mg/L	9/ 739	0.0000095	0.013			0.0002	ca	Yes	Exceeds PRG
4,4'-DDT	50293	mg/L	19/ 738	0.000012	0.00022			0.0002	ca	Yes	Exceeds PRG
Aldrin	309002	mg/L	3/ 739	0.000011	0.000054			0.000004	ca	Yes	Exceeds PRG
Dieldrin	60571	mg/L	4/ 739	0.0000093	0.000053			0.0000042	ca	Yes	Exceeds PRG
Endosulfan I	959988	mg/L	2/ 732	0.000035	0.00017			0.022	nc	No	Max < PRG
Endosulfan II	33213659	mg/L	2/ 739	0.000016	0.000018			0.022	nc	No	Max < PRG
Endosulfan Sulfate	1031078	mg/L	1/ 739	0.000023	0.000023			0.022	nc	No	Max < PRG
Endrin	72208	mg/L	2/ 723	0.000025	0.00031			0.0011	nc	No	Max < PRG
Endrin Aldehyde	7421934	mg/L	8/ 739	0.0000091	0.00018			0.0011	nc	No	Max < PRG
Endrin Ketone	53494705	mg/L	1/ 736	0.000044	0.000044			0.0011	nc	No	Max < PRG
Heptachlor	76448	mg/L	18/ 736	0.0000063	0.00019			0.000015	ca	Yes	Exceeds PRG
Heptachlor Epoxide	1024573	mg/L	29/ 740	0.000007	0.013			0.0000074	ca	Yes	Exceeds PRG
Lindane	58899	mg/L	12/ 739	0.0000083	0.0001			0.000052	ca	Yes	Exceeds PRG
Methoxychlor	72435	mg/L	20/ 739	0.000012	0.00009			0.018	nc	No	Max < PRG
Toxaphene	8001352	mg/L	4/ 732	0.00034	0.0053			0.000061	ca	Yes	Exceeds PRG
alpha-BHC	319846	mg/L	2/ 739	0.000011	0.000065			0.000011	ca	Yes	Exceeds PRG
alpha-Chlordane	5103719	mg/L	21/ 736	0.0000073	0.00016			0.00019	ca	No	Max < PRG
beta-BHC	319857	mg/L	47/ 739	0.0000071	0.00057			0.000037	ca	Yes	Exceeds PRG
delta-BHC	319868	mg/L	4/ 713	0.0000066	0.000046					Yes	No PRG
gamma-Chlordane	5103742	mg/L	3/ 736	0.000019	0.000028			0.00019	ca	No	Max < PRG
<i>Polychlorinated Biphenyls</i>											
PCB-1242	53469219	mg/L	3/ 740	0.00072	0.009			0.000034	ca	Yes	Exceeds PRG
PCB-1254	11097691	mg/L	2/ 740	0.000051	0.00016			0.000034	ca	Yes	Exceeds PRG
PCB-1260	11096825	mg/L	1/ 722	0.0067	0.0067			0.000034	ca	Yes	Exceeds PRG
<i>Volatile Organic Compounds</i>											
1,1,1-Trichloroethane	71556	mg/L	2/ 782	0.0058	0.01			0.32	nc	No	Max < PRG
1,1,2,2-Tetrachloroethane	79345	mg/L	1/ 782	0.00084	0.00084			0.000055	ca	Yes	Exceeds PRG
1,1-Dichloroethane	75343	mg/L	1/ 782	0.0022	0.0022			0.081	nc	No	Max < PRG
1,1-Dichloroethene	75354	mg/L	5/ 780	0.0003	0.0042			0.034	nc	No	Max < PRG

Table 2-2. Facility-Wide Chemicals of Potential Concern in Groundwater (continued)

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria - Unconsolidated	Background Criteria - Bedrock	EPA Tap Water PRG=10E-6, HQ=0.1	PRG Type	COPC?	Justification
1,2-Dichloroethane	107062	mg/L	1/ 780	0.00046	0.00046			0.00012	ca	Yes	Exceeds PRG
1,2-Dichloroethene	540590	mg/L	2/ 740	0.00038	0.001			0.0061	nc	No	Max < PRG
2-Butanone	78933	mg/L	12/ 757	0.00055	0.064			0.7	nc	No	Max < PRG
4-Methyl-2-pentanone	108101	mg/L	2/ 782	0.00035	0.0083			0.2	nc	No	Max < PRG
Acetone	67641	mg/L	29/ 707	0.00086	0.074			0.55	nc	No	Max < PRG
Benzene	71432	mg/L	9/ 782	0.00022	0.0011			0.00035	ca	Yes	Exceeds PRG
Bromoform	75252	mg/L	1/ 738	0.00035	0.00035			0.0085	ca	No	Max < PRG
Carbon Disulfide	75150	mg/L	44/ 782	0.0002	0.0079			0.1	nc	No	Max < PRG
Carbon Tetrachloride	56235	mg/L	4/ 756	0.00015	0.0016			0.00017	ca	Yes	Exceeds PRG
Chloroform	67663	mg/L	12/ 782	0.00019	0.0017			0.00017	ca	Yes	Exceeds PRG
Chloromethane	74873	mg/L	33/ 780	0.00013	0.0038			0.016	nc	No	Max < PRG
Methylene Chloride	75092	mg/L	34/ 759	0.00023	0.007			0.0043	ca	Yes	Exceeds PRG
Tetrachloroethene	127184	mg/L	4/ 780	0.00049	0.00066			0.0001	ca	Yes	Exceeds PRG
Toluene	108883	mg/L	16/ 780	0.0002	0.011			0.072	nc	No	Max < PRG
Trichloroethene	79016	mg/L	4/ 782	0.002	0.012			0.000028	ca	Yes	Exceeds PRG

1 ca = Carcinogenic.

2 CAS = Chemical Abstracts Service.

3 COPC = Chemical of potential concern.

4 EPA = U. S. Environmental Protection Agency.

5 HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.

6 HQ = Hazard quotient.

7 nc = Non-carcinogenic.

8 PCB = Polychlorinated biphenyl.

9 PETN = Pentaerythritol tetranitrate.

10 PRG = Preliminary remediation goal.

11 RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

Table 2-3. Facility-Wide Chemicals of Potential Concern in Surface Water

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria run	EPA Tap Water PRG=10E-6, HQ=0.1	PRG Type	COPC?	Justification
<i>Inorganics</i>										
Aluminum	7429905	mg/L	241/ 325	0.0236	123	3.37	3.6	nc	Yes	Exceeds PRG
Antimony	7440360	mg/L	55/ 326	0.00042	0.88	0	0.0015	nc	Yes	Exceeds PRG
Arsenic	7440382	mg/L	133/ 327	0.00052	0.77	0.0032	0.000045	ca	Yes	Exceeds PRG
Barium	7440393	mg/L	326/ 327	0.0069	1.9	0.0475	0.26	nc	Yes	Exceeds PRG
Beryllium	7440417	mg/L	21/ 327	0.000021	0.0011	0	0.0073	nc	No	Max < PRG
Cadmium	7440439	mg/L	61/ 327	0.00013	0.051	0	0.0018	nc	Yes	Exceeds PRG
Calcium	7440702	mg/L	326/ 327	4.5	184	41.4	500		No	Max < PRG
Chromium	7440473	mg/L	112/ 323	0.00069	0.2	0	0.011	nc	Yes	Exceeds PRG
Chromium, hexavalent	18540299	mg/L	8/ 39	0.01	0.05		0.011	nc	Yes	Exceeds PRG
Cobalt	7440484	mg/L	71/ 327	0.00019	0.062	0	0.073	nc	No	Max < PRG
Copper	7440508	mg/L	141/ 319	0.00081	0.89	0.0079	0.15	nc	Yes	Exceeds PRG
Cyanide	57125	mg/L	4/ 178	0.0071	0.065	0	0.073	nc	No	Max < PRG
Iron	7439896	mg/L	299/ 327	0.046	197	2.56	1.1	nc	Yes	Exceeds PRG
Lead	7439921	mg/L	138/ 337	0.00082	14	0			Yes	No PRG
Magnesium	7439954	mg/L	322/ 327	0.38	202	10.8	200		Yes	Exceeds PRG
Manganese	7439965	mg/L	318/ 327	0.00099	15.8	0.391	0.088	nc	Yes	Exceeds PRG
Mercury	7439976	mg/L	44/ 327	0.00005	0.0219	0	0.0011	nc	Yes	Exceeds PRG
Nickel	7440020	mg/L	112/ 327	0.00079	0.24	0	0.073	nc	Yes	Exceeds PRG
Selenium	7782492	mg/L	19/ 327	0.003	0.016	0	0.018	nc	No	Max < PRG
Silver	7440224	mg/L	10/ 327	0.00074	0.092	0	0.018	nc	Yes	Exceeds PRG
Thallium	7440280	mg/L	8/ 308	0.0013	0.4	0	0.00024	nc	Yes	Exceeds PRG
Vanadium	7440622	mg/L	90/ 327	0.00076	0.21	0	0.0036	nc	Yes	Exceeds PRG
Zinc	7440666	mg/L	200/ 327	0.0027	5.4	0.042	1.1	nc	Yes	Exceeds PRG
Chloride	16887006	mg/L	2/ 4	1.7	2.2		1,700		No	Max < PRG
Nitrate	14797558	mg/L	36/ 74	0.06	2,600		1	nc	Yes	Exceeds PRG
Perchlorate	7601903	mg/L	3/ 13	0.0075	0.025		0.00036	nc	Yes	Exceeds PRG
<i>Organics</i>										
<i>Explosives/Propellants</i>										
1,3,5-Trinitrobenzene	99354	mg/L	14/ 308	0.00007	0.009		0.11	nc	No	Max < PRG
1,3-Dinitrobenzene	99650	mg/L	7/ 308	0.000047	0.000097		0.00036	nc	No	Max < PRG
2,4,6-Trinitrotoluene	118967	mg/L	34/ 308	0.000049	1		0.0018	nc	Yes	Exceeds PRG
2,4-Dinitrotoluene	121142	mg/L	17/ 308	0.000051	0.012		0.000099	ca	Yes	Exceeds PRG

Table 2-3. Facility-Wide Chemicals of Potential Concern in Surface Water (continued)

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria run	EPA Tap Water PRG=10E-6, HQ=0.1	PRG Type	COPC?	Justification
2,6-Dinitrotoluene	606202	mg/L	6/ 308	0.00011	0.0045		0.000099	ca	Yes	Exceeds PRG
2-Amino-4,6-Dinitrotoluene	35572782	mg/L	9/ 104	0.00023	0.0076				Yes	No PRG
2-Amino-4,6-dinitrotoluene	35572782	mg/L	32/ 110	0.00013	0.46				Yes	No PRG
2-Nitrotoluene	88722	mg/L	5/ 309	0.00021	0.0051		0.000049	ca	Yes	Exceeds PRG
3-Nitrotoluene	99081	mg/L	8/ 308	0.00014	0.00049		0.012	nc	No	Max < PRG
4-Amino-2,6-Dinitrotoluene	19406510	mg/L	12/ 104	0.00025	0.021				Yes	No PRG
4-Amino-2,6-dinitrotoluene	19406510	mg/L	33/ 110	0.0001	0.81				Yes	No PRG
4-Nitrotoluene	99990	mg/L	10/ 309	0.0001	0.0039		0.00066	ca	Yes	Exceeds PRG
HMX	2691410	mg/L	31/ 308	0.000093	1.7		0.18	nc	Yes	Exceeds PRG
Nitrobenzene	98953	mg/L	2/ 308	0.000066	0.00016		0.00034	nc	No	Max < PRG
Nitrocellulose	9004700	mg/L	22/ 132	0.094	1.1				Yes	No PRG
Nitroguanidine	556887	mg/L	2/ 133	0.009	0.012		0.36	nc	No	Max < PRG
RDX	121824	mg/L	51/ 309	0.0001	4.4		0.00061	ca	Yes	Exceeds PRG
Tetryl	479458	mg/L	4/ 309	0.00013	0.01		0.036	nc	No	Max < PRG
<i>Semivolatile Organic Compounds</i>										
1,3-Dichlorobenzene	541731	mg/L	2/ 223	0.00044	0.00087		0.018	nc	No	Max < PRG
1,4-Dichlorobenzene	106467	mg/L	1/ 223	0.00052	0.00052		0.0005	ca	Yes	Exceeds PRG
2,4,6-Trichlorophenol	88062	mg/L	1/ 240	0.00031	0.00031		0.00036	nc	No	Max < PRG
2,4-Dimethylphenol	105679	mg/L	1/ 240	0.088	0.088		0.073	nc	Yes	Exceeds PRG
2,4-Dinitrotoluene	121142	mg/L	1/ 222	0.011	0.011		0.000099	ca	Yes	Exceeds PRG
2,6-Dinitrotoluene	606202	mg/L	1/ 222	0.013	0.013		0.000099	ca	Yes	Exceeds PRG
2-Methylphenol	95487	mg/L	4/ 240	0.0018	0.072		0.18	nc	No	Max < PRG
4-Methylphenol	106445	mg/L	19/ 240	0.00026	0.17		0.018	nc	Yes	Exceeds PRG
Acenaphthene	83329	mg/L	2/ 240	0.00061	0.0018		0.037	nc	No	Max < PRG
Acenaphthylene	208968	mg/L	1/ 240	0.00094	0.00094				Yes	No PRG
Anthracene	120127	mg/L	6/ 240	0.00017	0.0027		0.18	nc	No	Max < PRG
Benz(a)anthracene	56553	mg/L	9/ 240	0.00012	0.0053		0.000092	ca	Yes	Exceeds PRG
Benzenemethanol	100516	mg/L	5/ 137	0.0064	0.012		1.1	nc	No	Max < PRG
Benzo(a)pyrene	50328	mg/L	12/ 240	0.0001	0.0035		9.2E-06	ca	Yes	Exceeds PRG
Benzo(b)fluoranthene	205992	mg/L	11/ 240	0.00011	0.016		0.000092	ca	Yes	Exceeds PRG
Benzo(g,h,i)perylene	191242	mg/L	9/ 237	0.00019	0.0037				Yes	No PRG
Benzo(k)fluoranthene	207089	mg/L	13/ 240	0.00012	0.0057		0.00092	ca	Yes	Exceeds PRG



Table 2-3. Facility-Wide Chemicals of Potential Concern in Surface Water (continued)

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria run	EPA Tap Water PRG=10E-6, HQ=0.1	PRG Type	COPC?	Justification
Benzoic Acid	65850	mg/L	6/ 119	0.0038	0.41		15	nc	No	Max < PRG
Bis(2-ethylhexyl)phthalate	117817	mg/L	42/ 240	0.0014	0.97		0.0048	ca	Yes	Exceeds PRG
Butyl benzyl phthalate	85687	mg/L	1/ 240	0.0029	0.0029		0.73	nc	No	Max < PRG
Carbazole	86748	mg/L	2/ 240	0.0012	0.0034		0.0034	ca	No	Max < PRG
Chrysene	218019	mg/L	14/ 240	0.0001	0.025		0.0092	ca	Yes	Exceeds PRG
Di-n-butyl phthalate	84742	mg/L	2/ 240	0.0012	0.003		0.36	nc	No	Max < PRG
Dibenz(a,h)anthracene	53703	mg/L	8/ 237	0.00013	0.00082		9.2E-06	ca	Yes	Exceeds PRG
Dibenzofuran	132649	mg/L	2/ 240	0.00049	0.0011		0.0012	nc	No	Max < PRG
Fluoranthene	206440	mg/L	12/ 240	0.00013	0.059		0.15	nc	No	Max < PRG
Fluorene	86737	mg/L	2/ 240	0.00063	0.0017		0.024	nc	No	Max < PRG
Indeno(1,2,3-cd)pyrene	193395	mg/L	13/ 237	0.0001	0.0038		0.000092	ca	Yes	Exceeds PRG
Isophorone	78591	mg/L	1/ 240	0.0022	0.0022		0.071	ca	No	Max < PRG
N-Nitrosodiphenylamine	86306	mg/L	1/ 240	0.00021	0.00021		0.014	ca	No	Max < PRG
Naphthalene	91203	mg/L	1/ 240	0.0006	0.0006		0.00062	nc	No	Max < PRG
Pentachlorophenol	87865	mg/L	1/ 240	0.0048	0.0048		0.00056	ca	Yes	Exceeds PRG
Phenanthrene	85018	mg/L	7/ 240	0.00015	0.012				Yes	No PRG
Phenol	108952	mg/L	14/ 240	0.00062	0.21		1.1	nc	No	Max < PRG
Pyrene	129000	mg/L	13/ 240	0.00014	0.046		0.018	nc	Yes	Exceeds PRG
<b><i>Pesticides/Herbicides</i></b>										
4,4'-DDT	50293	mg/L	1/ 199	0.00031	0.00031		0.0002	ca	Yes	Exceeds PRG
Aldrin	309002	mg/L	2/ 206	0.000012	0.000012		0.000004	ca	Yes	Exceeds PRG
Endosulfan Sulfate	1031078	mg/L	1/ 206	0.000071	0.000071		0.022	nc	No	Max < PRG
Endrin Ketone	53494705	mg/L	1/ 206	0.000055	0.000055		0.0011	nc	No	Max < PRG
Heptachlor Epoxide	1024573	mg/L	3/ 206	0.00026	0.00075		7.4E-06	ca	Yes	Exceeds PRG
beta-BHC	319857	mg/L	3/ 206	0.000062	0.000069		0.000037	ca	Yes	Exceeds PRG
<b><i>Polychlorinated Biphenyls</i></b>										
PCB-1254	11097691	mg/L	4/ 254	0.00057	0.012		0.000034	ca	Yes	Exceeds PRG
<b><i>Volatile Organic Compounds</i></b>										
1,1,2,2-Tetrachloroethane	79345	mg/L	2/ 244	0.0021	0.003		0.000055	ca	Yes	Exceeds PRG
1,2-Dichloroethene	540590	mg/L	1/ 214	0.0092	0.0092		0.0061	nc	Yes	Exceeds PRG
2-Butanone	78933	mg/L	6/ 242	0.00066	0.0051		0.7	nc	No	Max < PRG
Acetone	67641	mg/L	52/ 238	0.00083	0.016		0.55	nc	No	Max < PRG
Carbon Disulfide	75150	mg/L	13/ 242	0.00066	0.004		0.1	nc	No	Max < PRG

Table 2-3. Facility-Wide Chemicals of Potential Concern in Surface Water (continued)

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria run	EPA Tap Water PRG=10E-6, HQ=0.1	PRG Type	COPC?	Justification
Chloroform	67663	mg/L	7/ 244	0.00054	0.0021		0.00017	ca	Yes	Exceeds PRG
Chloromethane	74873	mg/L	4/ 244	0.0003	0.001		0.016	nc	No	Max < PRG
Dimethylbenzene	1330207	mg/L	1/ 214	0.0017	0.0017		0.021	nc	No	Max < PRG
Methylene Chloride	75092	mg/L	21/ 240	0.0018	0.012		0.0043	ca	Yes	Exceeds PRG
Styrene	100425	mg/L	1/ 244	0.0011	0.0011		0.16	nc	No	Max < PRG
Tetrachloroethene	127184	mg/L	1/ 244	0.0006	0.0006		0.0001	ca	Yes	Exceeds PRG
Toluene	108883	mg/L	28/ 244	0.00049	0.064		0.072	nc	No	Max < PRG
Trichloroethene	79016	mg/L	5/ 244	0.00046	0.011		0.000028	ca	Yes	Exceeds PRG
<i>cis</i> -1,2-Dichloroethene	156592	mg/L	1/ 123	0.009	0.009		0.0061	nc	Yes	Exceeds PRG

- 1 ca = Carcinogenic.  
2 CAS = Chemical Abstracts Service.  
3 COPC = Chemical of potential concern.  
4 EPA = U. S. Environmental Protection Agency.  
5 HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.  
6 HQ = Hazard quotient.  
7 nc = Non-carcinogenic.  
8 PCB = Polychlorinated biphenyl.  
9 PRG = Preliminary remediation goal.  
10 RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

Table 2-4. Facility-Wide Chemicals of Potential Concern in Sediment

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria	Max. > Bkg.?	EPA Region 9 Res. Soil PRG (HQ=1,10E-6)	PRG Type	COPC?	Justification
<i>Inorganics</i>											
Aluminum	7429905	mg/kg	498/ 498	214	34,800	13,900	Yes	7,600	nc	Yes	Max Detect >PRG
Antimony	7440360	mg/kg	139/ 451	0.086	8,120	0	Yes	3.1	nc	Yes	Max Detect >PRG
Arsenic	7440382	mg/kg	508/ 509	1.3	418	19.5	Yes	0.39	ca	Yes	Max Detect >PRG
Barium	7440393	mg/kg	509/ 509	6.4	2,170	123	Yes	540	nc	Yes	Max Detect >PRG
Beryllium	7440417	mg/kg	294/ 458	0.064	2.5	0.38	Yes	15	nc	No	Max Detect < Risk Criteria
Cadmium	7440439	mg/kg	317/ 509	0.032	67.9	0	Yes	3.7	nc	Yes	Max Detect >PRG
Calcium	7440702	mg/kg	456/ 458	278	130,000	5,510	Yes	1,000,000		No	Max Detect < Risk Criteria
Chromium	7440473	mg/kg	506/ 507	1.6	4,000	18.1	Yes	22	nc	Yes	Max Detect >PRG
Chromium, hexavalent	18540299	mg/kg	37/ 109	1	33		None	22	nc	Yes	Max Detect >PRG
Cobalt	7440484	mg/kg	451/ 458	1.1	115	9.1	Yes	140	nc	No	Max Detect < Risk Criteria
Copper	7440508	mg/kg	458/ 458	1.8	1,140	27.6	Yes	310	nc	Yes	Max Detect >PRG
Cyanide	57125	mg/kg	22/ 254	0.1	8.3	0	Yes	120	nc	No	Max Detect < Risk Criteria
Iron	7439896	mg/kg	458/ 458	1,200	331,000	28,200	Yes	2,300	nc	Yes	Max Detect >PRG
Lead	7439921	mg/kg	508/ 509	1.6	24,800	27.4	Yes	400	nc	Yes	Max Detect >PRG
Magnesium	7439954	mg/kg	457/ 458	362	58,000	2,760	Yes	1,000,000		No	Max Detect < Risk Criteria
Manganese	7439965	mg/kg	508/ 509	21.8	30,500	1,950	Yes	180	nc	Yes	Max Detect >PRG
Mercury	7439976	mg/kg	346/ 507	0.0091	35	0.059	Yes	2.3	nc	Yes	Max Detect >PRG
Nickel	7440020	mg/kg	455/ 458	2.6	305	17.7	Yes	160	nc	Yes	Max Detect >PRG
Selenium	7782492	mg/kg	211/ 509	0.22	8.2	1.7	Yes	39	nc	No	Max Detect < Risk Criteria
Silver	7440224	mg/kg	113/ 509	0.045	534	0	Yes	39	nc	Yes	Max Detect >PRG
Thallium	7440280	mg/kg	152/ 378	0.18	3.6	0.89	Yes	0.52	nc	Yes	Max Detect >PRG
Vanadium	7440622	mg/kg	457/ 458	1.6	51	26.1	Yes	7.8	nc	Yes	Max Detect >PRG
Zinc	7440666	mg/kg	506/ 509	11.4	18,400	532	Yes	2,300	nc	Yes	Max Detect >PRG
<i>Organics</i>											
<i>Explosives/Propellants</i>											
1,3,5-Trinitrobenzene	99354	mg/kg	8/ 402	0.071	0.45	0	Yes	180	nc	No	Max Detect < Risk Criteria
1,3-Dinitrobenzene	99650	mg/kg	6/ 402	0.03	0.11	0	Yes	0.61	nc	No	Max Detect < Risk Criteria
2,4,6-Trinitrotoluene	118967	mg/kg	61/ 402	0.021	310	0	Yes	3.1	nc	Yes	Max Detect >PRG
2,4-Dinitrotoluene	121142	mg/kg	19/ 402	0.033	2	0	Yes	0.72	ca	Yes	Max Detect >PRG
2,6-Dinitrotoluene	606202	mg/kg	13/ 402	0.076	0.28	0	Yes	0.72	ca	No	Max Detect < Risk Criteria
2-Amino-4,6-dinitrotoluene	35572782	mg/kg	18/ 126	0.073	23	0	Yes			Yes	No Screening Criteria
2-Nitrotoluene	88722	mg/kg	2/ 402	0.07	0.23	0	Yes	0.88	ca	No	Max Detect < Risk Criteria
3-Nitrotoluene	99081	mg/kg	8/ 402	0.071	0.16	0	Yes	73	nc	No	Max Detect < Risk Criteria
4-Amino-2,6-dinitrotoluene	19406510	mg/kg	20/ 126	0.054	15	0	Yes			Yes	No Screening Criteria
4-Nitrotoluene	99990	mg/kg	7/ 402	0.07	0.22	0	Yes	12	ca	No	Max Detect < Risk Criteria

Table 2-4. Facility-Wide Chemicals of Potential Concern in Sediment (continued)

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria	Max. > Bkg.?	EPA Region 9 Res. Soil PRG (HQ=.1,10E-6)	PRG Type	COPC?	Justification
HMX	2691410	mg/kg	18/ 402	0.11	600	0	Yes	310	nc	Yes	Max Detect >PRG
Nitrobenzene	98953	mg/kg	25/ 402	0.038	0.38	0	Yes	2	nc	No	Max Detect < Risk Criteria
Nitrocellulose	9004700	mg/kg	62/ 161	0.43	700	0	Yes			Yes	No Screening Criteria
Nitroglycerin	55630	mg/kg	4/ 275	20	49	0	Yes	35	ca	Yes	Max Detect >PRG
Nitroguanidine	556887	mg/kg	5/ 166	0.035	0.16	0	Yes	610	nc	No	Max Detect < Risk Criteria
RDX	121824	mg/kg	5/ 402	0.18	2,100	0	Yes	4.4	ca	Yes	Max Detect >PRG
<i>Semivolatile Organic Compounds</i>											
1,2,4-Trichlorobenzene	120821	mg/kg	1/ 250	0.064	0.064	0	Yes	6.2	nc	No	Max Detect < Risk Criteria
1,2-Dichlorobenzene	95501	mg/kg	2/ 239	0.089	0.092	0	Yes	110	nc	No	Max Detect < Risk Criteria
2-Methylnaphthalene	91576	mg/kg	16/ 294	0.004	1.6	0	Yes	5.6	nc	No	Max Detect < Risk Criteria
4-Methylphenol	106445	mg/kg	9/ 293	0.056	0.51	0	Yes	31	nc	No	Max Detect < Risk Criteria
Acenaphthene	83329	mg/kg	7/ 294	0.088	1.4	0	Yes	370	nc	No	Max Detect < Risk Criteria
Acenaphthylene	208968	mg/kg	4/ 294	0.0018	0.31	0	Yes	370	nc	No	Max Detect < Risk Criteria
Anthracene	120127	mg/kg	20/ 294	0.0031	2.6	0	Yes	2,200	nc	No	Max Detect < Risk Criteria
Benz(a)anthracene	56553	mg/kg	70/ 294	0.0052	9.5	0	Yes	0.62	ca	Yes	Max Detect >PRG
Benzo(a)pyrene	50328	mg/kg	71/ 294	0.0062	15	0	Yes	0.062	ca	Yes	Max Detect >PRG
Benzo(b)fluoranthene	205992	mg/kg	85/ 294	0.0058	14	0	Yes	0.62	ca	Yes	Max Detect >PRG
Benzo(g,h,i)perylene	191242	mg/kg	42/ 294	0.013	11	0	Yes	6.2	ca	Yes	Max Detect >PRG
Benzo(k)fluoranthene	207089	mg/kg	40/ 294	0.019	19	0	Yes	6.2	ca	Yes	Max Detect >PRG
Benzoic Acid	65850	mg/kg	2/ 55	0.24	0.3	0	Yes	24,000	nc	No	Max Detect < Risk Criteria
Bis(2-ethylhexyl)phthalate	117817	mg/kg	46/ 294	0.032	1.9	0	Yes	35	ca	No	Max Detect < Risk Criteria
Butyl benzyl phthalate	85687	mg/kg	3/ 294	0.0088	0.087	0	Yes	1,200	nc	No	Max Detect < Risk Criteria
Carbazole	86748	mg/kg	11/ 294	0.066	3	0	Yes	24	ca	No	Max Detect < Risk Criteria
Chrysene	218019	mg/kg	78/ 294	0.0081	15	0	Yes	62	ca	No	Max Detect < Risk Criteria
Di-n-butyl phthalate	84742	mg/kg	23/ 294	0.038	16	0	Yes	610	nc	No	Max Detect < Risk Criteria
Dibenz(a,h)anthracene	53703	mg/kg	9/ 294	0.043	5.4	0	Yes	0.062	ca	Yes	Max Detect >PRG
Dibenzofuran	132649	mg/kg	6/ 294	0.11	0.5	0	Yes	15	nc	No	Max Detect < Risk Criteria
Fluoranthene	206440	mg/kg	101/ 294	0.014	30	0	Yes	230	nc	No	Max Detect < Risk Criteria
Fluorene	86737	mg/kg	9/ 294	0.073	1.1	0	Yes	270	nc	No	Max Detect < Risk Criteria
Indeno(1,2,3-cd)pyrene	193395	mg/kg	44/ 294	0.0043	9.9	0	Yes	0.62	ca	Yes	Max Detect >PRG
N-Nitrosodiphenylamine	86306	mg/kg	2/ 294	0.085	0.62	0	Yes	99	ca	No	Max Detect < Risk Criteria
Naphthalene	91203	mg/kg	8/ 294	0.06	0.97	0	Yes	5.6	nc	No	Max Detect < Risk Criteria
Phenanthrene	85018	mg/kg	59/ 294	0.02	13	0	Yes	230	nc	No	Max Detect < Risk Criteria
Phenol	108952	mg/kg	1/ 293	0.16	0.16	0	Yes	1,800	nc	No	Max Detect < Risk Criteria
Pyrene	129000	mg/kg	85/ 294	0.011	25	0	Yes	230	nc	No	Max Detect < Risk Criteria
<i>Pesticides/Herbicides</i>											
4,4'-DDD	72548	mg/kg	8/ 161	0.00053	0.026	0	Yes	2.4	ca	No	Max Detect < Risk Criteria

Table 2-4. Facility-Wide Chemicals of Potential Concern in Sediment (continued)

Analyte	CAS Number	Units	Results >Detection Limit	Minimum Detect	Maximum Detect	Background Criteria	Max. > Bkg.?	EPA Region 9 Res. Soil PRG (HQ=.1,10E-6)	PRG Type	COPC?	Justification
4,4'-DDE	72559	mg/kg	18/ 161	0.00052	0.13	0	Yes	1.7	ca	No	Max Detect < Risk Criteria
4,4'-DDT	50293	mg/kg	3/ 150	0.0016	0.0065	0	Yes	1.7	ca	No	Max Detect < Risk Criteria
Dieldrin	60571	mg/kg	6/ 161	0.00041	0.058	0	Yes	0.03	ca	Yes	Max Detect >PRG
Endosulfan I	959988	mg/kg	1/ 161	0.00052	0.00052	0	Yes	37	nc	No	Max Detect < Risk Criteria
Endosulfan Sulfate	1031078	mg/kg	1/ 161	0.0045	0.0045	0	Yes	37	nc	No	Max Detect < Risk Criteria
Endrin	72208	mg/kg	4/ 150	0.00055	0.022	0	Yes	1.8	nc	No	Max Detect < Risk Criteria
Endrin Aldehyde	7421934	mg/kg	4/ 161	0.0018	0.072	0	Yes	1.8	nc	No	Max Detect < Risk Criteria
Endrin Ketone	53494705	mg/kg	2/ 161	0.01	0.019	0	Yes	1.8	nc	No	Max Detect < Risk Criteria
Heptachlor	76448	mg/kg	2/ 161	0.0019	0.0034	0	Yes	0.11	ca	No	Max Detect < Risk Criteria
Heptachlor Epoxide	1024573	mg/kg	2/ 161	0.00057	0.037	0	Yes	0.053	ca	No	Max Detect < Risk Criteria
Lindane	58899	mg/kg	2/ 161	0.00086	0.013	0	Yes	0.44	ca	No	Max Detect < Risk Criteria
Methoxychlor	72435	mg/kg	7/ 161	0.00094	0.0073	0	Yes	31	nc	No	Max Detect < Risk Criteria
alpha-Chlordane	5103719	mg/kg	1/ 161	11	11	0	Yes	1.6	ca	Yes	Max Detect >PRG
beta-BHC	319857	mg/kg	7/ 161	0.00066	0.12	0	Yes	0.32	ca	No	Max Detect < Risk Criteria
gamma-Chlordane	5103742	mg/kg	5/ 161	0.0061	10	0	Yes	1.6	ca	Yes	Max Detect >PRG
<i>Polychlorinated Biphenyls</i>											
PCB-1016	12674112	mg/kg	2/ 233	0.1	3.3	0	Yes	0.39	nc	Yes	Max Detect >PRG
PCB-1248	12672296	mg/kg	1/ 233	0.09	0.09	0	Yes	0.11	nc	No	Max Detect < Risk Criteria
PCB-1254	11097691	mg/kg	33/ 233	0.031	260	0	Yes	0.11	nc	Yes	Max Detect >PRG
PCB-1260	11096825	mg/kg	6/ 227	0.032	0.22	0	Yes	0.11	nc	Yes	Max Detect >PRG
<i>Volatile Organic Compounds</i>											
1,2-Dichloroethene	540590	mg/kg	3/ 139	0.0022	0.01	0	Yes	4.3	nc	No	Max Detect < Risk Criteria
2-Butanone	78933	mg/kg	61/ 204	0.0042	0.11	0	Yes	2,200	nc	No	Max Detect < Risk Criteria
Acetone	67641	mg/kg	111/ 203	0.003	0.54	0	Yes	1,400	nc	No	Max Detect < Risk Criteria
Benzene	71432	mg/kg	1/ 204	0.0018	0.0018	0	Yes	0.64	ca	No	Max Detect < Risk Criteria
Carbon Disulfide	75150	mg/kg	5/ 193	0.0023	0.013	0	Yes	36	nc	No	Max Detect < Risk Criteria
Chloroform	67663	mg/kg	2/ 204	0.002	0.005	0	Yes	0.22	ca	No	Max Detect < Risk Criteria
Chloromethane	74873	mg/kg	2/ 204	0.003	0.004	0	Yes	4.7	nc	No	Max Detect < Risk Criteria
Dimethylbenzene	1330207	mg/kg	1/ 149	0.003	0.003	0	Yes	27	nc	No	Max Detect < Risk Criteria
Methylene Chloride	75092	mg/kg	52/ 204	0.00073	0.048	0	Yes	9.1	ca	No	Max Detect < Risk Criteria
Toluene	108883	mg/kg	30/ 204	0.0011	3.7	0	Yes	66	nc	No	Max Detect < Risk Criteria
Trichloroethene	79016	mg/kg	3/ 193	0.0012	0.012	0	Yes	0.053	ca	No	Max Detect < Risk Criteria

1 Bkg. = Background.  
2 ca = Carcinogenic.  
3 CAS = Chemical Abstracts Service.  
4 COPC = Chemical of potential concern.  
5 EPA = U. S. Environmental Protection Agency.

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.  
HQ = Hazard quotient.  
nc = Non-carcinogenic.  
PCB = Polychlorinated biphenyl.  
PRG = Preliminary remediation goal.

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.  
Res. = Residential.

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### 3.0 EXPOSURE ASSESSMENT CONSIDERATIONS IN CLEANUP GOAL DEVELOPMENT

This chapter summarizes RVAAP land uses and receptors that were considered in the development of CUGs. Much of the information summarized herein is presented in detail in the Risk Manual.

When the RVAAP IRP began in 1989, RVAAP was identified as a 21,419-acre installation. The property boundary was resurveyed by OHARNG over a 2-year period (2002 and 2003) and the actual total acreage of the property was found to be 21,683.289 acres. As of February 2006, a total of 20,403 acres of the former 21,683-acre RVAAP have been transferred to NGB and subsequently licensed to OHARNG for use as a military training site [Ravenna Training and Logistics Site (RTLS)]. When RVAAP was operational, RTLS did not exist and the entire 21,683-acre parcel was a government-owned, contractor-operated industrial facility. The RVAAP IRP encompasses investigation and cleanup of contamination from past activities over the entire 21,683 acres of the former RVAAP. The current RVAAP consists of the 1,280 acres that include AOCs. At present, workers infrequently visit the RVAAP AOCs for maintenance purposes, such as mowing; to conduct environmental investigations; and to perform remediation activities. As cleanup of the AOCs is completed, they will also be transferred to OHARNG.

Under the current and future planned land use for RVAAP, the Risk Manual identified human receptors and exposure pathways that must be evaluated in RVAAP risk assessments. The identified receptors include:

- Security and Maintenance Personnel,
- National Guard – Fire/Dust Suppression Worker,
- National Guard Trainee,
- Resident Farmer,
- Trespasser Adult/Juvenile, and
- Recreators – Hunter/Trapper/Fisher.

Based on review of National Guard training activities, there will be mounted versus dismounted, and digging versus no digging activities at the site. In all cases, the National Guard Trainee is exposed to surface soil (considered to be 0 – 4 ft BGS due to the use of tracked vehicles). In cases where there will be dismounted/digging activities, the National Guard Trainee is also exposed to subsurface soil (4 to 7 ft BGS).

As planning for OHARNG training activities progressed, two additional training activities were identified that were not covered in the RVAAP Risk Manual. These activities include:

- National Guard Engineering School training, and
- National Guard Small Arms Range maintenance.

Table 3-1 summarizes the complete set of receptors and exposure pathways that are being considered in the development of the facility-wide CUGs. The exposure models for the initial six receptors used to estimate the amount of a chemical that humans may ingest or absorb are presented in the Risk Manual. The detailed exposure parameters for the six receptors are also presented in the Risk Manual. The detailed exposure parameter values for the two additional receptors, the Engineering School Instructor and the Small Arms Range Maintenance Soldier, are presented in a White Paper (included herein as Appendix A). As indicated in Table 3-1, CUGs for one soil exposure pathway, “ingestion of foodstuffs/crops,” are being

**Table 3-1. Exposure Pathways Considered for Cleanup Goal Development**

<b>Exposure Pathways</b>	<b>Trespasser Adult/Juvenile</b>	<b>National Guard Engineering School Instructor</b>	<b>Recreators – Hunter/Trapper/Fisher</b>	<b>National Guard – Fire/Dust Suppression Worker</b>	<b>Range Maintenance Soldier</b>	<b>National Guard Trainee<sup>a</sup></b>	<b>Resident Farmer</b>	<b>Security Guard/Maintenance Personnel</b>
<b><i>Surface Soil</i></b>								
Incidental Ingestion	X	X	X	X	X	X	X	X
Dermal Contact	X	X	X	X	X	X	X	X
Inhalation of VOCs and Dust	X	X	X	X	X	X	X	X
Ingestion of Foodstuffs/Crops							O	
<b><i>Subsurface Soil</i></b>								
Incidental Ingestion		X				X	X	
Dermal Contact		X				X	X	
Inhalation		X				X	X	
<b><i>Groundwater</i></b>								
Drinking Water Ingestion						X	X	
Dermal Contact while Showering						X	X	
Inhalation of VOCs during Household Water Use						X	X	
<b><i>Surface Water</i></b>								
Ingestion (drinking water, incidental)	X		X	X		X	X	
Dermal Contact while Swimming/Wading	X		X	X		X	X	
Inhalation of VOCs	X		X	X		X	X	
Ingestion of Fish			X					
<b><i>Sediment</i></b>								
Incidental Ingestion	X		X	X		X	X	
Dermal Contact	X		X	X		X	X	
Inhalation of VOCs and Dust	X		X	X		X	X	
Ingestion of Fish			X					

<sup>a</sup> The National Guard Trainee scenario presented herein represents the “dismounted training – digging” scenario, which assumes digging activities and thus exposure to both surface and subsurface soil. Unless detailed training land use requirements are well understood, this is the default scenario for the National Guard trainee.

Mounted/Dismounted Training – Digging (7’): Direct contact is permitted with soil and water from the surface to 7 ft below ground surface (BGS) 24 hr/day, 24 days/year on inactive duty training and/or 24 hr/day, 15 days/year during annual training with no ill effect to the soldier. Digging and occupying fighting positions to 7 ft BGS is permitted (IAW STP 21-1-SMCT, Oct 94, pp 245-255). Tracked and wheeled operations are permitted only as directed in Section 16, AGO Pam 210-1.

Mounted/Dismounted Training – No Digging: Direct contact is permitted with soil and/or water 24 hr/day, 24 days/year on inactive duty training and/or 24 hr/day, 15 days/year during annual training with no ill effect to the soldier. All digging is prohibited in this area. Digging and occupying fighting positions, tank defilade positions, tank ditches, and battle positions that extend BGS is prohibited. Exposures are expected to occur down to 4 ft BGS due to track disturbances of soil. Tracked and wheeled operations are permitted only as directed in Section 16, AGO Pam 210-1.

O = Pathway evaluated separately from other pathways identified for this media, thus resulting in two sets of cleanup goals: (1) without foodstuff, and (2) foodstuff exposure.

VOC = Volatile organic compound.

X = Pathway evaluated.



1 evaluated and presented separately from the other soil exposure pathways. As discussed with Ohio EPA,  
2 these food ingestion-based values could be applied on a case-by-case basis but are not considered part of  
3 the default approach.

4 Table 3-2 summarizes all exposure parameters used to develop the CUGs, many of which come directly  
5 from the Risk Manual (USACE 2005). The footnotes in Table 3-2 also come directly from the  
6 Risk Manual.

Table 3-2. Exposure Factors for Receptors at RVAAP, Facility-Wide

Parameter	Units	Security Guard/ Maintenance Worker	National Guard			Engineering School Instructor*	Resident Farmer		Hunter/ Trapper	Fisher Recreator	Trespasser	
			Dust/Fire Control Worker	Trainee	Range Maintenance Soldier		Adult	Child			Adult	Juvenile
<i>Surface Soil</i>												
<b>Incidental ingestion</b>												
Soil ingestion rate	kg/day	0.0001 <sup>a</sup>	0.0001 <sup>a</sup>	0.0001 <sup>a</sup>	0.0001 <sup>a</sup>	0.0001 <sup>a</sup>	0.0001 <sup>a</sup>	0.0002 <sup>a</sup>	0.0001 <sup>a</sup>	0.0001 <sup>a</sup>	0.0001 <sup>a</sup>	0.0002 <sup>a</sup>
Exposure time	hr/day	1 <sup>b</sup>	4 <sup>b</sup>	24 <sup>b</sup>	6	9.5	24 <sup>a</sup>	24 <sup>a</sup>	6 <sup>b</sup>	4 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>
Exposure frequency	days/year	250 <sup>a</sup>	15 <sup>b</sup>	39 <sup>b</sup>	85	180	350 <sup>a</sup>	350 <sup>a</sup>	2 <sup>b</sup>	5 <sup>b</sup>	75 <sup>b</sup>	50 <sup>b</sup>
Exposure duration	years	25 <sup>a</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25	25	30 <sup>a</sup>	6 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	10
Body weight	kg	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	15 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	45 <sup>a</sup>
Carcinogen averaging time	days	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>
Non-carcinogen averaging time	days	9125 <sup>a</sup>	9125 <sup>a</sup>	9125 <sup>a</sup>	9125 <sup>a</sup>	9125 <sup>a</sup>	10,950 <sup>a</sup>	2190 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	3650 <sup>a</sup>
Fraction ingested	unitless	1 <sup>b</sup>	1 <sup>b</sup>	1 <sup>b</sup>	1	1	1 <sup>b</sup>	1 <sup>b</sup>	1 <sup>b</sup>	1 <sup>b</sup>	1 <sup>b</sup>	1 <sup>b</sup>
Conversion factor	days/hr	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
<b>Dermal contact</b>												
Skin area	m <sup>2</sup> /event	0.33 <sup>d</sup>	0.33 <sup>d</sup>	0.33 <sup>d</sup>	0.33 <sup>d</sup>	0.33 <sup>d</sup>	0.57 <sup>d</sup>	0.22 <sup>i</sup>	0.57 <sup>d</sup>	0.57 <sup>d</sup>	0.57 <sup>d</sup>	0.815
Adherence factor	mg/cm <sup>2</sup>	0.7 <sup>c</sup>	0.3 <sup>c</sup>	0.3 <sup>c</sup>	0.3 <sup>c</sup>	0.3 <sup>c</sup>	0.4 <sup>c</sup>	0.2 <sup>i</sup>	0.3 <sup>c</sup>	0.3 <sup>c</sup>	0.4 <sup>c</sup>	0.2 <sup>i</sup>
Absorption fraction	unitless	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>
Exposure frequency	days/year	250 <sup>a</sup>	15 <sup>b</sup>	39 <sup>b</sup>	85	180	350 <sup>a</sup>	350 <sup>a</sup>	2 <sup>b</sup>	5 <sup>b</sup>	75 <sup>a</sup>	50 <sup>a</sup>
Exposure duration	years	25 <sup>a</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25	25	30 <sup>a</sup>	6 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	10
Body weight	kg	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	15 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	45 <sup>a</sup>
Carcinogen averaging time	days	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>
Non-carcinogen averaging time	days	9125 <sup>a</sup>	9125 <sup>a</sup>	9125 <sup>a</sup>	9125 <sup>a</sup>	9125 <sup>a</sup>	10,950 <sup>a</sup>	2190 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	3650 <sup>a</sup>
Conversion factor	(kg-cm <sup>2</sup> )/ (mg-m <sup>2</sup> )	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
<b>Inhalation of VOCs and dust</b>												
Inhalation rate	m <sup>3</sup> /day	20 <sup>a</sup>	44.4 <sup>i</sup>	44.4 <sup>i</sup>	19.5	19.8	20 <sup>a</sup>	10 <sup>a</sup>	20 <sup>a</sup>	20 <sup>a</sup>	20 <sup>a</sup>	20 <sup>a</sup>
Exposure time	hr/day	1 <sup>b</sup>	4 <sup>b</sup>	24 <sup>b</sup>	6	9.5	24 <sup>a</sup>	24 <sup>a</sup>	6 <sup>b</sup>	4 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>
Exposure frequency	days/year	250 <sup>a</sup>	15 <sup>b</sup>	39 <sup>b</sup>	85	180	350 <sup>a</sup>	350 <sup>a</sup>	2 <sup>b</sup>	5 <sup>b</sup>	75 <sup>a</sup>	50 <sup>a</sup>
Precipitation modifying factor	unitless	NA	NA	NA	NA	0.68	NA	NA	NA	NA	NA	NA
Exposure duration	years	25 <sup>a</sup>	25 <sup>b</sup>	25 <sup>b</sup>	25	25	30 <sup>a</sup>	6 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	10
Body weight	kg	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	15 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	45 <sup>a</sup>
Carcinogen averaging time	days	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>
Non-carcinogen averaging time	days	9125 <sup>a</sup>	9125 <sup>a</sup>	9125 <sup>a</sup>	9125 <sup>a</sup>	9125 <sup>a</sup>	10,950 <sup>a</sup>	2190 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	3650 <sup>a</sup>
Particulate emission factor	m <sup>3</sup> /day	9.24E+08	9.24E+08	1.67E+06	9.24E+08	1.67E+06	9.24E+08	9.24E+08	9.24E+08	9.24E+08	9.24E+08	9.24E+08
Conversion factor	days/hr	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042
<i>Subsurface Soil</i>												
<b>Incidental ingestion</b>												
Soil ingestion rate	kg/day	NA	NA	0.0001 <sup>a</sup>	NA	NA	0.0001 <sup>a</sup>	0.0002 <sup>a</sup>	NA	NA	NA	NA
Exposure time	hr/day	NA	NA	24 <sup>b</sup>	NA	NA	24 <sup>a</sup>	24 <sup>a</sup>	NA	NA	NA	NA
Exposure frequency	days/year	NA	NA	39 <sup>b</sup>	NA	NA	350 <sup>a</sup>	350 <sup>a</sup>	NA	NA	NA	NA
Exposure duration	years	NA	NA	25 <sup>b</sup>	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	NA	NA	NA	NA
Body weight	kg	NA	NA	70 <sup>a</sup>	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	NA	NA	NA	NA
Carcinogen averaging time	days	NA	NA	25,550 <sup>a</sup>	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	NA	NA

Table 3-2. Exposure Factors for Receptors at RVAAP Facility Wide (continued)

Parameter	Units	Security Guard/Maintenance Worker	National Guard			Engineering School Instructor*	Resident Farmer		Hunter/Trapper	Fisher Recreator	Trespasser	
			Dust/Fire Control Worker	Trainee	Range Maintenance Soldier		Adult	Child			Adult	Juvenile
Non-carcinogen averaging time	days	NA	NA	9125 <sup>a</sup>	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	NA	NA	NA	NA
Fraction ingested	unitless	NA	NA	1 <sup>b</sup>	NA	NA	1 <sup>b</sup>	1 <sup>b</sup>	NA	NA	NA	NA
Conversion factor	days/hr	NA	NA	0.042	NA	NA	0.042	0.042	NA	NA	NA	NA
<b>Dermal contact</b>												
Skin area	m <sup>2</sup> /event	NA	NA	0.33 <sup>d</sup>	NA	NA	0.57 <sup>d</sup>	0.22 <sup>f</sup>	NA	NA	NA	NA
Adherence factor	mg/cm <sup>2</sup>	NA	NA	0.3 <sup>c</sup>	NA	NA	0.4 <sup>c</sup>	0.2 <sup>f</sup>	NA	NA	NA	NA
Absorption fraction	unitless	NA	NA	chem. spec. <sup>p</sup>	NA	NA	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>	NA	NA	NA	NA
Exposure frequency	days/year	NA	NA	39 <sup>b</sup>	NA	NA	350 <sup>a</sup>	350 <sup>a</sup>	NA	NA	NA	NA
Exposure duration	years	NA	NA	25 <sup>b</sup>	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	NA	NA	NA	NA
Body weight	kg	NA	NA	70 <sup>a</sup>	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	NA	NA	NA	NA
Carcinogen averaging time	days	NA	NA	25,550 <sup>a</sup>	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	NA	NA
Non-carcinogen averaging time	days	NA	NA	9125 <sup>a</sup>	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	NA	NA	NA	NA
Conversion factor	(kg-cm <sup>2</sup> )/(mg-m <sup>2</sup> )	NA	NA	0.01	NA	NA	0.01	0.01	NA	NA	NA	NA
<b>Inhalation of VOCs and dust</b>												
Inhalation rate	m <sup>3</sup> /day	NA	NA	44.4 <sup>f</sup>	NA	NA	20 <sup>g</sup>	10 <sup>g</sup>	NA	NA	NA	NA
Exposure time	hr/day	NA	NA	24 <sup>b</sup>	NA	NA	24 <sup>a</sup>	24 <sup>a</sup>	NA	NA	NA	NA
Exposure frequency	days/year	NA	NA	39 <sup>b</sup>	NA	NA	350 <sup>a</sup>	350 <sup>a</sup>	NA	NA	NA	NA
Exposure duration	years	NA	NA	25 <sup>b</sup>	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	NA	NA	NA	NA
Body weight	kg	NA	NA	70 <sup>a</sup>	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	NA	NA	NA	NA
Carcinogen averaging time	days	NA	NA	25,550 <sup>a</sup>	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	NA	NA
Non-carcinogen averaging time	days	NA	NA	9125 <sup>a</sup>	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	NA	NA	NA	NA
Particulate emission factor	m <sup>3</sup> /day	NA	NA	1.67E+06	NA	NA	9.24E+08	9.24E+08	NA	NA	NA	NA
Conversion factor	days/hr	NA	NA	0.042	NA	NA	0.042	0.042	NA	NA	NA	NA
<i>Sediment</i>												
<b>Incidental ingestion</b>												
Soil ingestion rate	kg/day	NA	0.0001 <sup>a</sup>	0.0001 <sup>a</sup>	NA	NA	0.0001 <sup>a</sup>	0.0002 <sup>a</sup>	0.0001 <sup>a</sup>	0.0001 <sup>a</sup>	0.0001 <sup>a</sup>	0.0002 <sup>a</sup>
Exposure time	hr/day	NA	4 <sup>b</sup>	24 <sup>b</sup>	NA	NA	24 <sup>a</sup>	24 <sup>a</sup>	6 <sup>b</sup>	4 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>
Exposure frequency	days/year	NA	15 <sup>b</sup>	39 <sup>b</sup>	NA	NA	350 <sup>a</sup>	350 <sup>a</sup>	2 <sup>b</sup>	5 <sup>b</sup>	75 <sup>b</sup>	50 <sup>b</sup>
Exposure duration	years	NA	25 <sup>b</sup>	25 <sup>b</sup>	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	10
Body weight	kg	NA	70 <sup>a</sup>	70 <sup>a</sup>	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	45 <sup>a</sup>
Carcinogen averaging time	days	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>
Non-carcinogen averaging time	days	NA	9125 <sup>a</sup>	9125 <sup>a</sup>	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	3650 <sup>a</sup>
Fraction ingested	unitless	NA	1 <sup>b</sup>	1 <sup>b</sup>	NA	NA	1 <sup>b</sup>	1 <sup>b</sup>	1 <sup>b</sup>	1 <sup>b</sup>	1 <sup>b</sup>	1 <sup>b</sup>
Conversion factor	days/hr	NA	0.042	0.042	NA	NA	0.042	0.042	0.042	0.042	0.042	0.042
<b>Dermal contact</b>												
Skin area	m <sup>2</sup> /event	NA	0.33 <sup>d</sup>	0.33 <sup>d</sup>	NA	NA	0.57 <sup>d</sup>	0.22 <sup>f</sup>	0.52 <sup>d</sup>	0.52 <sup>d</sup>	0.57 <sup>d</sup>	0.815
Adherence factor	mg/cm <sup>2</sup>	NA	0.3 <sup>c</sup>	0.3 <sup>c</sup>	NA	NA	0.4 <sup>c</sup>	0.2 <sup>f</sup>	0.3 <sup>c</sup>	0.3 <sup>c</sup>	0.4 <sup>c</sup>	0.2 <sup>f</sup>
Absorption fraction	unitless	NA	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>	NA	NA	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>	chem. spec. <sup>p</sup>
Exposure frequency	days/year	NA	15 <sup>b</sup>	39 <sup>b</sup>	NA	NA	350 <sup>a</sup>	350 <sup>a</sup>	2 <sup>b</sup>	5 <sup>b</sup>	75 <sup>b</sup>	50 <sup>b</sup>

Table 3-2. Exposure Factors for Receptors at RVAAP Facility Wide (continued)

Parameter	Units	Security Guard/Maintenance Worker	National Guard			Engineering School Instructor*	Resident Farmer		Hunter/Trapper	Fisher Recreator	Trespasser	
			Dust/Fire Control Worker	Trainee	Range Maintenance Soldier		Adult	Child			Adult	Juvenile
Exposure duration	years	NA	25 <sup>b</sup>	25 <sup>b</sup>	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	10
Body weight	kg	NA	70 <sup>a</sup>	70 <sup>a</sup>	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	45 <sup>a</sup>
Carcinogen averaging time	days	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>
Non-carcinogen averaging time	days	NA	9125 <sup>a</sup>	9125 <sup>a</sup>	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	3650 <sup>a</sup>
Conversion factor	(kg-cm <sup>2</sup> )/(mg-m <sup>2</sup> )	NA	0.01	0.01	NA	NA	0.01	0.01	0.01	0.01	0.01	0.01
<b>Inhalation of VOCs and dust</b>												
Inhalation rate	m <sup>3</sup> /day	NA	44.4 <sup>i</sup>	44.4 <sup>i</sup>	NA	NA	20 <sup>a</sup>	10 <sup>a</sup>	20 <sup>a</sup>	20 <sup>a</sup>	20 <sup>a</sup>	20 <sup>a</sup>
Exposure time	hr/day	NA	4 <sup>b</sup>	24 <sup>b</sup>	NA	NA	24 <sup>a</sup>	24 <sup>a</sup>	6 <sup>b</sup>	4 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>
Exposure frequency	days/year	NA	15 <sup>b</sup>	39 <sup>b</sup>	NA	NA	350 <sup>a</sup>	350 <sup>a</sup>	2 <sup>b</sup>	5 <sup>b</sup>	75 <sup>b</sup>	50 <sup>b</sup>
Exposure duration	years	NA	25 <sup>b</sup>	25 <sup>b</sup>	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	10
Body weight	kg	NA	70 <sup>a</sup>	70 <sup>a</sup>	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	45 <sup>a</sup>
Carcinogen averaging time	days	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>
Non-carcinogen averaging time	days	NA	9125 <sup>a</sup>	9125 <sup>a</sup>	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	3650 <sup>a</sup>
Particulate emission factor	m <sup>3</sup> /day	NA	9.24E+08	1.67E+06	NA	NA	9.24E+08	9.24E+08	9.24E+08	9.24E+08	9.24E+08	9.24E+08
Conversion factor	days/hr	NA	0.042	0.042	NA	NA	0.042	0.042	0.042	0.042	0.042	0.042
<i>Surface Water</i>												
<b>Incidental ingestion while swimming/wading/showering</b>												
Incidental water ingestion rate	L/hr	NA	0.1 <sup>b</sup>	0.1 <sup>b</sup>	NA	NA	0.1 <sup>b</sup>	0.1 <sup>b</sup>	0.1 <sup>b</sup>	0.1 <sup>b</sup>	0.05 <sup>b</sup>	0.05 <sup>b</sup>
Exposure time	hr/day	NA	1	1	NA	NA	1	1	1	1	2	2
Exposure frequency	days/year	NA	15 <sup>b</sup>	39 <sup>b</sup>	NA	NA	350 <sup>a</sup>	350 <sup>a</sup>	2 <sup>b</sup>	5 <sup>b</sup>	75 <sup>b</sup>	50 <sup>b</sup>
Exposure duration	years	NA	25 <sup>b</sup>	25 <sup>b</sup>	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	10
Body weight	kg	NA	70 <sup>a</sup>	70 <sup>a</sup>	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	45 <sup>a</sup>
Carcinogen averaging time	days	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>
Non-carcinogen averaging time	days	NA	9125 <sup>a</sup>	9125 <sup>a</sup>	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	3650 <sup>a</sup>
<b>Dermal contact while swimming/wading/showering</b>												
Skin area	m <sup>2</sup>	NA	0.33 <sup>d</sup>	0.33 <sup>d</sup>	NA	NA	0.57 <sup>d</sup>	0.22 <sup>i</sup>	0.52 <sup>d</sup>	0.52 <sup>d</sup>	0.57 <sup>d</sup>	0.815
Exposure time	hr/day	NA	4 <sup>b</sup>	24 <sup>b</sup>	NA	NA	0.25 <sup>c</sup>	0.25 <sup>c</sup>	6 <sup>b</sup>	4 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>
Exposure frequency	days/year	NA	15 <sup>b</sup>	39 <sup>b</sup>	NA	NA	350 <sup>a</sup>	350 <sup>a</sup>	2 <sup>b</sup>	5 <sup>b</sup>	75 <sup>b</sup>	50 <sup>b</sup>
Exposure duration	years	NA	25 <sup>b</sup>	25 <sup>b</sup>	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	10
Body weight	kg	NA	70 <sup>a</sup>	70 <sup>a</sup>	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	45 <sup>a</sup>
Carcinogen averaging time	days	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>
Non-carcinogen averaging time	days	NA	9125 <sup>a</sup>	9125 <sup>a</sup>	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	3650 <sup>a</sup>
Conversion factor	(m/cm)/(L/m <sup>3</sup> )	NA	10	10	NA	NA	10	10	10	10	10	10
<b>Inhalation of VOCs</b>												
Inhalation rate	m <sup>3</sup> /day	NA	44.4 <sup>i</sup>	44.4 <sup>i</sup>	NA	NA	20 <sup>a</sup>	20 <sup>a</sup>	20 <sup>a</sup>	20 <sup>a</sup>	20 <sup>a</sup>	20 <sup>a</sup>
Exposure time	hr/day	NA	4 <sup>b</sup>	24 <sup>b</sup>	NA	NA	2 <sup>a</sup>	2 <sup>a</sup>	6 <sup>b</sup>	4 <sup>b</sup>	2 <sup>b</sup>	2 <sup>b</sup>
Exposure frequency	days/year	NA	15 <sup>b</sup>	39 <sup>b</sup>	NA	NA	350 <sup>a</sup>	350 <sup>a</sup>	2 <sup>b</sup>	5 <sup>b</sup>	75 <sup>b</sup>	50 <sup>b</sup>
Exposure duration	years	NA	25 <sup>b</sup>	25 <sup>b</sup>	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	30 <sup>a</sup>	10
Body weight	kg	NA	70 <sup>a</sup>	70 <sup>a</sup>	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	45 <sup>a</sup>
Carcinogen averaging time	days	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>

Table 3-2. Exposure Factors for Receptors at RVAAP Facility Wide (continued)

Parameter	Units	Security Guard/ Maintenance Worker	National Guard			Engineering School Instructor*	Resident Farmer		Hunter/ Trapper	Fisher Recreator	Trespasser	
			Dust/Fire Control Worker	Trainee	Range Maintenance Soldier		Adult	Child			Adult	Juvenile
Non-carcinogen averaging time	days	NA	9125 <sup>a</sup>	9125 <sup>a</sup>	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	3650 <sup>a</sup>
Conversion factor	days/hr	NA	0.042	0.042	NA	NA	0.042	0.042	0.042	0.042	0.042	0.042
Volatilization factor	1000 L/m <sup>3</sup>	NA	0.5	0.5	NA	NA	0.5	0.5	0.5	0.5	0.5	0.5
<i>Groundwater</i>												
<b>Drinking water ingestion</b>												
Drinking water ingestion rate	L/day	NA	NA	2 <sup>a</sup>	NA	NA	2 <sup>a</sup>	1.5 <sup>f</sup>	NA	NA	NA	NA
Exposure frequency	days/year	NA	NA	39 <sup>b</sup>	NA	NA	350 <sup>a</sup>	350 <sup>a</sup>	NA	NA	NA	NA
Exposure duration	years	NA	NA	25 <sup>b</sup>	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	NA	NA	NA	NA
Body weight	kg	NA	NA	70 <sup>a</sup>	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	NA	NA	NA	NA
Carcinogen averaging time	days	NA	NA	25,550 <sup>a</sup>	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	NA	NA
Non-carcinogen averaging time	days	NA	NA	9125 <sup>a</sup>	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	NA	NA	NA	NA
<b>Dermal contact while showering</b>												
Skin area	m <sup>2</sup>	NA	NA	1.94 <sup>g</sup>	NA	NA	1.94 <sup>g</sup>	0.866 <sup>g</sup>	NA	NA	NA	NA
Exposure time	hr/day	NA	NA	0.25 <sup>a</sup>	NA	NA	0.25 <sup>a</sup>	0.25 <sup>a</sup>	NA	NA	NA	NA
Exposure frequency	days/year	NA	NA	39 <sup>b</sup>	NA	NA	350 <sup>a</sup>	350 <sup>a</sup>	NA	NA	NA	NA
Exposure duration	years	NA	NA	25 <sup>b</sup>	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	NA	NA	NA	NA
Body weight	kg	NA	NA	70 <sup>a</sup>	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	NA	NA	NA	NA
Carcinogen averaging time	days	NA	NA	25,550 <sup>a</sup>	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	NA	NA
Non-carcinogen averaging time	days	NA	NA	9125 <sup>a</sup>	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	NA	NA	NA	NA
Conversion factor	(m/cm)/ (L/m <sup>3</sup> )	NA	NA	10	NA	NA	10	10	NA	NA	NA	NA
<b>Inhalation of VOCs during household water use</b>												
Inhalation rate	m <sup>3</sup> /day	NA	NA	20 <sup>a</sup>	NA	NA	20 <sup>a</sup>	10 <sup>a</sup>	NA	NA	NA	NA
Exposure frequency	days/year	NA	NA	39 <sup>b</sup>	NA	NA	350 <sup>a</sup>	350 <sup>a</sup>	NA	NA	NA	NA
Exposure duration	years	NA	NA	25 <sup>b</sup>	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	NA	NA	NA	NA
Body weight	kg	NA	NA	70 <sup>a</sup>	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	NA	NA	NA	NA
Carcinogen averaging time	days	NA	NA	25,550 <sup>a</sup>	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	NA	NA
Non-carcinogen averaging time	days	NA	NA	9125 <sup>a</sup>	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	NA	NA	NA	NA
Volatilization factor	1000 L/m <sup>3</sup>	NA	NA	0.5 <sup>a</sup>	NA	NA	0.5 <sup>a</sup>	0.5 <sup>a</sup>	NA	NA	NA	NA
<i>Ingestion of Foodstuffs</i>												
<b>Ingestion of venison</b>												
Conversion factor	unitless	NA	NA	NA	NA	NA	1.25	1.25	NA	NA	NA	NA
Browse ingestion rate	kg dry wt/day	NA	NA	NA	NA	NA	0.87 <sup>b</sup>	0.87 <sup>b</sup>	NA	NA	NA	NA
Fraction browse ingested from site	unitless	NA	NA	NA	NA	NA	1	1	NA	NA	NA	NA
Fat ratio (venison to beef)	unitless	NA	NA	NA	NA	NA	0.2	0.2	NA	NA	NA	NA
Venison ingestion rate	kg/day	NA	NA	NA	NA	NA	0.03 <sup>b</sup>	0.03 <sup>b</sup>	NA	NA	NA	NA
Fraction ingested	unitless	NA	NA	NA	NA	NA	1 <sup>b</sup>	1 <sup>b</sup>	NA	NA	NA	NA
Exposure frequency	days/year	NA	NA	NA	NA	NA	365 <sup>b</sup>	365 <sup>b</sup>	NA	NA	NA	NA
Exposure duration	years	NA	NA	NA	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	NA	NA	NA	NA
Body weight	kg	NA	NA	NA	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	NA	NA	NA	NA

Table 3-2. Exposure Factors for Receptors at RVAAP Facility Wide (continued)

Parameter	Units	Security Guard/Maintenance Worker	National Guard			Engineering School Instructor*	Resident Farmer		Hunter/Trapper	Fisher Recreator	Trespasser	
			Dust/Fire Control Worker	Trainee	Range Maintenance Soldier		Adult	Child			Adult	Juvenile
Carcinogen averaging time	days	NA	NA	NA	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	NA	NA
Non-carcinogen averaging time	days	NA	NA	NA	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	NA	NA	NA	NA
<b>Ingestion of beef</b>												
Resuspension multiplier	unitless	NA	NA	NA	NA	NA	0.25 <sup>i</sup>	0.25 <sup>i</sup>	NA	NA	NA	NA
Quantity of pasture ingested	kg dry wt/day	NA	NA	NA	NA	NA	7.2 <sup>j</sup>	7.2 <sup>j</sup>	NA	NA	NA	NA
Fraction of year cow is on-site	unitless	NA	NA	NA	NA	NA	1	1	NA	NA	NA	NA
Fraction of cow's food from on-site	unitless	NA	NA	NA	NA	NA	0.9 <sup>b</sup>	0.9 <sup>b</sup>	NA	NA	NA	NA
Quantity of soil ingested by cow	kg/day	NA	NA	NA	NA	NA	1 <sup>k</sup>	1 <sup>k</sup>	NA	NA	NA	NA
Beef ingestion rate	kg/day	NA	NA	NA	NA	NA	0.044 <sup>l</sup>	0.044 <sup>l</sup>	NA	NA	NA	NA
Fraction ingested	unitless	NA	NA	NA	NA	NA	1 <sup>b</sup>	1 <sup>b</sup>	NA	NA	NA	NA
Exposure frequency	days/year	NA	NA	NA	NA	NA	365 <sup>b</sup>	365 <sup>b</sup>	NA	NA	NA	NA
Exposure duration	years	NA	NA	NA	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	NA	NA	NA	NA
Body weight	kg	NA	NA	NA	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	NA	NA	NA	NA
Carcinogen averaging time	days	NA	NA	NA	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	NA	NA
Non-carcinogen averaging time	days	NA	NA	NA	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	NA	NA	NA	NA
<b>Ingestion of milk products</b>												
Resuspension multiplier	unitless	NA	NA	NA	NA	NA	0.25 <sup>i</sup>	0.25 <sup>i</sup>	NA	NA	NA	NA
Quantity of pasture ingested	kg dry wt/day	NA	NA	NA	NA	NA	16.1 <sup>j</sup>	16.1 <sup>j</sup>	NA	NA	NA	NA
Fraction of year cow is on-site	unitless	NA	NA	NA	NA	NA	1 <sup>b</sup>	1 <sup>b</sup>	NA	NA	NA	NA
Fraction of cow's food from on-site	unitless	NA	NA	NA	NA	NA	0.6 <sup>b</sup>	0.6 <sup>b</sup>	NA	NA	NA	NA
Quantity of soil ingested by cow	kg/day	NA	NA	NA	NA	NA	1 <sup>k</sup>	1 <sup>k</sup>	NA	NA	NA	NA
Milk ingestion rate	kg/day	NA	NA	NA	NA	NA	0.305 <sup>l</sup>	0.509 <sup>m</sup>	NA	NA	NA	NA
Fraction ingested	unitless	NA	NA	NA	NA	NA	1 <sup>b</sup>	1 <sup>b</sup>	NA	NA	NA	NA
Exposure frequency	days/year	NA	NA	NA	NA	NA	365 <sup>b</sup>	365 <sup>b</sup>	NA	NA	NA	NA
Exposure duration	years	NA	NA	NA	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	NA	NA	NA	NA
Body weight	kg	NA	NA	NA	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	NA	NA	NA	NA
Carcinogen averaging time	days	NA	NA	NA	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	NA	NA
Non-carcinogen averaging time	days	NA	NA	NA	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	NA	NA	NA	NA
<b>Ingestion of vegetables</b>												
Resuspension multiplier	unitless	NA	NA	NA	NA	NA	0.26 <sup>n</sup>	0.26 <sup>n</sup>	NA	NA	NA	NA
Vegetable ingestion rate	kg/day	NA	NA	NA	NA	NA	0.2 <sup>j</sup>	0.2 <sup>j</sup>	NA	NA	NA	NA
Fraction ingested	unitless	NA	NA	NA	NA	NA	0.4 <sup>l</sup>	0.4 <sup>l</sup>	NA	NA	NA	NA
Exposure frequency	days/year	NA	NA	NA	NA	NA	365 <sup>a</sup>	365 <sup>a</sup>	NA	NA	NA	NA
Exposure duration	years	NA	NA	NA	NA	NA	30 <sup>a</sup>	6 <sup>a</sup>	NA	NA	NA	NA
Body weight	kg	NA	NA	NA	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	NA	NA	NA	NA
Carcinogen averaging time	days	NA	NA	NA	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA	NA	NA
Non-carcinogen averaging time	days	NA	NA	NA	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	NA	NA	NA	NA
<b>Ingestion of fish/waterfowl</b>												

**Table 3-2. Exposure Factors for Receptors at RVAAP Facility Wide (continued)**

Parameter	Units	Security Guard/Maintenance Worker	National Guard			Engineering School Instructor*	Resident Farmer		Hunter/Trapper	Fisher Recreator	Trespasser	
			Dust/Fire Control Worker	Trainee	Range Maintenance Soldier		Adult	Child			Adult	Juvenile
Fish ingestion rate	kg/day	NA	NA	NA	NA	NA	0.054 <sup>o</sup>	0.054 <sup>o</sup>	0.0132 <sup>b</sup>	0.0154 <sup>o</sup>	NA	NA
Fraction ingested	unitless	NA	NA	NA	NA	NA	1 <sup>a</sup>	1 <sup>a</sup>	1 <sup>b</sup>	1 <sup>b</sup>	NA	NA
Exposure frequency	days/year	NA	NA	NA	NA	NA	365 <sup>b</sup>	365 <sup>b</sup>	365 <sup>b</sup>	365 <sup>b</sup>	NA	NA
Exposure duration	years	NA	NA	NA	NA	NA	30 <sup>c</sup>	6 <sup>a</sup>	30 <sup>b</sup>	30 <sup>b</sup>	NA	NA
Body weight	kg	NA	NA	NA	NA	NA	70 <sup>a</sup>	15 <sup>a</sup>	70 <sup>a</sup>	70 <sup>a</sup>	NA	NA
Carcinogen averaging time	days	NA	NA	NA	NA	NA	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	25,550 <sup>a</sup>	NA	NA
Non-carcinogen averaging time	days	NA	NA	NA	NA	NA	10,950 <sup>a</sup>	2190 <sup>a</sup>	10,950 <sup>a</sup>	10,950 <sup>a</sup>	NA	NA

\* New receptor developed in this report.

<sup>o</sup> Risk Assessment Guidance for Superfund (RAGS), Part B (EPA 1991).

<sup>b</sup> Site-specific (value assumed for site or value obtained from site personnel). National Guard Trainee is assumed to be on-site 24 hr/day for 24 days/year for inactive duty training and 24 hr/day for 15 days/year for annual training. National Guard Fire/Dust Suppression receptor is assumed to spend 4 hr/day for 5 days/year for fire suppression and 4 hr/day for 10 days/year (i.e., 40 hr/year) for dust suppression. Both National Guard Receptors are assumed to remain at RVAAP and at the area of concern (AOC) of interest for their entire 25-year enlistment. The hunter is assumed to be on-site 6 hr/day for 2 days/year. The trapper will be exposed less (i.e., 0.5 hr/day for 6 days/year); therefore, the hunter exposure is used as the more conservative scenario. The fisher is assumed to be on-site 4 hr/day for 5 days/year. The hunter/fisher is assumed to hunt/fish as long as he/she resides in the area, so the residential default exposure duration is used. The Security Guard/Maintenance Worker is assumed to visit each AOC for 1 hr/day for a standard worker default of 250 days/year and 25 years. National Guard Trainee and Resident Farmer are assumed to ingest 0.05 L/hr [per RAGS Part A (EPA 1998)] for approximately 2 hr/day spent in the surface water. National Guard Fire/Dust Suppression receptors are assumed to ingest 0.1 L/day due to direct exposure while setting pumps/hoses in surface water or from ingesting mist while spraying. Hunter/fisher are assumed to ingest 0.05 L/day due to splashing while setting traps or wading. Hunter/trapper is assumed to catch and eat the bag limit for ducks and geese each year.

<sup>c</sup> Security Guard/Maintenance Worker = Adult Groundskeeper (95th percentile); Hunter/Trapper = Residential Default; National Guard Trainee = Construction Worker (95th percentile); Resident Farmer Adult = Adult Farmer (95th percentile) (RAGS, Vol. 1 Part E, *Supplemental Guidance for Dermal Risk Assessment*).

<sup>d</sup> Security Guard/Maintenance Worker, National Guard Trainee, and National Guard Dust/Fire Control = Industrial Default; Hunter/Fisher and Resident Farmer = Adult Residential Default. Exposure Factors Handbook (EPA 1997) (Note dermal contact for hunter/fisher during wading is 0.52 based on head, hands, forearms, and lower legs from the Exposure Factors Handbook.)

<sup>e</sup> Average surface area for head, hands, forearms, torso, and lower legs for a child (EPA 1992a).

<sup>f</sup> RAGS, Part A (EPA 1989).

<sup>g</sup> Average total body surface area for an adult (EPA 1992b).

<sup>h</sup> Average total body surface area for a child (EPA 1992b).

<sup>i</sup> Plant mass loading factor for pasture (Hinton 1992).

<sup>j</sup> International Atomic Energy Agency 1994.

<sup>k</sup> Soil ingestion by dairy cattle (Darwin 1990).

<sup>l</sup> Exposure Factors Handbook (EPA 1997). 50th percentile meat ingestion 2.1g/kg-day = 147 g/day for a 70-kg adult, 95th percentile meat ingestion 5.1g/kg-day = 357 g/day for a 70-kg adult, 50th percentile beef ingestion 2.327g/kg-day = 163 g/day for a 70-kg adult, 95th percentile beef ingestion 0.626 g/kg-day = 44 g/day for a 70-kg adult.

<sup>m</sup> Pao et al. (1982).

<sup>n</sup> Plant mass loading factor for vegetables (Pinder 1989).

<sup>o</sup> Standard default exposure factors for fish ingestion (EPA 1991).

<sup>p</sup> RAGS, Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment, Interim) (EPA 2004a).

<sup>q</sup> Recommended value for child age 6 to 8 (EPA 1997).

<sup>r</sup> 90th percentile value for child age 3 to 5 (EPA 1997).

<sup>s</sup> 50th percentile value for male child age 6 to 7 (EPA 1997).

<sup>t</sup> Per Ohio EPA comment 2002.

<sup>u</sup> Ecological Risk Assessment, Ohio EPA/DERR, 2003.

NA = Not applicable for this scenario.

RVAAP = Ravenna Army Ammunition Plant.

VOC = Volatile organic compound.

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## 4.0 CHEMICAL-SPECIFIC INFORMATION FOR CHEMICALS OF POTENTIAL CONCERN

Two types of chemical-specific information are needed to calculate CUGs: (1) chemical-specific migration and exposure parameters, such as volatilization factors and soil-to-plant bioconcentration factors, and (2) chemical-specific toxicity information. The manner in which this information is used in the calculations is described in Chapter 5. This chapter presents the specific data used to calculate the facility-wide CUGs.

### 4.1 CHEMICAL-SPECIFIC EXPOSURE PARAMETERS

Table 4-1 presents the chemical-specific parameters for all COPCs that are used to develop the facility-wide CUGs.

### 4.2 TOXICITY INFORMATION

#### 4.2.1 Toxicity Information for Non-carcinogens

To understand non-cancer impacts, EPA has developed reference doses (RfDs), or reference concentrations (RfCs), that represent the intake or dose below which no adverse health effects are expected. The RfDs and RfCs are determined using available dose-response data from animal studies for individual chemicals. From the animal studies, scientists determine the “no effects” intake/dose and then add a safety factor (from 10 to 1,000) to determine the RfD or RfC. RfDs and RfCs are reviewed and finalized by scientific advisory boards supported by EPA. The RfDs available for the facility-wide COPCs are listed in Table 4-2. Where no oral RfD was available, RfCs, measured in milligrams per cubic meter, were converted to RfDs expressed in units of milligrams per kilogram body weight per day by using the default adult inhalation rate and body weight [i.e.,  $(\text{RfC} \times 20 \text{ m}^3/\text{day})/70 \text{ kg} = \text{RfD}$ ] (EPA 1989). Only chronic RfDs are used to develop the CUGs because exposures are assumed to occur over long durations. These values represent updates to the EPA Integrated Risk Information System (IRIS) database as of April 2008.

The toxic effect of a chemical depends on several factors, including how it enters the body (i.e., inhalation or dermal absorption), how the body breaks down the chemicals into metabolites, and which organ is the target of the toxic effects (e.g., effects 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.

#### 4.2.2 Toxicity Information for Carcinogens

For carcinogens, risks are estimated as the probability that an individual will develop cancer over a lifetime as a result of exposure to a carcinogen at a site. Cancer risk from exposure to contamination is expressed as excess or incremental cancer risk, which is cancer occurrence over and above 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 contracting cancer per unit intake/dose 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 of chemical per cubic meter of ambient air]. These unit risks were converted to CSFs

Table 4-1. Chemical-Specific Exposure Parameters for Ravenna Facility-Wide COPCs

COPC	Dermal Absorption Factor <sup>a</sup> (unitless)	Permeability Constant <sup>b</sup> (cm/hr)	Volatilization Factor <sup>c</sup> (m <sup>3</sup> /kg)	Soil-to-Plant Uptake Factor <sup>d</sup>		Beef Transfer Coefficient <sup>d</sup> (kg/kg)	Milk Transfer Coefficient <sup>d</sup> (kg/kg)	Fish Transfer Coefficient <sup>d</sup> (L/kg)
				Dry Weight (days/kg)	Wet Weight (days/kg)			
<i>Inorganics</i>								
Aluminum	1.0E-03	1.0E-03	--	4.0E-03	1.0E-03	1.5E-03	2.0E-04	5.0E+02
Antimony	1.0E-03	1.0E-03	--	5.0E-02	1.0E-02	4.0E-05	2.5E-05	1.0E+02
Arsenic	3.0E-02	1.0E-03	--	4.0E-02	1.0E-02	2.0E-03	6.0E-05	3.0E+02
Barium	1.0E-03	1.0E-03	--	1.0E-01	3.0E-03	2.0E-04	4.8E-04	4.0E+00
Cadmium	1.0E-03	1.0E-03	--	5.5E-01	1.4E-01	4.0E-04	1.0E-03	2.0E+02
Chromium	1.0E-03	2.0E-03	--	4.0E-02	1.0E-04	9.0E-03	1.0E-05	2.0E+02
Chromium, hexavalent	1.0E-03	2.0E-03	--	4.0E-02	1.0E-04	9.0E-03	1.0E-05	2.0E+02
Cobalt	1.0E-03	4.0E-04	--	5.4E-02	2.3E-02	1.0E-04	7.0E-05	3.0E+02
Copper	1.0E-03	1.0E-03	--	8.0E-01	8.0E-02	9.0E-03	1.5E-03	2.0E+02
Iron	1.0E-03	1.0E-03	--	1.0E-02	4.0E-04	2.0E-02	3.0E-05	2.0E+02
Manganese	1.0E-03	1.0E-03	--	6.8E-01	6.9E-02	5.0E-04	3.0E-05	4.0E+02
Mercury	1.0E-03	1.0E-03	--	--	--	--	--	1.0E+03
Nickel	1.0E-03	2.0E-04	--	1.8E-01	5.0E-02	5.0E-03	1.6E-02	1.0E+02
Nitrate	1.0E-03	1.0E-03	--	--	--	--	--	1.5E+05
Silver	1.0E-03	6.0E-04	--	1.0E+00	2.2E-05	3.0E-03	5.0E-05	5.0E+00
Thallium	1.0E-02	1.0E-03	--	--	--	--	--	1.0E+04
Vanadium	1.0E-03	1.0E-03	--	5.5E-03	1.4E-03	2.5E-03	2.0E-05	--
Zinc	1.0E-03	6.0E-04	--	9.9E-01	2.6E-01	1.0E-01	1.0E-02	1.0E+03
<i>Organics</i>								
1,1,2,2-Tetrachloroethane	--	6.9E-03	--	--	--	--	--	1.4E+01
1,2-Dichloroethane	--	4.2E-03	--	--	--	--	--	2.8E+00
1,2-Dichloroethene	--	7.7E-03	--	--	--	--	--	8.1E+00
1,3,5-Trinitrobenzene	1.9E-02	--	--	7.7E+00	1.6E+00	4.0E-07	1.3E-07	--
1,3-Dinitrobenzene	1.0E-02	2.1E-03	--	4.5E+00	9.1E-01	1.0E-06	3.1E-07	2.8E+00
1,4-Dichlorobenzene	--	4.2E-02	--	--	--	--	--	8.9E+01
2,4,6-Trinitrotoluene	3.2E-02	1.1E-03	--	1.8E+00	3.6E-01	5.0E-06	1.6E-06	3.4E+00
2,4-Dimethylphenol	--	1.1E-02	--	--	--	--	--	1.2E+01
2,4-Dinitrotoluene	1.0E-01	3.1E-03	--	2.6E+00	5.3E-01	2.5E-06	7.9E-07	6.7E+00
2,6-Dinitrotoluene	9.9E-02	2.1E-03	--	3.9E+00	8.0E-01	1.3E-06	4.0E-07	8.3E+00
2-Amino-4,6-dinitrotoluene	6.0E-03	2.4E-03	--	--	--	--	--	5.2E+00
2-Methylnaphthalene	1.0E-02	--	9.0E+04	2.1E-01	4.2E-02	2.0E-04	6.3E-05	--

Table 4-1. Chemical-specific Exposure Parameters for Ravenna Facility Wide COPCs (continued)

COPC	Dermal Absorption Factor <sup>a</sup> (unitless)	Permeability Constant <sup>b</sup> (cm/hr)	Volatilization Factor <sup>c</sup> (m <sup>3</sup> /kg)	Soil-to-Plant Uptake Factor <sup>d</sup>	Wet Weight (days/kg)	Beef Transfer Coefficient <sup>d</sup> (kg/kg)	Milk Transfer Coefficient <sup>d</sup> (kg/kg)	Fish Transfer Coefficient <sup>d</sup> (L/kg)
				Dry Weight (days/kg)				
2-Nitrotoluene	1.0E-02	1.2E-02	1.9E+05	1.8E+00	3.6E-01	5.0E-06	1.6E-06	1.2E+01
4,4'-DDD	--	1.8E-01	--	--	--	--	--	8.6E+03
4,4'-DDE	1.0E-02	1.6E-01	--	1.9E-02	3.8E-03	1.3E-02	4.0E-03	2.1E+04
4,4'-DDT	--	2.7E-01	--	--	--	--	--	4.2E+04
4-Amino-2,6-dinitrotoluene	6.0E-03	2.4E-03	--	--	--	--	--	5.2E+00
4-Chloro-3-methylphenol	1.0E-02	--	--	--	--	--	--	--
4-Methylphenol	--	7.7E-03	--	--	--	--	--	6.2E+00
4-Nitrobenzamine	--	2.7E-03	--	--	--	--	--	2.3E+00
4-Nitrophenol	1.0E-02	--	--	3.0E+00	6.1E-01	2.0E-06	6.3E-07	--
4-Nitrotoluene	1.0E-02	1.3E-02	--	1.5E+00	3.1E-01	6.3E-06	2.0E-06	1.3E+01
Aldrin	1.0E-02	1.4E-03	--	6.9E-01	1.4E-01	2.5E-05	7.9E-06	2.0E+04
Benz(a)anthracene	1.3E-01	4.7E-01	--	1.9E-02	3.8E-03	1.3E-02	4.0E-03	5.4E+03
Benzene	--	1.5E-02	--	--	--	--	--	8.7E+00
Benzo(a)pyrene	1.3E-01	7.0E-01	--	1.1E-02	2.2E-03	3.1E-02	9.9E-03	1.1E+04
Benzo(b)fluoranthene	1.3E-01	7.0E-01	--	1.1E-02	2.2E-03	3.1E-02	9.9E-03	5.6E+03
Benzo(k)fluoranthene	1.3E-01	1.2E+00	--	4.3E-03	8.8E-04	1.6E-01	5.0E-02	1.0E+04
Bis(2-chloroethoxy)methane	1.0E-02	--	--	6.7E+00	1.4E+00	5.0E-07	1.6E-07	--
Bis(2-ethylhexyl)phthalate	--	2.5E-02	--	--	--	--	--	3.1E+02
Carbazole	1.0E-02	--	--	2.4E-01	4.8E-02	1.6E-04	5.0E-05	--
Carbon Tetrachloride	--	1.6E-02	--	--	--	--	--	3.0E+01
Chloroform	--	6.8E-03	--	--	--	--	--	6.6E+00
Chrysene	1.3E-01	4.7E-01	--	1.9E-02	3.8E-03	1.3E-02	4.0E-03	5.9E+03
Dibenz(a,h)anthracene	1.3E-01	1.5E+00	--	4.3E-03	8.8E-04	1.6E-01	5.0E-02	2.2E+04
Dibenzofuran	1.0E-02	--	--	1.5E-01	3.1E-02	3.3E-04	1.0E-04	--
Dieldrin	1.0E-02	1.2E-02	--	8.2E-02	1.7E-02	1.0E-03	3.1E-04	2.0E+03
Endrin	1.0E-02	--	--	8.2E-02	1.7E-02	1.0E-03	3.1E-04	--
Endrin Aldehyde	--	--	--	--	--	--	--	--
Fluoranthene	1.3E-01	--	--	5.5E-02	1.1E-02	2.0E-03	6.3E-04	--
Fluorene	1.3E-01	--	4.6E+05	1.1E-01	2.2E-02	6.3E-04	2.0E-04	--
HMX	6.0E-03	1.1E-04	--	1.7E+01	3.5E+00	9.7E-08	3.1E-08	3.2E+00
Heptachlor	1.0E-02	8.6E-03	--	1.2E-01	2.5E-02	5.0E-04	1.6E-04	9.9E+03
Heptachlor Epoxide	1.0E-02	2.8E-02	--	2.8E-02	5.7E-03	6.3E-03	2.0E-03	1.4E+03

Table 4-1. Chemical-specific Exposure Parameters for Ravenna Facility Wide COPCs (continued)

COPC	Dermal Absorption Factor <sup>a</sup> (unitless)	Permeability Constant <sup>b</sup> (cm/hr)	Volatilization Factor <sup>c</sup> (m <sup>3</sup> /kg)	Soil-to-Plant Uptake Factor <sup>d</sup>		Beef Transfer Coefficient <sup>d</sup> (kg/kg)	Milk Transfer Coefficient <sup>d</sup> (kg/kg)	Fish Transfer Coefficient <sup>d</sup> (L/kg)
				Dry Weight (days/kg)	Wet Weight (days/kg)			
Indeno(1,2,3- <i>cd</i> )pyrene	1.3E-01	1.0E+00	--	5.6E-03	1.1E-03	1.0E-01	3.1E-02	2.9E+04
Lindane	--	1.1E-02	--	--	--	--	--	3.1E+02
Methylene Chloride	--	3.5E-03	--	--	--	--	--	1.8E+00
N-Nitroso-di-n-propylamine	1.0E-02	--	--	5.9E+00	1.2E+00	6.3E-07	2.0E-07	--
Naphthalene	1.3E-01	--	6.9E+04	4.6E-01	9.4E-02	5.0E-05	1.6E-05	--
Nitrobenzene	--	7.0E-03	--	--	--	--	--	5.3E+00
Nitroglycerin	1.0E-02	1.1E-03	--	--	--	--	--	3.5E+00
PCB-1016	1.4E-01	--	--	1.4E-02	2.9E-03	2.0E-02	6.3E-03	--
PCB-1242	--	9.2E-01	--	--	--	--	--	5.8E+04
PCB-1248	1.4E-01	--	--	1.6E-02	3.3E-03	1.6E-02	5.0E-03	--
PCB-1254	1.4E-01	1.3E+00	--	1.3E-02	2.5E-03	2.5E-02	7.9E-03	1.4E+05
PCB-1260	1.4E-01	5.5E+00	--	2.9E-03	5.9E-04	3.1E-01	9.9E-02	4.9E+03
Pentachlorophenol	2.5E-01	3.9E-01	--	1.4E-02	2.9E-03	2.0E-02	6.3E-03	7.0E+02
Pyrene	1.3E-01	3.2E-01	--	5.5E-02	1.1E-02	2.0E-03	6.3E-04	1.1E+03
RDX	1.5E-02	3.5E-04	--	4.6E-01	9.4E-02	5.0E-05	1.6E-05	3.2E+00
Tetrachloroethene	--	3.3E-02	--	--	--	--	--	8.3E+01
Toxaphene	--	1.2E-02	--	--	--	--	--	5.6E+03
Trichloroethene	--	1.2E-02	--	--	--	--	--	1.5E+01
alpha-BHC	--	2.8E-02	--	--	--	--	--	3.1E+02
alpha-Chlordane	--	--	--	--	--	--	--	--
beta-BHC	1.0E-02	2.8E-02	--	1.8E-01	3.7E-02	2.5E-04	7.9E-05	3.1E+02
<i>cis</i> -1,2-Dichloroethene	--	1.5E-02	--	--	--	--	--	8.1E+00
gamma-Chlordane	--	--	--	--	--	--	--	--

**Table 4-1. Chemical-specific Exposure Parameters for Ravenna Facility Wide COPCs (continued)**

COPC	Dermal Absorption Factor <sup>a</sup> (unitless)	Permeability Constant <sup>b</sup> (cm/hr)	Volatilization Factor <sup>c</sup> (m <sup>3</sup> /kg)	Soil-to-Plant Uptake Factor <sup>d</sup>		Beef Transfer Coefficient <sup>d</sup> (kg/kg)	Milk Transfer Coefficient <sup>d</sup> (kg/kg)	Fish Transfer Coefficient <sup>d</sup> (L/kg)
				Dry Weight (days/kg)	Wet Weight (days/kg)			

<sup>a</sup> Chemical-specific absorption factor values from Risk Assessment Information System (RAIS). When chemical-specific values are not available, the following default values are used for soil and sediment only: semivolatile organic compounds = 0.1, volatile organic compounds (VOCs) = 0.01, inorganics = 0.001, per the U. S. Environmental Protection Agency (EPA) Region 4 Supplemental Guidance to Risk Assessment Guidance for Superfund.

<sup>b</sup> From RAIS [http://risk.lsd.ornl.gov/tox/tox\\_values.shtml](http://risk.lsd.ornl.gov/tox/tox_values.shtml) for groundwater and surface water.

<sup>c</sup> Volatilization factors calculated using the 1996 EPA Soil Screening Guidance Methodology, using site-specific parameter values for Los Angeles, California. Only used for soil and sediment VOCs.

<sup>d</sup> Parameter used to evaluate food pathways.

COPC = Chemical of potential concern.

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.

PCB = Polychlorinated biphenyl.

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine

-- = No value available or chemical is not a COPC for the appropriate media requiring the exposure parameter in a calculation.

Table 4-2. Non-Carcinogenic Reference Doses for Ravenna Facility-Wide COPCs

COPC	Oral Chronic RfD (mg/kg-day)	Confidence Level	% GI Absorption <sup>a</sup>	Dermal Chronic RfD (mg/kg-day)	Inhalation Chronic RfD (mg/kg-day)	RfD Basis (vehicle)	Critical Effect	Uncertainty/ Modifying Factor
<i>Inorganics</i>								
Aluminum	1.0E+00	(O) Low	0.1	1.0E-01	1.4E-03	Oral (mice)	Minimal neurotoxicity in offspring	(O) MF=1 (O) UF=100
Antimony	4.0E-04	(O) Low	0.02	8.0E-06	--	Oral (rat)	Longevity, blood glucose, and cholesterol	(O) MF=1 (O) UF=1000
Arsenic	3.0E-04	(O) Medium	0.41	1.2E-04	--	Oral (human)	Hyperpigmentation, keratosis, and possible vascular complications	(O) MF=1 (O) UF=3
Barium	2.0E-01	(O) Medium	0.07	1.4E-02	1.4E-04	Oral (mice)	Nephropathy	(O) MF=1 (O) UF=300
Cadmium (soil)	1.0E-03	(O) High	0.01	1.0E-05	--	Oral	Significant proteinuria	(O) MF=1 (O) UF=10
Cadmium (water)	5.0E-04	(O) High	0.01	5.0E-06	--	Oral	Significant proteinuria	(O) MF=1 (O) UF=10
Chromium (as Chromium VI)	3.0E-03	(O) Low	0.02	6.0E-05	2.3E-06	Oral (rat)	Stomach ulcers, convulsions, kidney and liver damage	(O) MF=10 (O) UF=100
Chromium, hexavalent	3.0E-03	(O) Low	0.02	6.0E-05	2.3E-06	Oral (rat)	Stomach ulcers, convulsions, kidney and liver damage	(O) MF=10 (O) UF=100
Cobalt	2.0E-02	NA	0.8	2.0E-02	5.7E-06	NA	NA	NA
Copper	4.0E-02	(O) Medium	0.3	1.2E-02	--	Oral (animals)	Gastrointestinal, hepatic, and renal effects, abdominal pain, vomiting, diarrhea, hemolysis, hepatic necrosis, hematuria, proteinuria, hypotension, tachycardia, convulsions, coma, and death	(O) UF=1000

Table 4-2. Non-carcinogenic Reference Doses for Ravenna Facility Wide COPCs (continued)

COPC	Oral Chronic RfD (mg/kg-day)	Confidence Level	% GI Absorption <sup>a</sup>	Dermal Chronic RfD (mg/kg-day)	Inhalation Chronic RfD (mg/kg-day)	RfD Basis (vehicle)	Critical Effect	Uncertainty/ Modifying Factor
Iron	3.0E-01	NA	0.15	4.5E-02	--	NA	Gastrointestinal	NA
Manganese	4.6E-02	(O) Medium	0.04	1.8E-03	1.4E-05	Oral (human)	Central nervous system effects	(O) MF=1 (O) UF=1
Mercury	3.0E-04	(I) Medium	0.07	2.1E-05	--	Inhalation (human)	Hand tremor, memory disturbance, objective autonomic dysfunction	(I) MF=1 (I) UF=30
Nickel	2.0E-02	(O) Medium	0.27	5.4E-03	--	Oral: diet (rat)	Decreased body and major organ weights (rat)	(O) UF=100
Nitrate	1.6E+00	(O) High	0.5	1.6E+00	--	Oral (human)	Iron oxidation in hemoglobin of the blood, cardiovascular system	(O) MF=1 (O) UF=1
Silver	5.0E-03	(O) Low	0.18	9.0E-04	--	Oral (rats)	Gastrointestinal tract, abdominal pain, diarrhea, vomiting, shock, convulsions, skin, mucous membranes, eyes and death	(O) UF=3
Thallium	8.0E-05	(O) Low	0.5	8.0E-05	--	Oral (human)	Vomiting, diarrhea, temporary hair loss, and effects on the nervous system, lungs, heart, liver, and kidneys	(O) MF=1 (O) UF=3000
Vanadium	7.0E-03	(O) Low	0.01	7.0E-05	--	Inhalation (animals)	Lungs, throat, and eyes	(O) MF=1 (O) UF=100

Table 4-2. Non-carcinogenic Reference Doses for Ravenna Facility Wide COPCs (continued)

COPC	Oral Chronic RfD (mg/kg-day)	Confidence Level	% GI Absorption <sup>a</sup>	Dermal Chronic RfD (mg/kg-day)	Inhalation Chronic RfD (mg/kg-day)	RfD Basis (vehicle)	Critical Effect	Uncertainty/Modifying Factor
Zinc	3.0E-01	(O) Medium	0.2	6.0E-02	--	Oral (rats)	(O) Copper deficiency & hypochromic microcytic anemia (human) (I) pulmonary and gastrointestinal effects (human)	(O) UF=3
<i>Organics</i>								
1,1,2,2-Tetrachloroethane	6.0E-02	(O) Low	0.7	6.0E-02	--	Oral (human)	Pulmonary congestion, edema, lung collapse, shallow breathing, low blood pressure, a faint pulse, epicardial and endocardial anoxic hemorrhage, mucosal irritation, nausea and vomiting, eye mucosal irritation, and dizziness	(O) MF=1 (O) UF=300
1,2-Dichloroethane	2.0E-02	(O) Low	1	2.0E-02	--	Oral, inhalation (animals)	Heart, central nervous system, liver, kidneys, skin, eyes, tumors, and lungs	(O) MF=1 (O) UF=3000
1,2-Dichloroethene	9.0E-03	NA	0.8	9.0E-03	--	Oral (rats)	Lesions in liver, eyes, central nervous system	(O) UF=1000
1,3,5-Trinitrobenzene	3.0E-02	NA	0.65	3.0E-02	--	NA	NA	NA
1,3-Dinitrobenzene	1.0E-04	NA	0.65	1.0E-04	--	NA	NA	NA
1,4-Dichlorobenzene	--	(I) Medium	0.9	--	2.3E-01	Inhalation (mice)	Dizziness, headaches, liver problems, increased weight in females	(I) MF=1 (I) UF=100
2,4,6-Trinitrotoluene	5.0E-04	(O) Medium	0.6	5.0E-04	--	Oral (dog)	Liver effects	(O) UF=1000



Table 4-2. Non-carcinogenic Reference Doses for Ravenna Facility Wide COPCs (continued)

COPC	Oral Chronic RfD (mg/kg-day)	Confidence Level	% GI Absorption <sup>a</sup>	Dermal Chronic RfD (mg/kg-day)	Inhalation Chronic RfD (mg/kg-day)	RfD Basis (vehicle)	Critical Effect	Uncertainty/Modifying Factor
2,4-Dimethylphenol	2.0E-02	NA	0.5	2.0E-02	--	NA	NA	NA
2,4-Dinitrotoluene	2.0E-03	(O) High	0.85	2.0E-03	--	Oral (rats)	Neurotoxicity, heinz bodies, biliary tract hyperplasia, ischemic heart disease, hematological effects, cyanosis, anemia, leukocytosis, neurological, dizziness, insomnia, nausea, blood, liver, nervous system, reproductive system	(O) UF=1 (O) MF=100
2,6-Dinitrotoluene	1.0E-03	NA	0.85	1.0E-03	--	Oral (dogs)	Blood, reproductive system, neurological, hematological and liver histopathology	(O) MF=1 (O) UF=3000
2-Amino-4,6-dinitrotoluene	2.0E-04	NA	0.5	2.0E-04	--	NA	NA	NA
2-Methylnaphthalene	4.0E-03	NA	0.8	4.0E-03	--	NA	NA	NA
2-Nitrotoluene	1.0E-02	NA	0.8	1.0E-02	--	NA	NA	NA
4,4'-DDD	2.0E-03	NA	0.7	2.0E-03	--	NA	NA	NA
4,4'-DDT	5.0E-04	NA	0.7	5.0E-04	--	NA	NA	NA
4-Amino-2,6-dinitrotoluene	2.0E-04	NA	0.5	2.0E-04	--	NA	NA	NA
4-Methylphenol	5.0E-03	NA	0.65	5.0E-03	--	NA	NA	NA
4-Nitrobenzenamine	3.0E-03	NA	0.8	3.0E-03	--	NA	NA	NA
4-Nitrophenol	8.0E-03	NA	1	8.0E-03	--	NA	NA	NA
4-Nitrotoluene	1.0E-02	NA	0.8	1.0E-02	--	NA	NA	NA
Aldrin	3.0E-05	NA	0.5	3.0E-05	--	NA	NA	NA
Benzene	4.0E-03	(I) Medium (O) Medium	0.97	4.0E-03	8.6E-03	Inhalation (human) Oral (animals)	Decreased lymphocyte count	(I) MF=1 (I) UF=300 (O) MF=1 (O) UF=300
Bis(2-chloroethoxy)methane	3.0E-03	NA	0.5	3.0E-03	--	NA	NA	NA

Table 4-2. Non-carcinogenic Reference Doses for Ravenna Facility Wide COPCs (continued)

COPC	Oral Chronic RfD (mg/kg-day)	Confidence Level	% GI Absorption <sup>a</sup>	Dermal Chronic RfD (mg/kg-day)	Inhalation Chronic RfD (mg/kg-day)	RfD Basis (vehicle)	Critical Effect	Uncertainty/Modifying Factor
Bis(2-ethylhexyl)phthalate	2.0E-02	(O) Medium	0.19	3.8E-03	--	Oral (rats, mice)	Liver and kidney damage, increased relative weight	(O) MF=1 (O) UF=1000
Carbon Tetrachloride	7.0E-04	(O) Medium	0.65	7.0E-04	--	Oral (rats, mice, hamsters)	Liver, kidney, and central nervous system, headaches, dizziness, sleepiness, and nausea and vomiting	(O) MF=1 (O) UF=1000
Chloroform	1.0E-02	(O) Medium	0.2	2.0E-03	--	Oral (rats) Inhalation (mice)	Fatty cyst formation on liver	(O) MF=1 (O) UF=1000
Dibenzofuran	2.0E-03	NA	0.8	2.0E-03	--	NA	NA	NA
Dieldrin	5.0E-05	NA	0.5	5.0E-05	--	NA	NA	NA
Endrin	3.0E-04	NA	0.02	6.0E-06	--	NA	NA	NA
Fluoranthene	4.0E-02	(O) Low	0.31	1.2E-02	--	Dermal (mice)	Nephropathy, increased weight, alterations and clinical effects on liver	(O) MF=1 (O) UF=3000
Fluorene	4.0E-02	(O) Low	0.5	4.0E-02	--	Dermal (mice)	Nephropathy, increased weight, alterations and clinical effects on liver	(O) MF=1 (O) UF=3000
HMX	5.0E-02	NA	0.15	7.5E-03	--	NA	NA	NA
Heptachlor	5.0E-04	(O) Low	0.72	5.0E-04	--	Oral (mice)	Nervous system, liver and adrenal glands	(O) MF=1 (O) UF=300
Heptachlor Epoxide	1.3E-05	(O) Low	0.72	1.3E-05	--	Oral (mice)	Nervous system, liver and adrenal glands	(O) MF=1 (O) UF=300
Lindane	3.0E-04	NA	0.97	3.0E-04	--	NA	NA	NA
Methylene Chloride	6.0E-02	(O) Medium	0.95	6.0E-02	8.6E-01	Inhalation (human)	Fatigue, liver toxicity, irritability, analgesia, narcosis, and death	(O) MF=1 (O) UF=100

Table 4-2. Non-carcinogenic Reference Doses for Ravenna Facility Wide COPCs (continued)

COPC	Oral Chronic RfD (mg/kg-day)	Confidence Level	% GI Absorption <sup>a</sup>	Dermal Chronic RfD (mg/kg-day)	Inhalation Chronic RfD (mg/kg-day)	RfD Basis (vehicle)	Critical Effect	Uncertainty/ Modifying Factor
Naphthalene	2.0E-02	(O) Low	0.8	2.0E-02	8.6E-04	Oral (mice)	Red blood cells, gastrointestinal distress, neurotoxic, hepatic, renal, and ocular effects, decreased mean terminal body weights in males	(O) MF=1 (O) UF=3000
Nitrobenzene	5.0E-04	(O) Low	0.97	5.0E-04	5.7E-04	Oral (animals)	Irritation to the skin or eyes, methemoglobinemia, nausea, vomiting, shortness of breath, headache, irritability, dizziness, weakness, drowsiness, liver damage, thyroid, and kidney tumors	(O) MF=1 (O) UF=10,000
PCB-1016	7.0E-05	NA	0.9	7.0E-05	--	NA	NA	NA
PCB-1254	2.0E-05	(O) Medium	0.9	2.0E-05	--	Oral (rats)	Ocular exudate, inflamed and prominent Meibomian glands	(O) MF=1 (O) UF=300
Pentachlorophenol	3.0E-02	(O) Medium	1	3.0E-02	--	Oral (mice)	Liver, kidneys, blood, lungs, nervous system, immune system, and digestive tract	(O) MF=1 (O) UF=100
Pyrene	3.0E-02	(O) Low	0.31	9.3E-03	--	Oral (mice, rats)	Nephropathy, decreased kidney weights, increased liver weights, hematological	(O) MF=1 (O) UF=3000
RDX	3.0E-03	NA	1	3.0E-03	--	NA	NA	NA

**Table 4-2. Non-carcinogenic Reference Doses for Ravenna Facility Wide COPCs (continued)**

<b>COPC</b>	<b>Oral Chronic RfD (mg/kg-day)</b>	<b>Confidence Level</b>	<b>% GI Absorption<sup>a</sup></b>	<b>Dermal Chronic RfD (mg/kg-day)</b>	<b>Inhalation Chronic RfD (mg/kg-day)</b>	<b>RfD Basis (vehicle)</b>	<b>Critical Effect</b>	<b>Uncertainty/ Modifying Factor</b>
Tetrachloroethene	1.0E-02	(O) Medium	1	1.0E-02	1.7E-01	Oral (human)	Dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death, liver and kidney damage, hepatotoxicity and weight gain	(O) MF=1 (O) UF=1000
Trichloroethene	3.0E-04	NA	0.15	4.5E-05	1.1E-02	Inhalation (human)	Liver, kidney, and developing fetus	NA
<i>cis</i> -1,2-Dichloroethene	1.0E-02	NA	1	1.0E-02	--	Oral (rats)	Nauseous, drowsiness, tiredness, death, liver, heart and lung damage, decreased hematocrit	(O) MF=1 (O) UF=3000

<sup>a</sup> % GI absorption values from the Risk Assessment Information System.

COPC = Chemical of potential concern.

GI = Gastrointestinal.

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.

(I) = Inhalation.

MF = Modifying factor (the default modifying factor is 1).

NA = Not available.

(O) = Oral.

PCB = Polychlorinated biphenyl.

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

RfD = Reference dose.

UF = Uncertainty factor.

-- = No value available.

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1 expressed in units of risk per milligram of chemical per kilogram body weight per day by using the  
2 default adult inhalation rate and body weight [i.e., (unit risk  $\times$  70 kg  $\times$  1,000  $\mu$ g/mg)/20 m<sup>3</sup>/day]. CSFs  
3 used to develop the facility-wide CUGs are presented in Table 4-3. These values represent updates to the  
4 IRIS database as of April 2008.

### 5 **4.2.3 Estimated Toxicity Values for Dermal Exposures**

6 Oral and inhalation RfDs and CSFs are currently available; however, dermal values are not. Dermal RfDs  
7 and CSFs were estimated from oral toxicity values using chemical-specific gastrointestinal absorption  
8 factors (GAFs) to calculate total absorbed dose. This conversion is necessary because most oral RfDs and  
9 CSFs are expressed as the amount of chemical administered per time and body weight; however, dermal  
10 exposure is expressed as an absorbed dose. Dermal toxicity factors are calculated from oral toxicity  
11 factors as shown below (EPA 2004a):

$$12 \quad \text{RfD}_{\text{dermal}} = \text{RfD}_{\text{oral}} \times \text{GAF}$$

$$13 \quad \text{CSF}_{\text{dermal}} = \text{CSF}_{\text{oral}} / \text{GAF}$$

14 Chemical-specific GAF values available from EPA's *Risk Assessment Guidance for Superfund, Vol. 1:*  
15 *Human Health Evaluation Manual (Part E)* (EPA 2004a) are used whenever possible. Not all COPCs  
16 have specific GAF values. When quantitative data are insufficient, a default GAF is used. A default value  
17 of 1.0 for organic and inorganic chemicals is used (EPA 2004a). Per EPA guidance (EPA 2004a), dermal  
18 CSFs and RfDs are estimated from the oral toxicity values using chemical-specific GAFs to calculate the  
19 total absorbed dose only for chemicals with GAF values <0.5 (i.e., for chemicals with GAF values  
20 between 0.5 and 1, the oral toxicity value itself is used to evaluate the dermal pathway). The GAF and  
21 resulting dermal toxicity values used in this effort are listed in Tables 4-2 and 4-3, respectively.

Table 4-3. Cancer Slope Factors for Ravenna Facility-Wide COPCs

COPC	Oral Slope Factor (mg/kg-day) <sup>-1</sup>	% GI Absorption <sup>a</sup>	Dermal Slope Factor (mg/kg-day) <sup>-1</sup>	Inhalation Slope Factor (mg/kg-day) <sup>-1</sup>	EPA Class	TEF	Type of Cancer
<i>Inorganics</i>							
Arsenic	1.5E+00	0.41	3.7E+00	1.5E+01	A	--	Respiratory system tumors
Cadmium	--	0.01	--	6.3E+00	B1	--	Respiratory tract and lung tumors
Chromium	--	0.02	--	4.2E+01	A	--	Lung tumors
Chromium, hexavalent	--	0.02	--	4.2E+01	A	--	Lung tumors
Cobalt	--	0.8	--	9.8E+00	NA	--	NA
<i>Organics</i>							
1,1,2,2-Tetrachloroethane	2.0E-01	0.7	2.0E-01	2.0E-01	C	--	Carcinoma
1,2-Dichloroethane	9.1E-02	1	9.1E-02	9.1E-02	B2	--	Hemangiosarcomas
1,4-Dichlorobenzene	2.4E-02	0.9	2.4E-02	--	C	--	Liver tumors
2,4,6-Trinitrotoluene	3.0E-02	0.6	3.0E-02	--	C	--	Bladder transitional cell papilloma
2,4-Dinitrotoluene	6.8E-01	0.85	6.8E-01	--	B2	--	Liver carcinoma, mammary adenomas, fibromas (mouse)
2,6-Dinitrotoluene	6.8E-01	0.85	6.8E-01	--	B2	--	Liver carcinoma, mammary adenomas, fibromas (mouse)
2-Nitrotoluene	2.3E-01	0.8	2.3E-01	--	NA	--	Mesotheliomas of the tunica vaginalis (rat)
4,4'-DDD	2.4E-01	0.7	2.4E-01	--	B2	--	Increased tumor incidence (mouse)
4,4'-DDE	3.4E-01	0.7	3.4E-01	--	B2	--	Hepatocellular carcinoma (mouse)
4,4'-DDT	3.4E-01	0.7	3.4E-01	3.4E-01	B2	--	Liver tumors (mouse)
4-Nitrobenzenamine	2.1E-02	0.8	2.1E-02	--	NA	--	NA
4-Nitrotoluene	1.7E-02	0.8	1.7E-02	--	NA	--	NA
Aldrin	1.7E+01	0.5	1.7E+01	1.7E+01	B2	--	Tumor induction (mouse)
Benz(a)anthracene	7.3E-01	0.31	2.4E+00	3.1E-01	B2	0.1	Stomach tumors (mouse)
Benzene	5.5E-02	0.97	5.5E-02	2.7E-02	A	--	Acute nonlymphocytic leukemia
Benzo(a)pyrene	7.3E+00	0.31	2.4E+01	3.1E+00	B2	1	Stomach, nasal cavity, larynx, trachea, and pharynx
Benzo(b)fluoranthene	7.3E-01	0.31	2.4E+00	3.1E-01	B2	0.1	Tumors
Benzo(k)fluoranthene	7.3E-02	0.31	2.4E-01	3.1E-02	B2	0.01	Tumors (mouse)

Table 4-3. Cancer Slope Factors for Ravenna Facility Wide COPCs (continued)

COPC	Oral Slope Factor (mg/kg-day) <sup>-1</sup>	% GI Absorption <sup>a</sup>	Dermal Slope Factor (mg/kg-day) <sup>-1</sup>	Inhalation Slope Factor (mg/kg-day) <sup>-1</sup>	EPA Class	TEF	Type of Cancer
Bis(2-ethylhexyl)phthalate	1.4E-02	0.19	7.4E-02	--	B2	--	Liver neoplastic nodule and hepatocellular carcinoma (mouse)
Carbazole	2.0E-02	0.7	2.0E-02	--	B2	--	Liver tumors (mouse)
Carbon Tetrachloride	1.3E-01	0.65	1.3E-01	5.3E-02	B2	--	Liver tumors (mouse)
Chloroform	6.1E-03	0.2	3.1E-02	8.1E-02	B2	--	Colon, rectum, bladder, and liver carcinoma (mouse)
Chrysene	7.3E-03	0.31	2.4E-02	3.1E-03	B2	0.001	Carcinomas and malignant lymphoma (mouse)
Dibenz( <i>a,h</i> )anthracene	7.3E+00	0.31	2.4E+01	3.1E+00	B2	1	Immunodepressive effects (mouse)
Dieldrin	1.6E+01	0.5	1.6E+01	1.6E+01	B2	--	Liver carcinoma (mouse)
Heptachlor	4.5E+00	0.72	4.5E+00	4.6E+00	B2	--	Hepatocellular carcinoma (mouse)
Heptachlor Epoxide	9.1E+00	0.72	9.1E+00	9.1E+00	B2	--	Hepatocellular carcinoma (mouse)
Indeno(1,2,3- <i>cd</i> )pyrene	7.3E-01	0.31	2.4E+00	3.1E-01	B2	0.1	Tumors
Lindane	1.3E+00	0.97	1.3E+00	--	B2	--	NA
Methylene Chloride	7.5E-03	0.95	7.5E-03	1.7E-03	B2	--	Hepatocellular carcinoma, adenomas (mouse)
N-Nitroso-di-n-propylamine	7.0E+00	0.25	2.8E+01	--	B2	--	NA
Nitroglycerin	1.7E-02	0.5	1.7E-02	--	NA	--	NA
PCB-1016	2.0E+00	0.9	2.0E+00	2.0E+00	B2	--	Liver hepatocellular adenomas, carcinomas, cholangiomas, or cholangiocarcinomas (rat)
PCB-1242	4.0E-01	0.9	4.0E-01	3.5E-01	B2	--	Liver hepatocellular adenomas, carcinomas, cholangiomas, or cholangiocarcinomas (rat)
PCB-1248	2.0E+00	0.9	2.0E+00	2.0E+00	B2	--	Liver hepatocellular adenomas, carcinomas, cholangiomas, or cholangiocarcinomas (rat)
PCB-1254 (soil)	2.0E+00	0.9	2.0E+00	2.0E+00	B2	--	Liver hepatocellular adenomas, carcinomas, cholangiomas, or cholangiocarcinomas (rat)
PCB-1254 (water)	4.0E-01	0.9	4.0E-01	3.5E-01	B2	--	Liver hepatocellular adenomas, carcinomas, cholangiomas, or cholangiocarcinomas (rat)

**Table 4-3. Cancer Slope Factors for Ravenna Facility Wide COPCs (continued)**

<b>COPC</b>	<b>Oral Slope Factor (mg/kg-day)<sup>-1</sup></b>	<b>% GI Absorption<sup>a</sup></b>	<b>Dermal Slope Factor (mg/kg-day)<sup>-1</sup></b>	<b>Inhalation Slope Factor (mg/kg-day)<sup>-1</sup></b>	<b>EPA Class</b>	<b>TEF</b>	<b>Type of Cancer</b>
PCB-1260 (soil)	2.0E+00	0.9	2.0E+00	2.0E+00	B2	--	Liver hepatocellular adenomas, carcinomas, cholangiomas, or cholangiocarcinomas (rat)
PCB-1260 (water)	4.0E-01	0.9	4.0E-01	3.5E-01	B2	--	Liver hepatocellular adenomas, carcinomas, cholangiomas, or cholangiocarcinomas (rat)
Pentachlorophenol	1.2E-01	1	1.2E-01	--	B2	--	Carcinoma/adenoma
RDX	1.1E-01	1	1.1E-01	--	C	--	Liver hepatocellular carcinomas/adenomas (mouse)
Tetrachloroethene	5.4E-01	1	5.4E-01	2.1E-02	NA	--	Liver cancer
Toxaphene	1.1E+00	0.5	1.1E+00	1.1E+00	B2	--	NA
Trichloroethene	4.0E-01	0.15	2.7E+00	4.0E-01	NA	--	Liver or lung cancer
alpha-BHC	6.3E+00	0.97	6.3E+00	6.3E+00	B2	--	NA
beta-BHC	1.8E+00	0.91	1.8E+00	1.9E+00	C	--	Hepatic nodules, hepatocellular carcinoma

<sup>a</sup> % GI absorption values from the Risk Assessment Information System.

COPC = Chemical of potential concern.

EPA = U. S. Environmental Protection Agency.

GI = Gastrointestinal.

NA = Not available.

PCB = Polychlorinated biphenyl.

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

TEF = Toxicity equivalency factor is based on the relative potency of each carcinogenic polycyclic aromatic hydrocarbon relative to that of benzo(a)pyrene.

-- = No value available.

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2



## 5.0 FACILITY-WIDE CLEANUP GOALS CALCULATION METHODS AND RESULTS

CUGs were developed for each COPC identified in Tables 2-1 through 2-4 and each of the land use/receptor scenarios identified in Table 3-1. The process for developing the CUGs involves rearranging the equations presented in the Risk Manual to solve for the CUG concentrations instead of solving for risk. Provided below is an example of taking the equations used to estimate intake and risk associated with ingestion of groundwater (Equations A, B, and C) and rearranging them to calculate an “acceptable intake” or CUG (Equation D).

Intake for drinking water ingestion (for groundwater COPCs) is estimated as follows:

$$\text{(Equation A) Chemical Intake (mg/kg-day)} = \frac{C_w \times IR_w \times EF \times ED}{BW \times AT},$$

where

- $C_w$  = chemical concentration in water (mg/L),
- $IR_w$  = ingestion rate of water (L/day),
- EF = exposure frequency (days/year),
- ED = exposure duration (years),
- BW = body weight (kg),
- AT = averaging (days) for carcinogens or non-carcinogens.

And the incremental lifetime cancer risk (ILCR) associated with this intake is calculated as follows (EPA 1989):

$$\text{(Equation B) ILCR} = I \times CSF$$

where

- I = chemical intake for a specific chemical and pathway (mg/kg-day),
- CSF = cancer slope factor for a specific chemical and pathway (mg/kg-day)<sup>-1</sup>.

These two equations are combined to produce the following equation:

$$\text{(Equation C) ILCR} = \frac{SF \times C_w \times IR_w \times EF \times ED}{BW \times AT \times 365 \text{ days/year}}$$

For a typical calculation of ILCR, the site exposure concentration  $C_w$  is known and a corresponding ILCR is the result. For the CUG concentration back calculation, the ILCR is replaced by the acceptable ILCR, which is referred to as the target risk (TR in the equation), and the equation is then rearranged to solve for the unknown site concentration  $C_w$ , that results in an acceptable intake. The site concentration that achieves the target risk level is the resulting CUG concentration as follows:

$$\text{(Equation D) RGC} = \frac{TR \times BW \times AT \times 356 \text{ days/yr}}{EF \times ED \times (SF \times IR_w)}$$

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1 Using this approach for rearranging the Risk Manual equations, CUGs have been calculated using the  
2 exposure models and parameters presented in the Risk Manual and the White Paper (Appendix A) for  
3 each of the eight receptor/exposure pathway combinations discussed in Chapter 4.

4 The one model parameter value that is unique to the development of the CUGs and is not discussed in the  
5 Risk Manual is the target risk for carcinogens and the target HI for non-carcinogens. These parameter  
6 values represent the quantitative goals of a remediation effort (e.g., reduce the risk of contracting cancer  
7 to  $1 \times 10^{-5}$  or  $1 \times 10^{-4}$ , whichever is deemed acceptable to all stakeholders). To provide maximum  
8 flexibility to decision makers during upcoming RI/FS processes, CUGs have been calculated based on a  
9 range of target risks and target HIs

- 10 • CUGs for carcinogenic contaminants have been developed for target risks of  $1 \times 10^{-4}$ ,  $1 \times 10^{-5}$ , and  
11  $1 \times 10^{-6}$ ; and
- 12 • CUGs for non-carcinogenic contaminants have been developed for target HIs of 0.1 and 1.

13 Tables 5-1 through 5-7 present calculated facility-wide CUGs for the COPCs at RVAAP for soil,  
14 subsurface soil, groundwater, surface water, and sediment, respectively. As indicated in Figure 1-1, future  
15 remediation efforts will identify the appropriate land use and receptor scenario for a given AOC to  
16 determine the proper set of likely CUGs for FSs and eventual RODs.

17 The process for applying the CUGs at future AOCs is provided below.

- 18 1. AOC projects complete characterization activities (presumably based on approved Sampling and  
19 Analysis Plans).
- 20 2. Project risk assessors
  - 21 • identify the future land-use at AOC;
  - 22 • select the appropriate receptor based on the land use and related CUGs in Tables 5-1 through  
23 5-7;
  - 24 • identify EUs within the AOC, and calculate EPCs for each EU; and
  - 25 • compare the chemical-specific EPCs to the selected CUGs to identify AOC-specific COCs for  
26 use in the FS.

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Table 5-1. Ravenna Facility-Wide CUGs for Surface Soil

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
<b>Adult Trespasser</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	1.0E+06	1.0E+06	--	--	--	17,700
Antimony	mg/kg	111	1,114	--	--	--	0.96
Arsenic	mg/kg	58.3	583	3.03	30.3	303	15.4
Barium	mg/kg	156,890	1.0E+06	--	--	--	88.4
Cadmium	mg/kg	144	1441	69,950	699,502	1.0E+06	0
Chromium	mg/kg	820	8,196	10,493	104,925	1.0E+06	17.4
Chromium, hexavalent	mg/kg	820	8,196	10,493	104,925	1.0E+06	NA
Cobalt	mg/kg	40,241	402,413	44,968	449,680	1.0E+06	10.4
Copper	mg/kg	85,523	855,230	--	--	--	17.7
Iron	mg/kg	434,278	1.0E+06	--	--	--	23,100
Manganese	mg/kg	22,029	220,293	--	--	--	1,450
Mercury	mg/kg	250	2,498	--	--	--	0.036
Nickel	mg/kg	40,609	406,093	--	--	--	21.1
Nitrate	mg/kg	1.0E+06	1.0E+06	--	--	--	NA
Silver	mg/kg	8,111	81,111	--	--	--	0
Thallium	mg/kg	87.5	875	--	--	--	0
Vanadium	mg/kg	1,009	10,090	--	--	--	31.1
Zinc	mg/kg	517,905	1.0E+06	--	--	--	61.8
<i>Organics</i>							
1,3,5-Trinitrobenzene	mg/kg	19,786	197,858	--	--	--	NA
1,3-Dinitrobenzene	mg/kg	109	1,094	--	--	--	NA
2,4,6-Trinitrotoluene	mg/kg	210	2,095	326	3259	32,593	NA
2,4-Dinitrotoluene	mg/kg	283	2,828	4.85	48.5	485	NA
2,6-Dinitrotoluene	mg/kg	146	1,456	4.99	49.9	499	NA
2-Amino-4,6-dinitrotoluene	mg/kg	310	3,095	--	--	--	NA
2-Methylnaphthalene	mg/kg	4,377	43,769	--	--	--	NA
2-Nitrotoluene	mg/kg	10,942	109,422	111	1,110	11,101	NA
4,4'-DDE	mg/kg	--	--	75.1	751	7509	NA
4-Amino-2,6-dinitrotoluene	mg/kg	310	3,095	--	--	--	NA
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--	NA
4-Nitrophenol	mg/kg	8,754	87,537	--	--	--	NA
4-Nitrotoluene	mg/kg	10,942	109,422	1502	15,019	150,187	NA
Aldrin	mg/kg	32.8	328	1.5	15.0	150	NA
Benz(a)anthracene	mg/kg	--	--	1.13	11.3	113	NA
Benzo(a)pyrene	mg/kg	--	--	0.113	1.13	11.3	NA
Benzo(b)fluoranthene	mg/kg	--	--	1.13	11.3	113	NA
Benzo(k)fluoranthene	mg/kg	--	--	11.3	113	1129	NA
Bis(2-chloroethoxy)methane	mg/kg	3,283	32,827	--	--	--	NA
Carbazole	mg/kg	--	--	1277	12,766	127,659	NA
Chrysene	mg/kg	--	--	113	1,129	11,290	NA
Dibenz(a,h)anthracene	mg/kg	--	--	0.113	1.13	11.3	NA
Dibenzofuran	mg/kg	2,188	21,884	--	--	--	NA
Dieldrin	mg/kg	54.7	547	1.6	16.0	160	NA
Endrin	mg/kg	8.9	89.0	--	--	--	NA
Endrin Aldehyde	mg/kg	--	--	--	--	--	NA
Fluoranthene	mg/kg	1,413	14,129	--	--	--	NA
Fluorene	mg/kg	4,472	44,717	--	--	--	NA
HMX	mg/kg	17,113	171,132	--	--	--	NA
Heptachlor	mg/kg	547	5,471	5.67	56.7	567	NA
Heptachlor Epoxide	mg/kg	14.2	142	2.81	28.1	281	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	1.13	11.3	113	NA
N-Nitroso-di-n-propylamine	mg/kg	--	--	1.14	11.4	114	NA
Naphthalene	mg/kg	2,236	22,355	--	--	--	NA

Table 5-1. Ravenna Facility Wide CUGs for Surface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Nitroglycerin	mg/kg	--	--	1,502	15,019	150,187	NA
PCB-1016	mg/kg	7.28	72.8	1.21	12.1	121	NA
PCB-1248	mg/kg	--	--	1.21	12.1	121	NA
PCB-1254	mg/kg	2.08	20.8	1.21	12.1	121	NA
PCB-1260	mg/kg	--	--	1.21	12.1	121	NA
Pentachlorophenol	mg/kg	1,767	17,671	11.5	115	1,145	NA
Pyrene	mg/kg	1,060	10,597	--	--	--	NA
RDX	mg/kg	2,403	24,028	170	1,699	16,990	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
beta-BHC	mg/kg	--	--	14.2	142	1,418	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>Engineering School Instructor</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	6210	62,103	--	--	--	17,700
Antimony	mg/kg	63.7	637	--	--	--	0.96
Arsenic	mg/kg	38.0	380	1.84	18.4	184	15.4
Barium	mg/kg	627	6,272	--	--	--	88.4
Cadmium	mg/kg	102	1,024	19.7	197	1,973	0
Chromium	mg/kg	10.0	100	2.96	29.6	296	17.4
Chromium, hexavalent	mg/kg	10.0	100	2.96	29.6	296	NA
Cobalt	mg/kg	25.3	253	12.7	127	1,268	10.4
Copper	mg/kg	13,240	132,401	--	--	--	17.7
Iron	mg/kg	92,205	922,050	--	--	--	23,100
Manganese	mg/kg	63.1	631	--	--	--	1450
Mercury	mg/kg	79.3	793	--	--	--	0.036
Nickel	mg/kg	6,564	65,639	--	--	--	21.1
Nitrate	mg/kg	559,755	1.0E+06	--	--	--	NA
Silver	mg/kg	1,574	15,742	--	--	--	0
Thallium	mg/kg	22.9	229	--	--	--	0
Vanadium	mg/kg	717	7,170	--	--	--	31.1
Zinc	mg/kg	95,621	956,213	--	--	--	61.8
<i>Organics</i>							
1,3,5-Trinitrobenzene	mg/kg	7,292	72,925	--	--	--	NA
1,3-Dinitrobenzene	mg/kg	28.7	287	--	--	--	NA
2,4,6-Trinitrotoluene	mg/kg	100	996	186	1859	18,590	NA
2,4-Dinitrotoluene	mg/kg	202	2,020	4.16	41.6	416	NA
2,6-Dinitrotoluene	mg/kg	103	1,032	4.25	42.5	425	NA
2-Amino-4,6-dinitrotoluene	mg/kg	62.4	624	--	--	--	NA
2-Methylnaphthalene	mg/kg	1,147	11,474	--	--	--	NA
2-Nitrotoluene	mg/kg	2,869	28,685	34.9	349	3,492	NA
4,4'-DDE	mg/kg	--	--	23.6	236	2,362	NA
4-Amino-2,6-dinitrotoluene	mg/kg	62.4	624	--	--	--	NA
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--	NA
4-Nitrophenol	mg/kg	2,295	22,948	--	--	--	NA
4-Nitrotoluene	mg/kg	2,869	28,685	472	4725	47,246	NA
Aldrin	mg/kg	8.61	86.1	0.443	4.43	44.3	NA
Benz(a)anthracene	mg/kg	--	--	1.19	11.9	119	NA
Benzo(a)pyrene	mg/kg	--	--	0.119	1.19	11.9	NA
Benzo(b)fluoranthene	mg/kg	--	--	1.19	11.9	119	NA
Benzo(k)fluoranthene	mg/kg	--	--	11.9	119	1,194	NA
Bis(2-chloroethoxy)methane	mg/kg	861	8,606	--	--	--	NA
Carbazole	mg/kg	--	--	402	4016	40,159	NA
Chrysene	mg/kg	--	--	119	1,194	11,937	NA
Dibenz(a,h)anthracene	mg/kg	--	--	0.119	1.19	11.9	NA

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Table 5-1. Ravenna Facility Wide CUGs for Surface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Dibenzofuran	mg/kg	574	5,737	--	--	--	NA
Dieldrin	mg/kg	14.3	143	0.471	4.71	47.1	NA
Endrin	mg/kg	7.97	79.7	--	--	--	NA
Endrin Aldehyde	mg/kg	--	--	--	--	--	NA
Fluoranthene	mg/kg	1,249	12,486	--	--	--	NA
Fluorene	mg/kg	3,374	33,739	--	--	--	NA
HMX	mg/kg	8,963	89,630	--	--	--	NA
Heptachlor	mg/kg	143	1,434	1.68	16.8	168	NA
Heptachlor Epoxide	mg/kg	3.73	37.3	0.829	8.29	82.9	NA
Indeno(1,2,3- <i>cd</i> )pyrene	mg/kg	--	--	1.19	11.9	119	NA
N-Nitroso-di-n-propylamine	mg/kg	--	--	0.717	7.17	71.7	NA
Naphthalene	mg/kg	1,169	11,687	--	--	--	NA
Nitroglycerin	mg/kg	--	--	472	4725	47,246	NA
PCB-1016	mg/kg	5.58	55.8	1.1	11.0	110	NA
PCB-1248	mg/kg	--	--	1.1	11.0	110	NA
PCB-1254	mg/kg	1.59	15.9	1.1	11.0	110	NA
PCB-1260	mg/kg	--	--	1.1	11.0	110	NA
Pentachlorophenol	mg/kg	1,483	14,833	11.5	115	1,154	NA
Pyrene	mg/kg	936	9,364	--	--	--	NA
RDX	mg/kg	782	7,823	66.4	664	6,638	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
beta-BHC	mg/kg	--	--	4.18	41.8	418	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>Fisher Recreator</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	1.0E+06	1.0E+06	--	--	--	17,700
Antimony	mg/kg	2,001	20,007	--	--	--	0.96
Arsenic	mg/kg	1,081	10,812	56.0	560	5605	15.4
Barium	mg/kg	1.0E+06	1.0E+06	--	--	--	88.4
Cadmium	mg/kg	2,723	27,229	524,627	1.0E+06	1.0E+06	0
Chromium	mg/kg	14,341	143,415	78,694	786,940	1.0E+06	17.4
Chromium, hexavalent	mg/kg	14,341	143,415	78,694	786,940	1.0E+06	NA
Cobalt	mg/kg	329,546	1.0E+06	337,260	1.0E+06	1.0E+06	10.4
Copper	mg/kg	913,860	1.0E+06	--	--	--	17.7
Iron	mg/kg	1.0E+06	1.0E+06	--	--	--	23,100
Manganese	mg/kg	330,971	1.0E+06	--	--	--	1,450
Mercury	mg/kg	3,730	37,304	--	--	--	0.036
Nickel	mg/kg	444,348	1.0E+06	--	--	--	21.1
Nitrate	mg/kg	1.0E+06	1.0E+06	--	--	--	NA
Silver	mg/kg	97,643	976,433	--	--	--	0
Thallium	mg/kg	1,211	12,107	--	--	--	0
Vanadium	mg/kg	19,060	190,604	--	--	--	31.1
Zinc	mg/kg	1.0E+06	1.0E+06	--	--	--	61.8
<i>Organics</i>							
1,3,5-Trinitrobenzene	mg/kg	311,860	1.0E+06	--	--	--	NA
1,3-Dinitrobenzene	mg/kg	1,513	15,133	--	--	--	NA
2,4,6-Trinitrotoluene	mg/kg	3,579	35,791	5567	55,675	556,749	NA
2,4-Dinitrotoluene	mg/kg	5,348	53,484	91.8	918	9,176	NA
2,6-Dinitrotoluene	mg/kg	2,748	27,480	94.3	943	9,429	NA
2-Amino-4,6-dinitrotoluene	mg/kg	3,795	37,955	--	--	--	NA
2-Methylnaphthalene	mg/kg	60,533	605,331	--	--	--	NA
2-Nitrotoluene	mg/kg	151,333	1.0E+06	1,535	15,353	153,526	NA
4,4'-DDE	mg/kg	--	--	1,039	10,386	103,856	NA
4-Amino-2,6-dinitrotoluene	mg/kg	3,795	37,955	--	--	--	NA
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--	NA

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Table 5-1. Ravenna Facility Wide CUGs for Surface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
4-Nitrophenol	mg/kg	121,066	1.0E+06	--	--	--	NA
4-Nitrotoluene	mg/kg	151,333	1.0E+06	20,771	207,712	1.0E+06	NA
Aldrin	mg/kg	454	4,540	20.8	208	2,077	NA
Benzo(a)anthracene	mg/kg	--	--	22.3	223	2,226	NA
Benzo(a)pyrene	mg/kg	--	--	2.23	22.3	223	NA
Benzo(b)fluoranthene	mg/kg	--	--	22.3	223	2,226	NA
Benzo(k)fluoranthene	mg/kg	--	--	223	2,226	22,260	NA
Bis(2-chloroethoxy)methane	mg/kg	45,400	453,998	--	--	--	NA
Carbazole	mg/kg	--	--	17,655	176,555	1.0E+06	NA
Chrysene	mg/kg	--	--	2,226	22,260	222,596	NA
Dibenz(a,h)anthracene	mg/kg	--	--	2.23	22.3	223	NA
Dibenzofuran	mg/kg	30,267	302,665	--	--	--	NA
Dieldrin	mg/kg	757	7,567	22.1	221	2,207	NA
Endrin	mg/kg	176	1,759	--	--	--	NA
Endrin Aldehyde	mg/kg	--	--	--	--	--	NA
Fluoranthene	mg/kg	27,856	278,564	--	--	--	NA
Fluorene	mg/kg	85,535	855,349	--	--	--	NA
HMX	mg/kg	300,353	1.0E+06	--	--	--	NA
Heptachlor	mg/kg	7,567	75,666	78.5	785	7,846	NA
Heptachlor Epoxide	mg/kg	197	1,967	38.8	388	3,880	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	22.3	223	2,226	NA
N-Nitroso-di-n-propylamine	mg/kg	--	--	20.0	200	2,002	NA
Naphthalene	mg/kg	42,752	427,524	--	--	--	NA
Nitroglycerin	mg/kg	--	--	20,771	207,712	1.0E+06	NA
PCB-1016	mg/kg	140	1,397	23.3	233	2,328	NA
PCB-1248	mg/kg	--	--	23.3	233	2,328	NA
PCB-1254	mg/kg	39.9	399	23.3	233	2,328	NA
PCB-1260	mg/kg	--	--	23.3	233	2,328	NA
Pentachlorophenol	mg/kg	34,514	345,141	224	2,237	22,370	NA
Pyrene	mg/kg	20,892	208,923	--	--	--	NA
RDX	mg/kg	36,227	362,269	2,561	25,615	256,150	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
beta-BHC	mg/kg	--	--	196	1,962	19,615	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>Hunter/Trapper</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	1.0E+06	1.0E+06	--	--	--	17,700
Antimony	mg/kg	4,624	46,244	--	--	--	0.96
Arsenic	mg/kg	2,553	25,529	132	1,323	13,233	15.4
Barium	mg/kg	1.0E+06	1.0E+06	--	--	--	88.4
Cadmium	mg/kg	6,518	65,179	874,378	1.0E+06	1.0E+06	0
Chromium	mg/kg	32,592	325,923	131,157	1.0E+06	1.0E+06	17.4
Chromium, hexavalent	mg/kg	32,592	325,923	131,157	1.0E+06	1.0E+06	NA
Cobalt	mg/kg	559,527	1.0E+06	562,100	1.0E+06	1.0E+06	10.4
Copper	mg/kg	1.0E+06	1.0E+06	--	--	--	17.7
Iron	mg/kg	1.0E+06	1.0E+06	--	--	--	23,100
Manganese	mg/kg	690,080	1.0E+06	--	--	--	1,450
Mercury	mg/kg	7,754	77,536	--	--	--	0.036
Nickel	mg/kg	815,426	1.0E+06	--	--	--	21.1
Nitrate	mg/kg	1.0E+06	1.0E+06	--	--	--	NA
Silver	mg/kg	185,145	1.0E+06	--	--	--	0
Thallium	mg/kg	2,428	24,276	--	--	--	0
Vanadium	mg/kg	45,625	456,250	--	--	--	31.1
Zinc	mg/kg	1.0E+06	1.0E+06	--	--	--	61.8

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Table 5-1. Ravenna Facility Wide CUGs for Surface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
<i>Organics</i>							
1,3,5-Trinitrobenzene	mg/kg	666,638	1.0E+06	--	--	--	NA
1,3-Dinitrobenzene	mg/kg	3,034	30,344	--	--	--	NA
2,4,6-Trinitrotoluene	mg/kg	8,012	80,124	12,464	124,638	1.0E+06	NA
2,4-Dinitrotoluene	mg/kg	12,812	128,122	220	2,198	21,982	NA
2,6-Dinitrotoluene	mg/kg	6,575	65,752	226	2,256	22,562	NA
2-Amino-4,6-dinitrotoluene	mg/kg	7,246	72,462	--	--	--	NA
2-Methylnaphthalene	mg/kg	121,378	1.0E+06	--	--	--	NA
2-Nitrotoluene	mg/kg	303,444	1.0E+06	3,078	30,784	307,842	NA
4,4'-DDE	mg/kg	--	--	2,082	20,825	208,246	NA
4-Amino-2,6-dinitrotoluene	mg/kg	7,246	72,462	--	--	--	NA
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--	NA
4-Nitrophenol	mg/kg	242,755	1.0E+06	--	--	--	NA
4-Nitrotoluene	mg/kg	303,444	1.0E+06	41,649	416,492	1.0E+06	NA
Aldrin	mg/kg	910	9,103	41.6	416	4,164	NA
Benzo(a)anthracene	mg/kg	--	--	55.0	550	5,502	NA
Benzo(a)pyrene	mg/kg	--	--	5.5	55.0	550	NA
Benzo(b)fluoranthene	mg/kg	--	--	55.0	550	5,502	NA
Benzo(k)fluoranthene	mg/kg	--	--	550	5,502	55,024	NA
Bis(2-chloroethoxy)methane	mg/kg	91,033	910,333	--	--	--	NA
Carbazole	mg/kg	--	--	35,402	354,018	1.0E+06	NA
Chrysene	mg/kg	--	--	5502	55,024	550,241	NA
Dibenz(a,h)anthracene	mg/kg	--	--	5.5	55.0	550	NA
Dibenzofuran	mg/kg	60,689	606,888	--	--	--	NA
Dieldrin	mg/kg	1,517	15,172	44.2	442	4,425	NA
Endrin	mg/kg	436	4,355	--	--	--	NA
Endrin Aldehyde	mg/kg	--	--	--	--	--	NA
Fluoranthene	mg/kg	68,859	688,589	--	--	--	NA
Fluorene	mg/kg	206,632	1.0E+06	--	--	--	NA
HMX	mg/kg	683,887	1.0E+06	--	--	--	NA
Heptachlor	mg/kg	15,172	151,722	157	1,573	15,732	NA
Heptachlor Epoxide	mg/kg	394	3,945	77.8	778	7,780	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	55.0	550	5,502	NA
N-Nitroso-di-n-propylamine	mg/kg	--	--	45.6	456	4,559	NA
Naphthalene	mg/kg	103,263	1.0E+06	--	--	--	NA
Nitroglycerin	mg/kg	--	--	41,649	416,492	1.0E+06	NA
PCB-1016	mg/kg	338	3,382	56.4	564	5,637	NA
PCB-1248	mg/kg	--	--	56.4	564	5,637	NA
PCB-1254	mg/kg	96.6	966	56.4	564	5,637	NA
PCB-1260	mg/kg	--	--	56.4	564	5,637	NA
Pentachlorophenol	mg/kg	84,696	846,961	549	5,490	54,896	NA
Pyrene	mg/kg	51,644	516,442	--	--	--	NA
RDX	mg/kg	75,666	756,663	5,350	53,501	535,015	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
beta-BHC	mg/kg	--	--	393	3,933	39,330	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>Juvenile Trespasser</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	959,740	1.0E+06	--	--	--	17,700
Antimony	mg/kg	134	1,339	--	--	--	0.96
Arsenic	mg/kg	72.5	725	11.3	113	1,128	15.4
Barium	mg/kg	154,679	1.0E+06	--	--	--	88.4
Cadmium	mg/kg	183	1,828	202,356	1.0E+06	1.0E+06	0
Chromium	mg/kg	980	9,803	30,353	303,534	1.0E+06	17.4
Chromium, hexavalent	mg/kg	980	9,803	30,353	303,534	1.0E+06	NA

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Table 5-1. Ravenna Facility Wide CUGs for Surface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Cobalt	mg/kg	26,692	266,915	130,086	1.0E+06	1.0E+06	10.4
Copper	mg/kg	59,457	594,570	--	--	--	17.7
Iron	mg/kg	357,930	1.0E+06	--	--	--	23,100
Manganese	mg/kg	23,903	239,026	--	--	--	1,450
Mercury	mg/kg	247	2,467	--	--	--	0.036
Nickel	mg/kg	28,938	289,380	--	--	--	21.1
Nitrate	mg/kg	1.0E+06	1.0E+06	--	--	--	NA
Silver	mg/kg	6,386	63,855	--	--	--	0
Thallium	mg/kg	79.7	797	--	--	--	0
Vanadium	mg/kg	1,280	12,799	--	--	--	31.1
Zinc	mg/kg	397,112	1.0E+06	--	--	--	61.8
<i>Organics</i>							
1,3,5-Trinitrobenzene	mg/kg	20,688	206,878	--	--	--	NA
1,3-Dinitrobenzene	mg/kg	100	996	--	--	--	NA
2,4,6-Trinitrotoluene	mg/kg	239	2,386	1,114	11,137	111,367	NA
2,4-Dinitrotoluene	mg/kg	359	3,592	18.5	185	1,849	NA
2,6-Dinitrotoluene	mg/kg	185	1,845	19.0	190	1,899	NA
2-Amino-4,6-dinitrotoluene	mg/kg	248	2,484	--	--	--	NA
2-Methylnaphthalene	mg/kg	3,986	39,858	--	--	--	NA
2-Nitrotoluene	mg/kg	9,965	99,646	303	3,033	30,327	NA
4,4'-DDE	mg/kg	--	--	205	2,052	20,515	NA
4-Amino-2,6-dinitrotoluene	mg/kg	248	2,484	--	--	--	NA
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--	NA
4-Nitrophenol	mg/kg	7,972	79,717	--	--	--	NA
4-Nitrotoluene	mg/kg	9,965	99,646	4,103	41,031	410,308	NA
Aldrin	mg/kg	29.9	299	4.1	41.0	410	NA
Benz(a)anthracene	mg/kg	--	--	4.5	45.0	450	NA
Benzo(a)pyrene	mg/kg	--	--	0.45	4.5	45.0	NA
Benzo(b)fluoranthene	mg/kg	--	--	4.5	45.0	450	NA
Benzo(k)fluoranthene	mg/kg	--	--	45.0	450	4,499	NA
Bis(2-chloroethoxy)methane	mg/kg	2,989	29,894	--	--	--	NA
Carbazole	mg/kg	--	--	3,488	34,876	348,761	NA
Chrysene	mg/kg	--	--	450	4,499	44,986	NA
Dibenz(a,h)anthracene	mg/kg	--	--	0.45	4.5	45.0	NA
Dibenzofuran	mg/kg	1,993	19,929	--	--	--	NA
Dieldrin	mg/kg	49.8	498	4.36	43.6	436	NA
Endrin	mg/kg	11.8	118	--	--	--	NA
Endrin Aldehyde	mg/kg	--	--	--	--	--	NA
Fluoranthene	mg/kg	1,877	18,766	--	--	--	NA
Fluorene	mg/kg	5,749	57,489	--	--	--	NA
HMX	mg/kg	20,063	200,631	--	--	--	NA
Heptachlor	mg/kg	498	4,982	15.5	155	1,550	NA
Heptachlor Epoxide	mg/kg	13.0	130	7.66	76.6	766	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	4.5	45.0	450	NA
N-Nitroso-di-n-propylamine	mg/kg	--	--	4.01	40.1	401	NA
Naphthalene	mg/kg	2874	28,739	--	--	--	NA
Nitroglycerin	mg/kg	--	--	4,103	41,031	410,308	NA
PCB-1016	mg/kg	9.39	93.9	4.7	47.0	470	NA
PCB-1248	mg/kg	--	--	4.7	47.0	470	NA
PCB-1254	mg/kg	2.68	26.8	4.7	47.0	470	NA
PCB-1260	mg/kg	--	--	4.7	47.0	470	NA
Pentachlorophenol	mg/kg	2,323	23,234	45.2	452	4,518	NA
Pyrene	mg/kg	1,407	14,074	--	--	--	NA
RDX	mg/kg	2,397	23,968	508	5,084	50,842	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA



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Table 5-1. Ravenna Facility Wide CUGs for Surface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
beta-BHC	mg/kg	--	--	38.7	387	3,875	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>National Guard Dust/Fire Control Worker</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	1.0E+06	1.0E+06	--	--	--	17,700
Antimony	mg/kg	1,030	10,297	--	--	--	0.96
Arsenic	mg/kg	573	5,735	35.7	357	3,565	15.4
Barium	mg/kg	810,909	1.0E+06	--	--	--	88.4
Cadmium	mg/kg	1,473	14,726	94,527	945,273	1.0E+06	0
Chromium	mg/kg	6,666	66,659	14,179	141,791	1.0E+06	17.4
Chromium, hexavalent	mg/kg	6,666	66,659	14,179	141,791	1.0E+06	NA
Cobalt	mg/kg	74,531	745,311	60,768	607,676	1.0E+06	10.4
Copper	mg/kg	341,235	1.0E+06	--	--	--	17.7
Iron	mg/kg	1.0E+06	1.0E+06	--	--	--	23,100
Manganese	mg/kg	116,634	1.0E+06	--	--	--	1,450
Mercury	mg/kg	1,659	16,586	--	--	--	0.036
Nickel	mg/kg	167,541	1.0E+06	--	--	--	21.1
Nitrate	mg/kg	1.0E+06	1.0E+06	--	--	--	NA
Silver	mg/kg	38,421	384,211	--	--	--	0
Thallium	mg/kg	513	5,129	--	--	--	0
Vanadium	mg/kg	10,308	103,084	--	--	--	31.1
Zinc	mg/kg	1.0E+06	1.0E+06	--	--	--	61.8
<i>Organics</i>							
1,3,5-Trinitrobenzene	mg/kg	144,038	1.0E+06	--	--	--	NA
1,3-Dinitrobenzene	mg/kg	641	6,412	--	--	--	NA
2,4,6-Trinitrotoluene	mg/kg	1,762	17,616	3,288	32,883	328,829	NA
2,4-Dinitrotoluene	mg/kg	2,896	28,957	59.6	596	5,962	NA
2,6-Dinitrotoluene	mg/kg	1,485	14,853	61.2	612	6,116	NA
2-Amino-4,6-dinitrotoluene	mg/kg	1,507	15,069	--	--	--	NA
2-Methylnaphthalene	mg/kg	25,646	256,462	--	--	--	NA
2-Nitrotoluene	mg/kg	64,115	641,154	781	7,805	78,054	NA
4,4'-DDE	mg/kg	--	--	528	5,280	52,801	NA
4-Amino-2,6-dinitrotoluene	mg/kg	1,507	15,069	--	--	--	NA
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--	NA
4-Nitrophenol	mg/kg	51,292	512,923	--	--	--	NA
4-Nitrotoluene	mg/kg	64,115	641,154	10,560	105,602	1.0E+06	NA
Aldrin	mg/kg	192	1,923	10.6	106	1,056	NA
Benz(a)anthracene	mg/kg	--	--	15.1	151	1,513	NA
Benzo(a)pyrene	mg/kg	--	--	1.51	15.1	151	NA
Benzo(b)fluoranthene	mg/kg	--	--	15.1	151	1,513	NA
Benzo(k)fluoranthene	mg/kg	--	--	151	1,513	15,129	NA
Bis(2-chloroethoxy)methane	mg/kg	19,235	192,346	--	--	--	NA
Carbazole	mg/kg	--	--	8,976	89,762	897,616	NA
Chrysene	mg/kg	--	--	1,513	15,129	151,294	NA
Dibenz(a,h)anthracene	mg/kg	--	--	1.51	15.1	151	NA
Dibenzofuran	mg/kg	12,823	128,231	--	--	--	NA
Dieldrin	mg/kg	321	3,206	11.2	112	1,122	NA
Endrin	mg/kg	100	999	--	--	--	NA
Endrin Aldehyde	mg/kg	--	--	--	--	--	NA
Fluoranthene	mg/kg	15,778	157,779	--	--	--	NA
Fluorene	mg/kg	46,870	468,700	--	--	--	NA
HMX	mg/kg	151,363	1.0E+06	--	--	--	NA
Heptachlor	mg/kg	3,206	32,058	39.9	399	3,988	NA
Heptachlor Epoxide	mg/kg	83.4	834	19.7	197	1,972	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	15.1	151	1,513	NA

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Table 5-1. Ravenna Facility Wide CUGs for Surface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
N-Nitroso-di-n-propylamine	mg/kg	--	--	12.1	121	1,211	NA
Naphthalene	mg/kg	23,405	234,049	--	--	--	NA
Nitroglycerin	mg/kg	--	--	10,560	105,602	1.0E+06	NA
PCB-1016	mg/kg	76.8	768	15.4	154	1,536	NA
PCB-1248	mg/kg	--	--	15.4	154	1,536	NA
PCB-1254	mg/kg	21.9	219	15.4	154	1,536	NA
PCB-1260	mg/kg	--	--	15.4	154	1,536	NA
Pentachlorophenol	mg/kg	19,344	193,438	150	1505	15,045	NA
Pyrene	mg/kg	11,833	118,334	--	--	--	NA
RDX	mg/kg	16,214	162,136	1,376	13,757	137,570	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
beta-BHC	mg/kg	--	--	100	997	9,970	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>National Guard Range Maintenance Soldier</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	778,938	1.0E+06	--	--	--	17,700
Antimony	mg/kg	161	1,614	--	--	--	0.96
Arsenic	mg/kg	92.5	925	5.76	57.6	576	15.4
Barium	mg/kg	129,225	1.0E+06	--	--	--	88.4
Cadmium	mg/kg	242	2,424	25,321	253,213	1.0E+06	0
Chromium	mg/kg	1,108	11,077	3,798	37,982	379,820	17.4
Chromium, hexavalent	mg/kg	1,108	11,077	3,798	37,982	379,820	NA
Cobalt	mg/kg	13,519	135,188	16,278	162,780	1.0E+06	10.4
Copper	mg/kg	42,486	424,860	--	--	--	17.7
Iron	mg/kg	285,369	1.0E+06	--	--	--	23,100
Manganese	mg/kg	20,723	207,235	--	--	--	1,450
Mercury	mg/kg	230	2,304	--	--	--	0.036
Nickel	mg/kg	20,971	209,713	--	--	--	21.1
Nitrate	mg/kg	1.0E+06	1.0E+06	--	--	--	NA
Silver	mg/kg	4,928	49,277	--	--	--	0
Thallium	mg/kg	68.9	689	--	--	--	0
Vanadium	mg/kg	1,697	16,969	--	--	--	31.1
Zinc	mg/kg	301,090	1.0E+06	--	--	--	61.8
<i>Organics</i>							
1,3,5-Trinitrobenzene	mg/kg	20,584	205,835	--	--	--	NA
1,3-Dinitrobenzene	mg/kg	86.1	861	--	--	--	NA
2,4,6-Trinitrotoluene	mg/kg	265	2,652	495	4,950	49,497	NA
2,4-Dinitrotoluene	mg/kg	477	4,772	9.82	98.2	982	NA
2,6-Dinitrotoluene	mg/kg	244	2,444	10.1	101	1,006	NA
2-Amino-4,6-dinitrotoluene	mg/kg	194	1,943	--	--	--	NA
2-Methylnaphthalene	mg/kg	3,445	34,451	--	--	--	NA
2-Nitrotoluene	mg/kg	8,613	86,128	105	1,049	10,485	NA
4,4'-DDE	mg/kg	--	--	70.9	709	7,093	NA
4-Amino-2,6-dinitrotoluene	mg/kg	194	1,943	--	--	--	NA
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--	NA
4-Nitrophenol	mg/kg	6,890	68,903	--	--	--	NA
4-Nitrotoluene	mg/kg	8,613	86,128	1,419	14,186	141,859	NA
Aldrin	mg/kg	25.8	258	1.42	14.2	142	NA
Benz(a)anthracene	mg/kg	--	--	2.62	26.2	262	NA
Benzo(a)pyrene	mg/kg	--	--	0.262	2.62	26.2	NA
Benzo(b)fluoranthene	mg/kg	--	--	2.62	26.2	262	NA
Benzo(k)fluoranthene	mg/kg	--	--	26.2	262	2,619	NA
Bis(2-chloroethoxy)methane	mg/kg	2,584	25,839	--	--	--	NA
Carbazole	mg/kg	--	--	1,206	12,058	120,580	NA
Chrysene	mg/kg	--	--	262	2,619	26,193	NA

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Table 5-1. Ravenna Facility Wide CUGs for Surface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Dibenz(a,h)anthracene	mg/kg	--	--	0.262	2.62	26.2	NA
Dibenzofuran	mg/kg	1,723	17,226	--	--	--	NA
Dieldrin	mg/kg	43.1	431	1.51	15.1	151	NA
Endrin	mg/kg	17.3	173	--	--	--	NA
Endrin Aldehyde	mg/kg	--	--	--	--	--	NA
Fluoranthene	mg/kg	2,732	27,316	--	--	--	NA
Fluorene	mg/kg	7,823	78,227	--	--	--	NA
HMX	mg/kg	23,265	232,653	--	--	--	NA
Heptachlor	mg/kg	431	4,306	5.36	53.6	536	NA
Heptachlor Epoxide	mg/kg	11.2	112	2.65	26.5	265	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	2.62	26.2	262	NA
N-Nitroso-di-n-propylamine	mg/kg	--	--	1.86	18.6	186	NA
Naphthalene	mg/kg	3,908	39,082	--	--	--	NA
Nitroglycerin	mg/kg	--	--	1,419	14,186	141,859	NA
PCB-1016	mg/kg	12.9	129	2.57	25.7	257	NA
PCB-1248	mg/kg	--	--	2.57	25.7	257	NA
PCB-1254	mg/kg	3.67	36.7	2.57	25.7	257	NA
PCB-1260	mg/kg	--	--	2.57	25.7	257	NA
Pentachlorophenol	mg/kg	3,309	33,092	25.7	257	2,574	NA
Pyrene	mg/kg	2,049	20,487	--	--	--	NA
RDX	mg/kg	2,263	22,629	192	1,920	19,200	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
beta-BHC	mg/kg	--	--	13.4	134	1,340	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>National Guard Trainee</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	3,496	34,960	--	--	--	17,700
Antimony	mg/kg	175	1,753	--	--	--	0.96
Arsenic	mg/kg	114	1,140	2.78	27.8	278	15.4
Barium	mg/kg	351	3,506	--	--	--	88.4
Cadmium	mg/kg	329	3,292	10.9	109	1,093	0
Chromium	mg/kg	5.61	56.1	1.64	16.4	164	17.4
Chromium, hexavalent	mg/kg	5.61	56.1	1.64	16.4	164	NA
Cobalt	mg/kg	14.0	140	7.03	70.3	703	10.4
Copper	mg/kg	25,368	253,680	--	--	--	17.7
Iron	mg/kg	184,370	1.0E+06	--	--	--	23,100
Manganese	mg/kg	35.1	351	--	--	--	1,450
Mercury	mg/kg	172	1,722	--	--	--	0.036
Nickel	mg/kg	12,639	126,391	--	--	--	21.1
Nitrate	mg/kg	1.0E+06	1.0E+06	--	--	--	NA
Silver	mg/kg	3,105	31,049	--	--	--	0
Thallium	mg/kg	47.7	477	--	--	--	0
Vanadium	mg/kg	2,304	23,045	--	--	--	31.1
Zinc	mg/kg	187,269	1.0E+06	--	--	--	61.8
<i>Organics</i>							
1,3,5-Trinitrobenzene	mg/kg	16,542	165,422	--	--	--	NA
1,3-Dinitrobenzene	mg/kg	59.6	596	--	--	--	NA
2,4,6-Trinitrotoluene	mg/kg	249	2,488	464	4,643	46,435	NA
2,4-Dinitrotoluene	mg/kg	652	6,519	13.4	134	1,342	NA
2,6-Dinitrotoluene	mg/kg	331	3,309	13.6	136	1,362	NA
2-Amino-4,6-dinitrotoluene	mg/kg	124	1,237	--	--	--	NA
2-Methylnaphthalene	mg/kg	2,384	23,845	--	--	--	NA
2-Nitrotoluene	mg/kg	5,961	59,611	72.6	726	7,257	NA
4,4'-DDE	mg/kg	--	--	49.1	491	4,909	NA
4-Amino-2,6-dinitrotoluene	mg/kg	124	1,237	--	--	--	NA

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Table 5-1. Ravenna Facility Wide CUGs for Surface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--	NA
4-Nitrophenol	mg/kg	4,769	47,689	--	--	--	NA
4-Nitrotoluene	mg/kg	5,961	59,611	982	9,818	98,183	NA
Aldrin	mg/kg	17.9	179	0.788	7.88	78.8	NA
Benzo(a)anthracene	mg/kg	--	--	4.77	47.7	477	NA
Benzo(a)pyrene	mg/kg	--	--	0.477	4.77	47.7	NA
Benzo(b)fluoranthene	mg/kg	--	--	4.77	47.7	477	NA
Benzo(k)fluoranthene	mg/kg	--	--	47.7	477	4,774	NA
Bis(2-chloroethoxy)methane	mg/kg	1,788	17,883	--	--	--	NA
Carbazole	mg/kg	--	--	835	8,346	83,456	NA
Chrysene	mg/kg	--	--	477	4,774	47,736	NA
Dibenz(a,h)anthracene	mg/kg	--	--	0.477	4.77	47.7	NA
Dibenzofuran	mg/kg	1,192	11,922	--	--	--	NA
Dieldrin	mg/kg	29.8	298	0.839	8.39	83.9	NA
Endrin	mg/kg	33.0	330	--	--	--	NA
Endrin Aldehyde	mg/kg	--	--	--	--	--	NA
Fluoranthene	mg/kg	5,087	50,868	--	--	--	NA
Fluorene	mg/kg	11,458	114,583	--	--	--	NA
HMX	mg/kg	23,464	234,645	--	--	--	NA
Heptachlor	mg/kg	298	2,981	2.98	29.8	298	NA
Heptachlor Epoxide	mg/kg	7.75	77.5	1.48	14.8	148	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	4.77	47.7	477	NA
N-Nitroso-di-n-propylamine	mg/kg	--	--	1.88	18.8	188	NA
Naphthalene	mg/kg	1,541	15,407	--	--	--	NA
Nitroglycerin	mg/kg	--	--	982	9818	98,183	NA
PCB-1016	mg/kg	19.2	192	3.46	34.6	346	NA
PCB-1248	mg/kg	--	--	3.46	34.6	346	NA
PCB-1254	mg/kg	5.49	54.9	3.46	34.6	346	NA
PCB-1260	mg/kg	--	--	3.46	34.6	346	NA
Pentachlorophenol	mg/kg	5,656	56,558	44.0	440	4,399	NA
Pyrene	mg/kg	3,815	38,151	--	--	--	NA
RDX	mg/kg	1,711	17,113	145	1,452	14,520	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
beta-BHC	mg/kg	--	--	7.42	74.2	742	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>Resident Farmer Adult</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	52,923	529,229	--	--	--	17,700
Antimony	mg/kg	13.6	136	--	--	--	0.96
Arsenic	mg/kg	8.21	82.1	0.425	4.25	42.5	15.4
Barium	mg/kg	8,966	89,656	--	--	--	88.4
Cadmium	mg/kg	22.3	223	1,249	12,491	124,911	0
Chromium	mg/kg	90.4	904	187	1,874	18,737	17.4
Chromium, hexavalent	mg/kg	90.4	904	187	1,874	18,737	NA
Cobalt	mg/kg	820	8,198	803	8,030	80,300	10.4
Copper	mg/kg	2,714	27,138	--	--	--	17.7
Iron	mg/kg	19,010	190,104	--	--	--	23,100
Manganese	mg/kg	1,482	14,817	--	--	--	1,450
Mercury	mg/kg	16.5	165	--	--	--	0.036
Nickel	mg/kg	1,346	13,463	--	--	--	21.1
Nitrate	mg/kg	114,196	1.0E+06	--	--	--	NA
Silver	mg/kg	324	3,240	--	--	--	0
Thallium	mg/kg	4.76	47.6	--	--	--	0
Vanadium	mg/kg	156	1,558	--	--	--	31.1
Zinc	mg/kg	19,659	196,589	--	--	--	61.8

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Table 5-1. Ravenna Facility Wide CUGs for Surface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
<i>Organics</i>							
1,3,5-Trinitrobenzene	mg/kg	1,528	15,280	--	--	--	NA
1,3-Dinitrobenzene	mg/kg	5.94	59.4	--	--	--	NA
2,4,6-Trinitrotoluene	mg/kg	21.1	211	32.8	328	3,283	NA
2,4-Dinitrotoluene	mg/kg	43.9	439	0.753	7.53	75.3	NA
2,6-Dinitrotoluene	mg/kg	22.4	224	0.769	7.69	76.9	NA
2-Amino-4,6-dinitrotoluene	mg/kg	12.8	128	--	--	--	NA
2-Methylnaphthalene	mg/kg	238	2,378	--	--	--	NA
2-Nitrotoluene	mg/kg	594	5,945	6.03	60.3	603	NA
4,4'-DDE	mg/kg	--	--	4.08	40.8	408	NA
4-Amino-2,6-dinitrotoluene	mg/kg	12.8	128	--	--	--	NA
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--	NA
4-Nitrophenol	mg/kg	476	4,756	--	--	--	NA
4-Nitrotoluene	mg/kg	594	5,945	81.6	816	8,159	NA
Aldrin	mg/kg	1.78	17.8	0.082	0.816	8.16	NA
Benzo(a)anthracene	mg/kg	--	--	0.221	2.21	22.1	NA
Benzo(a)pyrene	mg/kg	--	--	0.022	0.221	2.21	NA
Benzo(b)fluoranthene	mg/kg	--	--	0.221	2.21	22.1	NA
Benzo(k)fluoranthene	mg/kg	--	--	2.21	22.1	221	NA
Bis(2-chloroethoxy)methane	mg/kg	178	1,783	--	--	--	NA
Carbazole	mg/kg	--	--	69.4	694	6,935	NA
Chrysene	mg/kg	--	--	22.1	221	2,209	NA
Dibenz(a,h)anthracene	mg/kg	--	--	0.022	0.221	2.21	NA
Dibenzofuran	mg/kg	119	1,189	--	--	--	NA
Dieldrin	mg/kg	2.97	29.7	0.087	0.867	8.67	NA
Endrin	mg/kg	1.77	17.7	--	--	--	NA
Endrin Aldehyde	mg/kg	--	--	--	--	--	NA
Fluoranthene	mg/kg	276	2,765	--	--	--	NA
Fluorene	mg/kg	737	7,366	--	--	--	NA
HMX	mg/kg	1,909	19,090	--	--	--	NA
Heptachlor	mg/kg	29.7	297	0.308	3.08	30.8	NA
Heptachlor Epoxide	mg/kg	0.773	7.73	0.152	1.52	15.2	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	0.221	2.21	22.1	NA
N-Nitroso-di-n-propylamine	mg/kg	--	--	0.127	1.27	12.7	NA
Naphthalene	mg/kg	368	3,678	--	--	--	NA
Nitroglycerin	mg/kg	--	--	81.6	816	8,159	NA
PCB-1016	mg/kg	1.22	12.2	0.203	2.03	20.3	NA
PCB-1248	mg/kg	--	--	0.203	2.03	20.3	NA
PCB-1254	mg/kg	0.348	3.48	0.203	2.03	20.3	NA
PCB-1260	mg/kg	--	--	0.203	2.03	20.3	NA
Pentachlorophenol	mg/kg	327	3,269	2.12	21.2	212	NA
Pyrene	mg/kg	207	2,074	--	--	--	NA
RDX	mg/kg	163	1,632	11.5	115	1,154	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
beta-BHC	mg/kg	--	--	0.77	7.7	77.0	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>Resident Farmer Child</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	7,380	73,798	--	--	--	17,700
Antimony	mg/kg	2.82	28.2	--	--	--	0.96
Arsenic	mg/kg	2.02	20.2	0.524	5.24	52.4	15.4
Barium	mg/kg	1,413	14,129	--	--	--	88.4
Cadmium	mg/kg	6.41	64.1	2.677	26,767	267,667	0
Chromium	mg/kg	19.9	199	401.5	4,015	40,150	17.4
Chromium, hexavalent	mg/kg	19.9	199	401.5	4,015	40,150	NA

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Table 5-1. Ravenna Facility Wide CUGs for Surface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Cobalt	mg/kg	131	1,313	1721	17,207	172,071	10.4
Copper	mg/kg	311	3,106	--	--	--	17.7
Iron	mg/kg	2,313	23,125	--	--	--	23,100
Manganese	mg/kg	293	2,927	--	--	--	1,450
Mercury	mg/kg	2.27	22.7	--	--	--	0.036
Nickel	mg/kg	155	1,552	--	--	--	21.1
Nitrate	mg/kg	12,487	124,868	--	--	--	NA
Silver	mg/kg	38.6	386	--	--	--	0
Thallium	mg/kg	0.612	6.12	--	--	--	0
Vanadium	mg/kg	44.9	449	--	--	--	31.1
Zinc	mg/kg	2,321	23,209	--	--	--	61.8
<i>Organics</i>							
1,3,5-Trinitrobenzene	mg/kg	225	2,252	--	--	--	NA
1,3-Dinitrobenzene	mg/kg	0.765	7.65	--	--	--	NA
2,4,6-Trinitrotoluene	mg/kg	3.65	36.5	28.4	284	2,842	NA
2,4-Dinitrotoluene	mg/kg	12.8	128	1.1	11.0	110	NA
2,6-Dinitrotoluene	mg/kg	6.42	64.2	1.1	11.0	110	NA
2-Amino-4,6-dinitrotoluene	mg/kg	1.54	15.4	--	--	--	NA
2-Methylnaphthalene	mg/kg	30.6	306	--	--	--	NA
2-Nitrotoluene	mg/kg	76.5	765	3.88	38.8	388	NA
4,4'-DDE	mg/kg	--	--	2.63	26.3	263	NA
4-Amino-2,6-dinitrotoluene	mg/kg	1.54	15.4	--	--	--	NA
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--	NA
4-Nitrophenol	mg/kg	61.2	612	--	--	--	NA
4-Nitrotoluene	mg/kg	76.5	765	52.5	525	5,252	NA
Aldrin	mg/kg	0.23	2.3	0.053	0.525	5.25	NA
Benzo(a)anthracene	mg/kg	--	--	0.65	6.5	65.0	NA
Benzo(a)pyrene	mg/kg	--	--	0.065	0.65	6.5	NA
Benzo(b)fluoranthene	mg/kg	--	--	0.65	6.5	65.0	NA
Benzo(k)fluoranthene	mg/kg	--	--	6.5	65.0	650	NA
Bis(2-chloroethoxy)methane	mg/kg	23.0	230	--	--	--	NA
Carbazole	mg/kg	--	--	44.6	446	4,464	NA
Chrysene	mg/kg	--	--	65.0	650	6,502	NA
Dibenz(a,h)anthracene	mg/kg	--	--	0.065	0.65	6.5	NA
Dibenzofuran	mg/kg	15.3	153	--	--	--	NA
Dieldrin	mg/kg	0.383	3.83	0.056	0.558	5.58	NA
Endrin	mg/kg	1.12	11.2	--	--	--	NA
Endrin Aldehyde	mg/kg	--	--	--	--	--	NA
Fluoranthene	mg/kg	163	1,627	--	--	--	NA
Fluorene	mg/kg	243	2,433	--	--	--	NA
HMX	mg/kg	359	3,594	--	--	--	NA
Heptachlor	mg/kg	3.83	38.3	0.198	1.98	19.8	NA
Heptachlor Epoxide	mg/kg	0.099	0.995	0.098	0.981	9.81	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	0.65	6.5	65.0	NA
N-Nitroso-di-n-propylamine	mg/kg	--	--	0.12	1.2	12.0	NA
Naphthalene	mg/kg	122	1,215	--	--	--	NA
Nitroglycerin	mg/kg	--	--	52.5	525	5252	NA
PCB-1016	mg/kg	0.419	4.19	0.349	3.49	34.9	NA
PCB-1248	mg/kg	--	--	0.349	3.49	34.9	NA
PCB-1254	mg/kg	0.12	1.2	0.349	3.49	34.9	NA
PCB-1260	mg/kg	--	--	0.349	3.49	34.9	NA
Pentachlorophenol	mg/kg	151	1,514	4.91	49.1	491	NA
Pyrene	mg/kg	122	1,220	--	--	--	NA
RDX	mg/kg	22.7	227	8.03	80.3	803	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA

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Table 5-1. Ravenna Facility Wide CUGs for Surface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
beta-BHC	mg/kg	--	--	0.496	4.96	49.6	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>Security Guard/Maintenance Worker</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	366,343	1.0E+06	--	--	--	17,700
Antimony	mg/kg	34.2	342	--	--	--	0.96
Arsenic	mg/kg	17.7	177	1.1	11.0	110	15.4
Barium	mg/kg	53,190	531,903	--	--	--	88.4
Cadmium	mg/kg	43.5	435	50,364	503,642	1.0E+06	0
Chromium	mg/kg	254	2,537	7,555	75,546	755,462	17.4
Chromium, hexavalent	mg/kg	254	2,537	7,555	75,546	755,462	NA
Cobalt	mg/kg	21,213	212,130	32,377	323,770	1.0E+06	10.4
Copper	mg/kg	34,449	344,494	--	--	--	17.7
Iron	mg/kg	156,695	1.0E+06	--	--	--	23,100
Manganese	mg/kg	7,253	72,529	--	--	--	1,450
Mercury	mg/kg	82.5	825	--	--	--	0.036
Nickel	mg/kg	16,066	160,664	--	--	--	21.1
Nitrate	mg/kg	1.0E+06	1.0E+06	--	--	--	NA
Silver	mg/kg	3,006	30,059	--	--	--	0
Thallium	mg/kg	30.0	300	--	--	--	0
Vanadium	mg/kg	304	3,042	--	--	--	31.1
Zinc	mg/kg	195,080	1.0E+06	--	--	--	61.8
<i>Organics</i>							
1,3,5-Trinitrobenzene	mg/kg	6380	63,800	--	--	--	NA
1,3-Dinitrobenzene	mg/kg	37.5	375	--	--	--	NA
2,4,6-Trinitrotoluene	mg/kg	65.4	654	122	1,222	12,215	NA
2,4-Dinitrotoluene	mg/kg	85.2	852	1.75	17.5	175	NA
2,6-Dinitrotoluene	mg/kg	43.9	439	1.81	18.1	181	NA
2-Amino-4,6-dinitrotoluene	mg/kg	113	1,134	--	--	--	NA
2-Methylnaphthalene	mg/kg	1,499	14,993	--	--	--	NA
2-Nitrotoluene	mg/kg	3748	37,482	45.6	456	4,563	NA
4,4'-DDE	mg/kg	--	--	30.9	309	3,087	NA
4-Amino-2,6-dinitrotoluene	mg/kg	113	1,134	--	--	--	NA
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--	NA
4-Nitrophenol	mg/kg	2,999	29,985	--	--	--	NA
4-Nitrotoluene	mg/kg	3,748	37,482	617	6,173	61,735	NA
Aldrin	mg/kg	11.2	112	0.617	6.17	61.7	NA
Benz(a)anthracene	mg/kg	--	--	0.403	4.03	40.3	NA
Benzo(a)pyrene	mg/kg	--	--	0.04	0.403	4.03	NA
Benzo(b)fluoranthene	mg/kg	--	--	0.403	4.03	40.3	NA
Benzo(k)fluoranthene	mg/kg	--	--	4.03	40.3	403	NA
Bis(2-chloroethoxy)methane	mg/kg	1,124	11,244	--	--	--	NA
Carbazole	mg/kg	--	--	525	5,247	52,474	NA
Chrysene	mg/kg	--	--	40.3	403	4,029	NA
Dibenz(a,h)anthracene	mg/kg	--	--	0.04	0.403	4.03	NA
Dibenzofuran	mg/kg	750	7,496	--	--	--	NA
Dieldrin	mg/kg	18.7	187	0.656	6.56	65.6	NA
Endrin	mg/kg	2.65	26.5	--	--	--	NA
Endrin Aldehyde	mg/kg	--	--	--	--	--	NA
Fluoranthene	mg/kg	420	4,202	--	--	--	NA
Fluorene	mg/kg	1,343	13,427	--	--	--	NA
HMX	mg/kg	5,292	52,917	--	--	--	NA
Heptachlor	mg/kg	187	1,874	2.33	23.3	233	NA
Heptachlor Epoxide	mg/kg	4.87	48.7	1.15	11.5	115	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	0.403	4.03	40.3	NA

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**Table 5-1. Ravenna Facility Wide CUGs for Surface Soil (continued)**

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
N-Nitroso-di-n-propylamine	mg/kg	--	--	0.423	4.23	42.3	NA
Naphthalene	mg/kg	671	6,713	--	--	--	NA
Nitroglycerin	mg/kg	--	--	617	6,173	61,735	NA
PCB-1016	mg/kg	2.18	21.8	0.437	4.37	43.7	NA
PCB-1248	mg/kg	--	--	0.437	4.37	43.7	NA
PCB-1254	mg/kg	0.624	6.24	0.437	4.37	43.7	NA
PCB-1260	mg/kg	--	--	0.437	4.37	43.7	NA
Pentachlorophenol	mg/kg	527	5,271	4.1	41.0	410	NA
Pyrene	mg/kg	315	3,151	--	--	--	NA
RDX	mg/kg	790	7,899	67.0	670	6,702	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
beta-BHC	mg/kg	--	--	5.83	58.3	583	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA

COPC = Chemical of potential concern.  
 CUG = Cleanup goal across all pathways (ingestion, dermal, and inhalation).  
 HI = Hazard index.  
 HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.  
 NA = Not available.  
 PCB = Polychlorinated biphenyl.  
 RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.  
 -- = No CUG could be quantified based on lack of approved toxicity value.



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Table 5-2. Ravenna Facility-Wide CUGs for Ingestion of Foodstuffs from Surface Soil

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG		
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>
<b>Resident Farmer Adult</b>						
<i>Inorganics</i>						
Aluminum	mg/kg	329	3,292	--	--	--
Antimony	mg/kg	0.129	1.29	--	--	--
Arsenic	mg/kg	0.096	0.958	0.005	0.05	0.497
Barium	mg/kg	64.5	645	--	--	--
Cadmium	mg/kg	0.201	2.01	--	--	--
Chromium	mg/kg	0.956	9.56	--	--	--
Chromium, hexavalent	mg/kg	0.956	9.56	--	--	--
Cobalt	mg/kg	6.16	61.6	--	--	--
Copper	mg/kg	7.86	78.6	--	--	--
Iron	mg/kg	90.4	904	--	--	--
Manganese	mg/kg	12.1	121	--	--	--
Mercury	mg/kg	--	--	--	--	--
Nickel	mg/kg	2.76	27.6	--	--	--
Nitrate	mg/kg	--	--	--	--	--
Silver	mg/kg	1.57	15.7	--	--	--
Thallium	mg/kg	--	--	--	--	--
Vanadium	mg/kg	2.31	23.1	--	--	--
Zinc	mg/kg	16.9	169	--	--	--
<i>Organics</i>						
1,3,5-Trinitrobenzene	mg/kg	1.41	14.1	--	--	--
1,3-Dinitrobenzene	mg/kg	0.007	0.075	--	--	--
2,4,6-Trinitrotoluene	mg/kg	0.071	0.705	0.11	1.1	11.0
2,4-Dinitrotoluene	mg/kg	0.221	2.21	0.004	0.038	0.38
2,6-Dinitrotoluene	mg/kg	0.083	0.825	0.003	0.028	0.283
2-Amino-4,6-dinitrotoluene	mg/kg	--	--	--	--	--
2-Methylnaphthalene	mg/kg	1.15	11.5	--	--	--
2-Nitrotoluene	mg/kg	1.41	14.1	0.014	0.143	1.43
4,4'-DDE	mg/kg	--	--	0.018	0.177	1.77
4-Amino-2,6-dinitrotoluene	mg/kg	--	--	--	--	--
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--
4-Nitrophenol	mg/kg	0.805	8.05	--	--	--
4-Nitrotoluene	mg/kg	1.53	15.3	0.211	2.11	21.1
Aldrin	mg/kg	0.007	0.066	3.0E-04	0.003	0.03
Benz(a)anthracene	mg/kg	--	--	0.008	0.083	0.827
Benzo(a)pyrene	mg/kg	--	--	6.3E-04	0.006	0.063
Benzo(b)fluoranthene	mg/kg	--	--	0.006	0.063	0.634
Benzo(k)fluoranthene	mg/kg	--	--	0.024	0.243	2.43
Bis(2-chloroethoxy)methane	mg/kg	0.158	1.58	--	--	--
Carbazole	mg/kg	--	--	0.33	3.3	33.0
Chrysene	mg/kg	--	--	0.827	8.27	82.7
Dibenz(a,h)anthracene	mg/kg	--	--	2.4E-04	0.002	0.024
Dibenzofuran	mg/kg	0.596	5.96	--	--	--
Dieldrin	mg/kg	0.015	0.154	4.5E-04	0.004	0.045
Endrin	mg/kg	0.093	0.925	--	--	--
Endrin Aldehyde	mg/kg	--	--	--	--	--
Fluoranthene	mg/kg	12.3	123	--	--	--
Fluorene	mg/kg	12.2	122	--	--	--

Table 5-2. Ravenna Facility Wide CUGs for Ingestion of Foodstuffs from Surface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG		
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>
HMX	mg/kg	1.16	11.6	--	--	--
Heptachlor	mg/kg	0.152	1.52	0.002	0.016	0.157
Heptachlor epoxide	mg/kg	0.004	0.037	7.4E-04	0.007	0.074
Indeno(1,2,3- <i>cd</i> )pyrene	mg/kg	--	--	0.003	0.034	0.342
N-Nitroso-di-n-propylamine	mg/kg	--	--	2.0E-04	0.002	0.02
Naphthalene	mg/kg	4.93	49.3	--	--	--
Nitroglycerin	mg/kg	--	--	--	--	--
PCB-1016	mg/kg	0.016	0.162	0.003	0.027	0.27
PCB-1248	mg/kg	--	--	0.003	0.029	0.287
PCB-1254	mg/kg	0.004	0.043	0.003	0.025	0.251
PCB-1260	mg/kg	--	--	5.1E-04	0.005	0.051
Pentachlorophenol	mg/kg	6.94	69.4	0.045	0.45	4.5
Pyrene	mg/kg	9.25	92.5	--	--	--
RDX	mg/kg	0.74	7.4	0.052	0.523	5.23
alpha-Chlordane	mg/kg	--	--	--	--	--
beta-BHC	mg/kg	--	--	0.004	0.038	0.379
gamma-Chlordane	mg/kg	--	--	--	--	--
<b>Resident Farmer Child</b>						
<i>Inorganics</i>						
Aluminum	mg/kg	70.1	701	--	--	--
Antimony	mg/kg	0.028	0.277	--	--	--
Arsenic	mg/kg	0.02	0.205	0.005	0.053	0.531
Barium	mg/kg	13.6	136	--	--	--
Cadmium	mg/kg	0.041	0.41	--	--	--
Chromium	mg/kg	0.205	2.05	--	--	--
Chromium, hexavalent	mg/kg	0.205	2.05	--	--	--
Cobalt	mg/kg	1.32	13.2	--	--	--
Copper	mg/kg	1.54	15.4	--	--	--
Iron	mg/kg	19.4	194	--	--	--
Manganese	mg/kg	2.59	25.9	--	--	--
Mercury	mg/kg	--	--	--	--	--
Nickel	mg/kg	0.444	4.44	--	--	--
Nitrate	mg/kg	--	--	--	--	--
Silver	mg/kg	0.334	3.34	--	--	--
Thallium	mg/kg	--	--	--	--	--
Vanadium	mg/kg	0.494	4.94	--	--	--
Zinc	mg/kg	2.99	29.9	--	--	--
<i>Organics</i>						
1,3,5-Trinitrobenzene	mg/kg	0.302	3.02	--	--	--
1,3-Dinitrobenzene	mg/kg	0.002	0.016	--	--	--
2,4,6-Trinitrotoluene	mg/kg	0.015	0.151	0.118	1.18	11.8
2,4-Dinitrotoluene	mg/kg	0.047	0.475	0.004	0.041	0.407
2,6-Dinitrotoluene	mg/kg	0.018	0.177	0.003	0.03	0.303
2-Amino-4,6-dinitrotoluene	mg/kg	--	--	--	--	--
2-Methylnaphthalene	mg/kg	0.246	2.46	--	--	--
2-Nitrotoluene	mg/kg	0.302	3.02	0.015	0.153	1.53
4,4'-DDE	mg/kg	--	--	0.017	0.172	1.72
4-Amino-2,6-dinitrotoluene	mg/kg	--	--	--	--	--
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--

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Table 5-2. Ravenna Facility Wide CUGs for Ingestion of Foodstuffs from Surface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG		
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>
4-Nitrophenol	mg/kg	0.172	1.72	--	--	--
4-Nitrotoluene	mg/kg	0.329	3.29	0.226	2.26	22.6
Aldrin	mg/kg	0.001	0.014	3.2E-04	0.003	0.032
Benz(a)anthracene	mg/kg	--	--	0.008	0.08	0.799
Benzo(a)pyrene	mg/kg	--	--	5.7E-04	0.006	0.057
Benzo(b)fluoranthene	mg/kg	--	--	0.006	0.057	0.565
Benzo(k)fluoranthene	mg/kg	--	--	0.019	0.188	1.88
Bis(2-chloroethoxy)methane	mg/kg	0.034	0.339	--	--	--
Carbazole	mg/kg	--	--	0.353	3.53	35.3
Chrysene	mg/kg	--	--	0.799	7.99	79.9
Dibenz(a,h)anthracene	mg/kg	--	--	1.9E-04	0.002	0.019
Dibenzofuran	mg/kg	0.127	1.27	--	--	--
Dieldrin	mg/kg	0.003	0.033	4.8E-04	0.005	0.048
Endrin	mg/kg	0.02	0.196	--	--	--
Endrin Aldehyde	mg/kg	--	--	--	--	--
Fluoranthene	mg/kg	2.59	25.9	--	--	--
Fluorene	mg/kg	2.6	26.0	--	--	--
HMX	mg/kg	0.249	2.49	--	--	--
Heptachlor	mg/kg	0.032	0.323	0.002	0.017	0.167
Heptachlor Epoxide	mg/kg	7.6E-04	0.008	7.5E-04	0.007	0.075
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	0.003	0.027	0.275
N-Nitroso-di-n-propylamine	mg/kg	--	--	2.1E-04	0.002	0.021
Naphthalene	mg/kg	1.06	10.6	--	--	--
Nitroglycerin	mg/kg	--	--	--	--	--
PCB-1016	mg/kg	0.003	0.03	0.003	0.025	0.251
PCB-1248	mg/kg	--	--	0.003	0.027	0.273
PCB-1254	mg/kg	7.9E-04	0.008	0.002	0.023	0.229
PCB-1260	mg/kg	--	--	3.8E-04	0.004	0.038
Pentachlorophenol	mg/kg	1.29	12.9	0.042	0.419	4.19
Pyrene	mg/kg	1.94	19.4	--	--	--
RDX	mg/kg	0.158	1.58	0.056	0.56	5.6
alpha-Chlordane	mg/kg	--	--	--	--	--
beta-BHC	mg/kg	--	--	0.004	0.04	0.405
gamma-Chlordane	mg/kg	--	--	--	--	--

COPC = Chemical of potential concern.

CUG = Cleanup goal across all pathways (ingestion of venison, beef, pork, milk, and vegetables).

HI = Hazard index.

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.

PCB = Polychlorinated biphenyl.

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

-- = No CUG could be quantified based on lack of approved toxicity value.

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Table 5-3. Ravenna Facility-Wide CUGs for Subsurface Soil

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
<b>National Guard Trainee</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	3,496	34,960	--	--	--	19,500
Antimony	mg/kg	175	1,753	--	--	--	0.96
Arsenic	mg/kg	114	1,140	2.78	27.8	278	19.8
Barium	mg/kg	351	3,506	--	--	--	124
Cadmium	mg/kg	329	3,292	10.9	109	1,093	0
Chromium	mg/kg	5.61	56.1	1.64	16.4	164	27.2
Chromium, hexavalent	mg/kg	5.61	56.1	1.64	16.4	164	NA
Cobalt	mg/kg	14.0	140	7.03	70.3	703	23.2
Copper	mg/kg	25,368	253,680	--	--	--	32.3
Iron	mg/kg	184,370	1.0E+06	--	--	--	35,200
Manganese	mg/kg	35.1	351	--	--	--	3,030
Mercury	mg/kg	172	1,722	--	--	--	0.044
Nickel	mg/kg	12,639	126,391	--	--	--	60.7
Nitrate	mg/kg	1.0E+06	1.0E+06	--	--	--	NA
Silver	mg/kg	3105	31,049	--	--	--	0
Thallium	mg/kg	47.7	477	--	--	--	0.91
Vanadium	mg/kg	2,304	23,045	--	--	--	37.6
Zinc	mg/kg	187,269	1.0E+06	--	--	--	93.3
<i>Organics</i>							
1,3,5-Trinitrobenzene	mg/kg	16,542	165,422	--	--	--	NA
1,3-Dinitrobenzene	mg/kg	59.6	596	--	--	--	NA
2,4,6-Trinitrotoluene	mg/kg	249	2,488	464	4,643	46,435	NA
2,4-Dinitrotoluene	mg/kg	652	6,519	13.4	134	1,342	NA
2,6-Dinitrotoluene	mg/kg	331	3,309	13.6	136	1,362	NA
2-Amino-4,6-dinitrotoluene	mg/kg	124	1,237	--	--	--	NA
2-Methylnaphthalene	mg/kg	2,384	23,845	--	--	--	NA
2-Nitrotoluene	mg/kg	5,961	59,611	72.6	726	7,257	NA
4,4'-DDE	mg/kg	--	--	49.1	491	4,909	NA
4-Amino-2,6-dinitrotoluene	mg/kg	124	1,237	--	--	--	NA
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--	NA
4-Nitrophenol	mg/kg	4,769	47,689	--	--	--	NA
4-Nitrotoluene	mg/kg	5,961	59,611	982	9,818	98,183	NA
Aldrin	mg/kg	17.9	179	0.788	7.88	78.8	NA
Benz(a)anthracene	mg/kg	--	--	4.77	47.7	477	NA
Benzo(a)pyrene	mg/kg	--	--	0.477	4.77	47.7	NA
Benzo(b)fluoranthene	mg/kg	--	--	4.77	47.7	477	NA
Benzo(k)fluoranthene	mg/kg	--	--	47.7	477	4,774	NA
Bis(2-chloroethoxy)methane	mg/kg	1,788	17,883	--	--	--	NA
Carbazole	mg/kg	--	--	835	8,346	83,456	NA
Chrysene	mg/kg	--	--	477	4774	47,736	NA
Dibenz(a,h)anthracene	mg/kg	--	--	0.477	4.77	47.7	NA
Dibenzofuran	mg/kg	1,192	11,922	--	--	--	NA
Dieldrin	mg/kg	29.8	298	0.839	8.39	83.9	NA
Endrin	mg/kg	33.0	330	--	--	--	NA
Endrin Aldehyde	mg/kg	--	--	--	--	--	NA
Fluoranthene	mg/kg	5,087	50,868	--	--	--	NA
Fluorene	mg/kg	11,458	114,583	--	--	--	NA
HMX	mg/kg	23,464	234,645	--	--	--	NA
Heptachlor	mg/kg	298	2,981	2.98	29.8	298	NA
Heptachlor Epoxide	mg/kg	7.75	77.5	1.48	14.8	148	NA

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Table 5-3. Ravenna Facility Wide CUGs for Subsurface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	4.77	47.7	477	NA
N-Nitroso-di-n-propylamine	mg/kg	--	--	1.88	18.8	188	NA
Naphthalene	mg/kg	1,541	15,407	--	--	--	NA
Nitroglycerin	mg/kg	--	--	982	9,818	98,183	NA
PCB-1016	mg/kg	19.2	192	3.46	34.6	346	NA
PCB-1248	mg/kg	--	--	3.46	34.6	346	NA
PCB-1254	mg/kg	5.49	54.9	3.46	34.6	346	NA
PCB-1260	mg/kg	--	--	3.46	34.6	346	NA
Pentachlorophenol	mg/kg	5,656	56,558	44.0	440	4,399	NA
Pyrene	mg/kg	3,815	38,151	--	--	--	NA
RDX	mg/kg	1,711	17,113	145	1,452	14,520	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
beta-BHC	mg/kg	--	--	7.42	74.2	742	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>Resident Farmer Adult</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	52,923	529,229	--	--	--	19,500
Antimony	mg/kg	13.6	136	--	--	--	0.96
Arsenic	mg/kg	8.21	82.1	0.425	4.25	42.5	19.8
Barium	mg/kg	8,966	89,656	--	--	--	124
Cadmium	mg/kg	22.3	223	1,249	12,491	124,911	0
Chromium	mg/kg	90.4	904	187	1,874	18,737	27.2
Chromium, hexavalent	mg/kg	90.4	904	187	1,874	18,737	NA
Cobalt	mg/kg	820	8,198	803	8,030	80,300	23.2
Copper	mg/kg	2,714	27,138	--	--	--	32.3
Iron	mg/kg	19,010	190,104	--	--	--	35,200
Manganese	mg/kg	1,482	14,817	--	--	--	3,030
Mercury	mg/kg	16.5	165	--	--	--	0.044
Nickel	mg/kg	1,346	13,463	--	--	--	60.7
Nitrate	mg/kg	114,196	1.0E+06	--	--	--	NA
Silver	mg/kg	324	3,240	--	--	--	0
Thallium	mg/kg	4.76	47.6	--	--	--	0.91
Vanadium	mg/kg	156	1,558	--	--	--	37.6
Zinc	mg/kg	19,659	196,589	--	--	--	93.3
<i>Organics</i>							
1,3,5-Trinitrobenzene	mg/kg	1,528	15,280	--	--	--	NA
1,3-Dinitrobenzene	mg/kg	5.94	59.4	--	--	--	NA
2,4,6-Trinitrotoluene	mg/kg	21.1	211	32.8	328	3,283	NA
2,4-Dinitrotoluene	mg/kg	43.9	439	0.753	7.53	75.3	NA
2,6-Dinitrotoluene	mg/kg	22.4	224	0.769	7.69	76.9	NA
2-Amino-4,6-dinitrotoluene	mg/kg	12.8	128	--	--	--	NA
2-Methylnaphthalene	mg/kg	238	2,378	--	--	--	NA
2-Nitrotoluene	mg/kg	594	5,945	6.03	60.3	603	NA
4,4'-DDE	mg/kg	--	--	4.08	40.8	408	NA
4-Amino-2,6-dinitrotoluene	mg/kg	12.8	128	--	--	--	NA
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--	NA
4-Nitrophenol	mg/kg	476	4,756	--	--	--	NA
4-Nitrotoluene	mg/kg	594	5,945	81.6	816	8,159	NA
Aldrin	mg/kg	1.78	17.8	0.082	0.816	8.16	NA
Benz(a)anthracene	mg/kg	--	--	0.221	2.21	22.1	NA
Benzo(a)pyrene	mg/kg	--	--	0.022	0.221	2.21	NA

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Table 5-3. Ravenna Facility Wide CUGs for Subsurface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Benzo(b)fluoranthene	mg/kg	--	--	0.221	2.21	22.1	NA
Benzo(k)fluoranthene	mg/kg	--	--	2.21	22.1	221	NA
Bis(2-chloroethoxy)methane	mg/kg	178	1,783	--	--	--	NA
Carbazole	mg/kg	--	--	69.4	694	6,935	NA
Chrysene	mg/kg	--	--	22.1	221	2,209	NA
Dibenz(a,h)anthracene	mg/kg	--	--	0.022	0.221	2.21	NA
Dibenzofuran	mg/kg	119	1,189	--	--	--	NA
Dieldrin	mg/kg	2.97	29.7	0.087	0.867	8.67	NA
Endrin	mg/kg	1.77	17.7	--	--	--	NA
Endrin Aldehyde	mg/kg	--	--	--	--	--	NA
Fluoranthene	mg/kg	276	2,765	--	--	--	NA
Fluorene	mg/kg	737	7,366	--	--	--	NA
HMX	mg/kg	1,909	19,090	--	--	--	NA
Heptachlor	mg/kg	29.7	297	0.308	3.08	30.8	NA
Heptachlor Epoxide	mg/kg	0.773	7.73	0.152	1.52	15.2	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	0.221	2.21	22.1	NA
N-Nitroso-di-n-propylamine	mg/kg	--	--	0.127	1.27	12.7	NA
Naphthalene	mg/kg	368	3,678	--	--	--	NA
Nitroglycerin	mg/kg	--	--	81.6	816	8,159	NA
PCB-1016	mg/kg	1.22	12.2	0.203	2.03	20.3	NA
PCB-1248	mg/kg	--	--	0.203	2.03	20.3	NA
PCB-1254	mg/kg	0.348	3.48	0.203	2.03	20.3	NA
PCB-1260	mg/kg	--	--	0.203	2.03	20.3	NA
Pentachlorophenol	mg/kg	327	3,269	2.12	21.2	212	NA
Pyrene	mg/kg	207	2,074	--	--	--	NA
RDX	mg/kg	163	1,632	11.5	115	1,154	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
beta-BHC	mg/kg	--	--	0.77	7.7	77.0	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>Resident Farmer Child</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	7,380	73,798	--	--	--	19,500
Antimony	mg/kg	2.82	28.2	--	--	--	0.96
Arsenic	mg/kg	2.02	20.2	0.524	5.24	52.4	19.8
Barium	mg/kg	1,413	14,129	--	--	--	124
Cadmium	mg/kg	6.41	64.1	2,677	26,767	267,667	0
Chromium	mg/kg	19.9	199	401.5	4,015	40,150	27.2
Chromium, hexavalent	mg/kg	19.9	199	401.5	4,015	40,150	NA
Cobalt	mg/kg	131	1,313	1,721	17,207	172,071	23.2
Copper	mg/kg	311	3,106	--	--	--	32.3
Iron	mg/kg	2,313	23,125	--	--	--	35,200
Manganese	mg/kg	293	2,927	--	--	--	3,030
Mercury	mg/kg	2.27	22.7	--	--	--	0.044
Nickel	mg/kg	155	1,552	--	--	--	60.7
Nitrate	mg/kg	12,487	124,868	--	--	--	NA
Silver	mg/kg	38.6	386	--	--	--	0
Thallium	mg/kg	0.612	6.12	--	--	--	0.91
Vanadium	mg/kg	44.9	449	--	--	--	37.6
Zinc	mg/kg	2,321	23,209	--	--	--	93.3
<i>Organics</i>							
1,3,5-Trinitrobenzene	mg/kg	225	2,252	--	--	--	NA
1,3-Dinitrobenzene	mg/kg	0.765	7.65	--	--	--	NA

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Table 5-3. Ravenna Facility Wide CUGs for Subsurface Soil (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
2,4,6-Trinitrotoluene	mg/kg	3.65	36.5	28.4	284	2,842	NA
2,4-Dinitrotoluene	mg/kg	12.8	128	1.1	11.0	110	NA
2,6-Dinitrotoluene	mg/kg	6.42	64.2	1.1	11.0	110	NA
2-Amino-4,6-dinitrotoluene	mg/kg	1.54	15.4	--	--	--	NA
2-Methylnaphthalene	mg/kg	30.6	306	--	--	--	NA
2-Nitrotoluene	mg/kg	76.5	765	3.88	38.8	388	NA
4,4'-DDE	mg/kg	--	--	2.63	26.3	263	NA
4-Amino-2,6-dinitrotoluene	mg/kg	1.54	15.4	--	--	--	NA
4-Chloro-3-methylphenol	mg/kg	--	--	--	--	--	NA
4-Nitrophenol	mg/kg	61.2	612	--	--	--	NA
4-Nitrotoluene	mg/kg	76.5	765	52.5	525	5252	NA
Aldrin	mg/kg	0.23	2.3	0.053	0.525	5.25	NA
Benz(a)anthracene	mg/kg	--	--	0.65	6.5	65.0	NA
Benzo(a)pyrene	mg/kg	--	--	0.065	0.65	6.5	NA
Benzo(b)fluoranthene	mg/kg	--	--	0.65	6.5	65.0	NA
Benzo(k)fluoranthene	mg/kg	--	--	6.5	65.0	650	NA
Bis(2-chloroethoxy)methane	mg/kg	23.0	230	--	--	--	NA
Carbazole	mg/kg	--	--	44.6	446	4,464	NA
Chrysene	mg/kg	--	--	65.0	650	6,502	NA
Dibenz(a,h)anthracene	mg/kg	--	--	0.065	0.65	6.5	NA
Dibenzofuran	mg/kg	15.3	153	--	--	--	NA
Dieldrin	mg/kg	0.383	3.83	0.056	0.558	5.58	NA
Endrin	mg/kg	1.12	11.2	--	--	--	NA
Endrin Aldehyde	mg/kg	--	--	--	--	--	NA
Fluoranthene	mg/kg	163	1,627	--	--	--	NA
Fluorene	mg/kg	243	2,433	--	--	--	NA
HMX	mg/kg	359	3,594	--	--	--	NA
Heptachlor	mg/kg	3.83	38.3	0.198	1.98	19.8	NA
Heptachlor Epoxide	mg/kg	0.099	0.995	0.098	0.981	9.81	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	0.65	6.5	65.0	NA
N-Nitroso-di-n-propylamine	mg/kg	--	--	0.12	1.2	12.0	NA
Naphthalene	mg/kg	122	1,215	--	--	--	NA
Nitroglycerin	mg/kg	--	--	52.5	525	5252	NA
PCB-1016	mg/kg	0.419	4.19	0.349	3.49	34.9	NA
PCB-1248	mg/kg	--	--	0.349	3.49	34.9	NA
PCB-1254	mg/kg	0.12	1.2	0.349	3.49	34.9	NA
PCB-1260	mg/kg	--	--	0.349	3.49	34.9	NA
Pentachlorophenol	mg/kg	151	1,514	4.91	49.1	491	NA
Pyrene	mg/kg	122	1,220	--	--	--	NA
RDX	mg/kg	22.7	227	8.03	80.3	803	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
beta-BHC	mg/kg	--	--	0.496	4.96	49.6	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA

COPC = Chemical of potential concern.

CUG = Cleanup goal across all pathways (ingestion, dermal, and inhalation).

HI = Hazard index.

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.

NA = Not available.

PCB = Polychlorinated biphenyl.

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

-- = No CUG could be quantified based on lack of approved toxicity value.

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Table 5-4. Ravenna Facility-Wide CUGs for Groundwater

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background	
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	Uncon.	Bedrock
<b>National Guard Trainee</b>								
<i>Inorganics</i>								
Aluminum	µg/L	31,981	319,809	--	--	--	48,000	9,410
Antimony	µg/L	11.7	117	--	--	--	4.3	0
Arsenic	µg/L	9.77	97.7	0.608	6.08	60.8	215	19.1
Barium	µg/L	6,332	63,319	--	--	--	327	241
Cadmium	µg/L	13.2	132	--	--	--	0	0
Chromium	µg/L	79.1	791	--	--	--	85.2	19.5
Cobalt	µg/L	654	6,545	--	--	--	46.3	0
Iron	µg/L	9,671	96,706	--	--	--	195,000	21,500
Manganese	µg/L	1,421	14,207	--	--	--	2,860	1,260
Nickel	µg/L	654	6,540	--	--	--	117	85.3
Nitrate	µg/L	52,283	522,835	--	--	--	NA	NA
Thallium	µg/L	2.61	26.1	--	--	--	2.4	0
Vanadium	µg/L	185	1,845	--	--	--	98.1	15.5
Zinc	µg/L	9,756	97,559	--	--	--	888	193
<i>Organics</i>								
1,1,2,2-Tetrachloroethane	µg/L	1,804	18,044	0.744	7.44	74.4	NA	NA
1,2-Dichloroethane	µg/L	633	6,332	1.67	16.7	167	NA	NA
1,3-Dinitrobenzene	µg/L	3.28	32.8	--	--	--	NA	NA
2,4,6-Trinitrotoluene	µg/L	16.4	164	30.6	306	3,057	NA	NA
2,4-Dinitrotoluene	µg/L	62.8	628	1.29	12.9	129	NA	NA
2,6-Dinitrotoluene	µg/L	31.8	318	1.31	13.1	131	NA	NA
2-Amino-4,6-dinitrotoluene	µg/L	6.55	65.5	--	--	--	NA	NA
2-Nitrotoluene	µg/L	328	3,276	3.99	39.9	399	NA	NA
4,4'-DDD	µg/L	11.0	110	0.639	6.39	63.9	NA	NA
4,4'-DDE	µg/L	--	--	0.503	5.03	50.3	NA	NA
4,4'-DDT	µg/L	1.78	17.8	0.294	2.94	29.4	NA	NA
4-Amino-2,6-dinitrotoluene	µg/L	6.55	65.5	--	--	--	NA	NA
4-Nitrobenzenamine	µg/L	98.3	983	43.7	437	4,368	NA	NA
4-Nitrotoluene	µg/L	328	3,276	54.0	540	5,395	NA	NA
Aldrin	µg/L	0.923	9.23	0.051	0.507	5.07	NA	NA
Benz(a)anthracene	µg/L	--	--	0.042	0.419	4.19	NA	NA
Benzene	µg/L	38.1	381	4.64	46.4	464	NA	NA
Benzo(a)pyrene	µg/L	--	--	0.002	0.025	0.248	NA	NA
Benzo(b)fluoranthene	µg/L	--	--	0.024	0.245	2.45	NA	NA
Bis(2-ethylhexyl)phthalate	µg/L	97.0	970	9.7	97.0	970	NA	NA
Carbon Tetrachloride	µg/L	19.3	193	2.2	22.0	220	NA	NA
Chloroform	µg/L	248	2,477	2.23	22.3	223	NA	NA
Dibenz(a,h)anthracene	µg/L	--	--	0.002	0.016	0.162	NA	NA
Dieldrin	µg/L	1.1	11.0	0.038	0.384	3.84	NA	NA
Heptachlor	µg/L	12.3	123	0.153	1.53	15.3	NA	NA
Heptachlor Epoxide	µg/L	0.426	4.26	0.101	1.01	10.1	NA	NA
Indeno(1,2,3-cd)pyrene	µg/L	--	--	0.024	0.244	2.44	NA	NA
Lindane	µg/L	7.66	76.6	0.55	5.5	55.0	NA	NA
Methylene Chloride	µg/L	1,428	14,277	57.5	575	5,751	NA	NA
Nitrobenzene	µg/L	16.4	164	--	--	--	NA	NA
Nitroglycerin	µg/L	--	--	54.0	540	5,395	NA	NA
PCB-1242	µg/L	--	--	2.29	22.9	229	NA	NA
PCB-1254	µg/L	0.655	6.55	2.29	22.9	229	NA	NA
PCB-1260	µg/L	--	--	2.29	22.9	229	NA	NA
Pentachlorophenol	µg/L	103	1025	0.797	7.97	79.7	NA	NA



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Table 5-4. Ravenna Facility Wide CUGs for Groundwater (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background	
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	Uncon.	Bedrock
RDX	µg/L	98.3	983	8.34	83.4	834	NA	NA
Tetrachloroethene	µg/L	191	1,911	1.05	10.5	105	NA	NA
Toxaphene	µg/L	--	--	0.518	5.18	51.8	NA	NA
Trichloroethene	µg/L	5.04	50.4	0.336	3.36	33.6	NA	NA
alpha-BHC	µg/L	--	--	0.146	1.46	14.6	NA	NA
beta-BHC	µg/L	--	--	0.51	5.1	51.0	NA	NA
<b>Resident Farmer Adult</b>								
<i>Inorganics</i>								
Aluminum	µg/L	3,564	35,636	--	--	--	48,000	9,410
Antimony	µg/L	1.3	13.0	--	--	--	4.3	0
Arsenic	µg/L	1.09	10.9	0.056	0.564	5.64	215	19.1
Barium	µg/L	706	7056	--	--	--	327	241
Cadmium	µg/L	1.47	14.7	--	--	--	0	0
Chromium	µg/L	8.81	88.1	--	--	--	85.2	19.5
Cobalt	µg/L	72.9	729	--	--	--	46.3	0
Iron	µg/L	1,078	10,776	--	--	--	195,000	21,500
Manganese	µg/L	158	1,583	--	--	--	2,860	1,260
Nickel	µg/L	72.9	729	--	--	--	117	85.3
Nitrate	µg/L	5,826	58,259	--	--	--	NA	NA
Thallium	µg/L	0.291	2.91	--	--	--	2.4	0
Vanadium	µg/L	20.6	206	--	--	--	98.1	15.5
Zinc	µg/L	1,087	10,871	--	--	--	888	193
<i>Organics</i>								
1,1,2,2-Tetrachloroethane	µg/L	201	2,011	0.069	0.691	6.91	NA	NA
1,2-Dichloroethane	µg/L	70.6	706	0.155	1.55	15.5	NA	NA
1,3-Dinitrobenzene	µg/L	0.365	3.65	--	--	--	NA	NA
2,4,6-Trinitrotoluene	µg/L	1.83	18.3	2.84	28.4	284	NA	NA
2,4-Dinitrotoluene	µg/L	6.99	69.9	0.12	1.2	12.0	NA	NA
2,6-Dinitrotoluene	µg/L	3.54	35.4	0.122	1.22	12.2	NA	NA
2-Amino-4,6-dinitrotoluene	µg/L	0.73	7.3	--	--	--	NA	NA
2-Nitrotoluene	µg/L	36.5	365	0.37	3.7	37.0	NA	NA
4,4'-DDD	µg/L	1.22	12.2	0.059	0.594	5.94	NA	NA
4,4'-DDE	µg/L	--	--	0.047	0.467	4.67	NA	NA
4,4'-DDT	µg/L	0.199	1.99	0.027	0.273	2.73	NA	NA
4-Amino-2,6-dinitrotoluene	µg/L	0.73	7.3	--	--	--	NA	NA
4-Nitrobenzenamine	µg/L	11.0	109.5	4.06	40.6	406	NA	NA
4-Nitrotoluene	µg/L	36.5	365	5.01	50.1	501	NA	NA
Aldrin	µg/L	0.103	1.03	0.005	0.047	0.471	NA	NA
Benz(a)anthracene	µg/L	--	--	0.004	0.039	0.389	NA	NA
Benzene	µg/L	4.24	42.4	0.431	4.31	43.1	NA	NA
Benzo(a)pyrene	µg/L	--	--	2.3E-04	0.002	0.023	NA	NA
Benzo(b)fluoranthene	µg/L	--	--	0.002	0.023	0.227	NA	NA
Bis(2-ethylhexyl)phthalate	µg/L	10.8	108	0.9	9.0	90.0	NA	NA
Carbon Tetrachloride	µg/L	2.15	21.5	0.204	2.04	20.4	NA	NA
Chloroform	µg/L	27.6	276	0.207	2.07	20.7	NA	NA
Dibenz(a,h)anthracene	µg/L	--	--	1.5E-04	0.002	0.015	NA	NA
Dieldrin	µg/L	0.122	1.22	0.004	0.036	0.357	NA	NA
Heptachlor	µg/L	1.37	13.7	0.014	0.142	1.42	NA	NA
Heptachlor Epoxide	µg/L	0.047	0.475	0.009	0.094	0.936	NA	NA
Indeno(1,2,3-cd)pyrene	µg/L	--	--	0.002	0.023	0.227	NA	NA
Lindane	µg/L	0.853	8.53	0.051	0.51	5.1	NA	NA

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Table 5-4. Ravenna Facility Wide CUGs for Groundwater (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background	
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	Uncon.	Bedrock
Methylene Chloride	µg/L	159	1,591	5.34	53.4	534	NA	NA
Nitrobenzene	µg/L	1.83	18.3	--	--	--	NA	NA
Nitroglycerin	µg/L	--	--	5.01	50.1	501	NA	NA
PCB-1242	µg/L	--	--	0.213	2.13	21.3	NA	NA
PCB-1254	µg/L	0.073	0.73	0.213	2.13	21.3	NA	NA
PCB-1260	µg/L	--	--	0.213	2.13	21.3	NA	NA
Pentachlorophenol	µg/L	11.4	114	0.074	0.74	7.4	NA	NA
RDX	µg/L	11.0	110	0.774	7.74	77.4	NA	NA
Tetrachloroethene	µg/L	21.3	213	0.098	0.977	9.77	NA	NA
Toxaphene	µg/L	--	--	0.048	0.481	4.81	NA	NA
Trichloroethene	µg/L	0.562	5.62	0.031	0.312	3.12	NA	NA
alpha-BHC	µg/L	--	--	0.014	0.135	1.35	NA	NA
beta-BHC	µg/L	--	--	0.047	0.473	4.73	NA	NA
<b>Resident Farmer Child</b>								
<i>Inorganics</i>								
Aluminum	µg/L	1,028	10,280	--	--	--	48,000	9,410
Antimony	µg/L	0.389	3.89	--	--	--	4.3	0
Arsenic	µg/L	0.312	3.12	0.081	0.808	8.08	215	19.1
Barium	µg/L	204	2,044	--	--	--	327	241
Cadmium	µg/L	0.456	4.56	--	--	--	0	0
Chromium	µg/L	2.73	27.3	--	--	--	85.2	19.5
Cobalt	µg/L	20.8	208	--	--	--	46.3	0
Iron	µg/L	310	3,099	--	--	--	195,000	21,500
Manganese	µg/L	46.3	463	--	--	--	2,860	1,260
Nickel	µg/L	20.8	208	--	--	--	117	85.3
Nitrate	µg/L	1,666	16,662	--	--	--	NA	NA
Thallium	µg/L	0.083	0.833	--	--	--	2.4	0
Vanadium	µg/L	6.38	63.8	--	--	--	98.1	15.5
Zinc	µg/L	312	3115	--	--	--	888	193
<i>Organics</i>								
1,1,2,2-Tetrachloroethane	µg/L	59.4	594	0.137	1.37	13.7	NA	NA
1,2-Dichloroethane	µg/L	20.4	204	0.307	3.07	30.7	NA	NA
1,3-Dinitrobenzene	µg/L	0.104	1.04	--	--	--	NA	NA
2,4,6-Trinitrotoluene	µg/L	0.521	5.21	4.06	40.6	406	NA	NA
2,4-Dinitrotoluene	µg/L	2.03	20.3	0.174	1.74	17.4	NA	NA
2,6-Dinitrotoluene	µg/L	1.02	10.2	0.176	1.76	17.6	NA	NA
2-Amino-4,6-dinitrotoluene	µg/L	0.209	2.09	--	--	--	NA	NA
2-Nitrotoluene	µg/L	10.4	104	0.529	5.29	52.9	NA	NA
4,4'-DDD	µg/L	0.526	5.26	0.128	1.28	12.8	NA	NA
4,4'-DDE	µg/L	--	--	0.099	0.994	9.94	NA	NA
4,4'-DDT	µg/L	0.089	0.888	0.061	0.609	6.09	NA	NA
4-Amino-2,6-dinitrotoluene	µg/L	0.209	2.09	--	--	--	NA	NA
4-Nitrobenzenamine	µg/L	3.13	31.3	5.79	57.9	579	NA	NA
4-Nitrotoluene	µg/L	10.4	104	7.16	71.6	716	NA	NA
Aldrin	µg/L	0.03	0.301	0.007	0.069	0.689	NA	NA
Benz(a)anthracene	µg/L	--	--	0.009	0.091	0.914	NA	NA
Benzene	µg/L	1.59	15.9	0.814	8.14	81.4	NA	NA
Benzo(a)pyrene	µg/L	--	--	5.5E-04	0.005	0.055	NA	NA
Benzo(b)fluoranthene	µg/L	--	--	0.005	0.054	0.538	NA	NA
Bis(2-ethylhexyl)phthalate	µg/L	4.71	47.1	1.96	19.6	196	NA	NA
Carbon Tetrachloride	µg/L	0.656	6.56	0.381	3.81	38.1	NA	NA
Chloroform	µg/L	8.75	87.5	0.441	4.41	44.1	NA	NA

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**Table 5-4. Ravenna Facility Wide CUGs for Groundwater (continued)**

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background	
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	Uncon.	Bedrock
Dibenz(a,h)anthracene	µg/L	--	--	3.6E-04	0.004	0.036	NA	NA
Dieldrin	µg/L	0.04	0.403	0.006	0.059	0.588	NA	NA
Heptachlor	µg/L	0.435	4.35	0.023	0.225	2.25	NA	NA
Heptachlor Epoxide	µg/L	0.014	0.136	0.013	0.134	1.34	NA	NA
Indeno(1,2,3-cd)pyrene	µg/L	--	--	0.005	0.054	0.537	NA	NA
Lindane	µg/L	0.268	2.68	0.08	0.801	8.01	NA	NA
Methylene Chloride	µg/L	50.1	501	9.27	92.7	927	NA	NA
Nitrobenzene	µg/L	0.521	5.21	--	--	--	NA	NA
Nitroglycerin	µg/L	--	--	7.16	71.6	716	NA	NA
PCB-1242	µg/L	--	--	0.304	3.04	30.4	NA	NA
PCB-1254	µg/L	0.021	0.209	0.304	3.04	30.4	NA	NA
PCB-1260	µg/L	--	--	0.304	3.04	30.4	NA	NA
Pentachlorophenol	µg/L	5.12	51.2	0.166	1.66	16.6	NA	NA
RDX	µg/L	3.13	31.3	1.11	11.1	111	NA	NA
Tetrachloroethene	µg/L	7.21	72.1	0.163	1.63	16.3	NA	NA
Toxaphene	µg/L	--	--	0.081	0.812	8.12	NA	NA
Trichloroethene	µg/L	0.199	1.99	0.063	0.631	6.31	NA	NA
alpha-BHC	µg/L	--	--	0.019	0.193	1.93	NA	NA
beta-BHC	µg/L	--	--	0.068	0.676	6.76	NA	NA

COPC = Chemical of potential concern.  
 CUG = Cleanup goal across all pathways (ingestion, dermal, and inhalation).  
 HI = Hazard index.  
 NA = Not available.  
 PCB = Polychlorinated biphenyl.  
 RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.  
 -- = No CUG could be quantified based on lack of approved toxicity value.

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Table 5-5. Ravenna Facility-Wide CUGs for Surface Water

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
<b>Adult Trespasser</b>							
<i>Inorganics</i>							
Aluminum	µg/L	159,190	1.6E+06	--	--	--	3,370
Antimony	µg/L	20.3	203	--	--	--	0
Arsenic	µg/L	80.0	800	4.15	41.5	415	3.2
Barium	µg/L	25,920	259,203	--	--	--	47.5
Cadmium	µg/L	13.7	137	--	--	--	0
Chromium	µg/L	82.4	824	--	--	--	0
Chromium, hexavalent	µg/L	82.4	824	--	--	--	NA
Copper	µg/L	9,874	98,744	--	--	--	7.9
Iron	µg/L	58,068	580,682	--	--	--	2,560
Manganese	µg/L	4,070	40,703	--	--	--	391
Mercury	µg/L	38.9	389	--	--	--	0
Nickel	µg/L	6,283	62,828	--	--	--	0
Nitrate	µg/L	489,288	4.9E+06	--	--	--	NA
Silver	µg/L	1,234	12,343	--	--	--	0
Thallium	µg/L	24.5	245	--	--	--	0
Vanadium	µg/L	192	1,923	--	--	--	0
Zinc	µg/L	76,155	761,550	--	--	--	42
<i>Organics</i>							
1,1,2,2-Tetrachloroethane	µg/L	8,233	82,334	3.63	36.3	363	NA
1,2-Dichloroethene	µg/L	1,392	13,920	--	--	--	NA
1,4-Dichlorobenzene	µg/L	--	--	36.6	366	3,660	NA
2,4,6-Trinitrotoluene	µg/L	170	1,703	265	2,650	26,496	NA
2,4-Dimethylphenol	µg/L	2,345	23,445	--	--	--	NA
2,4-Dinitrotoluene	µg/L	394	3,936	6.75	67.5	675	NA
2,6-Dinitrotoluene	µg/L	228	2,278	7.82	78.2	782	NA
2-Amino-4,6-dinitrotoluene	µg/L	68.1	681	--	--	--	NA
2-Nitrotoluene	µg/L	3,407	34,067	34.6	346	3,456	NA
4,4'-DDT	µg/L	1.24	12.4	0.17	1.7	17.0	NA
4-Amino-2,6-dinitrotoluene	µg/L	68.1	681	--	--	--	NA
4-Methylphenol	µg/L	755	7,553	--	--	--	NA
4-Nitrotoluene	µg/L	3,407	34,067	468	4,676	46,758	NA
Aldrin	µg/L	4.92	49.2	0.225	2.25	22.5	NA
Benz(a)anthracene	µg/L	--	--	0.023	0.226	2.26	NA
Benzo(a)pyrene	µg/L	--	--	0.001	0.013	0.132	NA
Benzo(b)fluoranthene	µg/L	--	--	0.013	0.13	1.3	NA
Benzo(k)fluoranthene	µg/L	--	--	109	1,089	10,889	NA
Bis(2-ethylhexyl)phthalate	µg/L	70.5	705	5.87	58.7	587	NA
Chloroform	µg/L	500	5,000	11.2	112	1,116	NA
Chrysene	µg/L	--	--	2.26	22.6	226	NA
Dibenz(a,h)anthracene	µg/L	--	--	8.5E-04	0.009	0.085	NA
HMX	µg/L	17,033	170,333	--	--	--	NA
Heptachlor Epoxide	µg/L	4.43	44.3	0.874	8.74	87.4	NA
Indeno(1,2,3-cd)pyrene	µg/L	--	--	0.013	0.13	1.3	NA
Methylene Chloride	µg/L	9,687	96,867	315	3,154	31,543	NA
PCB-1254	µg/L	6.81	68.1	19.9	199	1,987	NA
Pentachlorophenol	µg/L	71.1	711	0.461	4.61	46.1	NA
Pyrene	µg/L	10,220	102,200	--	--	--	NA
RDX	µg/L	1,022	10,220	72.3	723	7,226	NA
Tetrachloroethene	µg/L	401	4,007	1.77	17.7	177	NA
Trichloroethene	µg/L	6.67	66.7	0.848	8.48	84.8	NA

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Table 5-5. Ravenna Facility Wide CUGs for Surface Water (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
beta-BHC	µg/L	--	--	4.42	44.2	442	NA
cis-1,2-Dichloroethene	µg/L	3,407	34,067	--	--	--	NA
<b>Fisher Recreator</b>							
<i>Inorganics</i>							
Aluminum	µg/L	1.7E+06	1.7E+07	--	--	--	3,370
Antimony	µg/L	179	1,793	--	--	--	0
Arsenic	µg/L	1,017	10,170	52.7	527	5,274	3.2
Barium	µg/L	257,338	2.6E+06	--	--	--	47.5
Cadmium	µg/L	117	1,172	--	--	--	0
Chromium	µg/L	703	7,032	--	--	--	0
Chromium, hexavalent	µg/L	703	7,032	--	--	--	NA
Copper	µg/L	120,709	1.2E+06	--	--	--	7.9
Iron	µg/L	642,318	6.4E+06	--	--	--	2,560
Manganese	µg/L	37,913	379,129	--	--	--	391
Mercury	µg/L	386	3,860	--	--	--	0
Nickel	µg/L	88,556	885,558	--	--	--	0
Nitrate	µg/L	6.8E+06	6.8E+07	--	--	--	NA
Silver	µg/L	15,089	150,886	--	--	--	0
Thallium	µg/L	338	3,384	--	--	--	0
Vanadium	µg/L	1,641	16,408	--	--	--	0
Zinc	µg/L	943,966	9.4E+06	--	--	--	42
<i>Organics</i>							
1,1,2,2-Tetrachloroethane	µg/L	98,821	988,214	29.8	298	2,978	NA
1,2-Dichloroethene	µg/L	15,870	158,701	--	--	--	NA
1,4-Dichlorobenzene	µg/L	--	--	415	4,145	41,455	NA
2,4,6-Trinitrotoluene	µg/L	2,555	25,550	3,974	39,744	397,444	NA
2,4-Dimethylphenol	µg/L	26,321	263,207	--	--	--	NA
2,4-Dinitrotoluene	µg/L	5,095	50,950	87.4	874	8,741	NA
2,6-Dinitrotoluene	µg/L	3,039	30,391	104	1,043	10,428	NA
2-Amino-4,6-dinitrotoluene	µg/L	1,022	10,220	--	--	--	NA
2-Nitrotoluene	µg/L	51,100	511,000	518	5,184	51,841	NA
4,4'-DDT	µg/L	14.5	145	1.99	19.9	199	NA
4-Amino-2,6-dinitrotoluene	µg/L	1,022	10,220	--	--	--	NA
4-Methylphenol	µg/L	8,673	86,729	--	--	--	NA
4-Nitrotoluene	µg/L	51,100	511,000	7,014	70,137	701,373	NA
Aldrin	µg/L	64.2	642	2.94	29.4	294	NA
Benz(a)anthracene	µg/L	--	--	0.263	2.63	26.3	NA
Benzo(a)pyrene	µg/L	--	--	0.015	0.153	1.53	NA
Benzo(b)fluoranthene	µg/L	--	--	0.151	1.51	15.1	NA
Benzo(k)fluoranthene	µg/L	--	--	1,633	16,333	163,333	NA
Bis(2-ethylhexyl)phthalate	µg/L	821	8,214	68.4	684	6,845	NA
Chloroform	µg/L	5,193	51,931	85.1	851	8,506	NA
Chrysene	µg/L	--	--	26.3	263	2,626	NA
Dibenz(a,h)anthracene	µg/L	--	--	0.01	0.099	0.993	NA
HMX	µg/L	255,500	2.6E+06	--	--	--	NA
Heptachlor Epoxide	µg/L	66.4	664	13.1	131	1,310	NA
Indeno(1,2,3-cd)pyrene	µg/L	--	--	0.151	1.51	15.1	NA
Methylene Chloride	µg/L	101,815	1.0E+06	2,885	28,847	288,466	NA
PCB-1254	µg/L	102.2	1,022	298	2,981	29,808	NA
Pentachlorophenol	µg/L	828	8,281	5.37	53.7	537	NA
Pyrene	µg/L	153,300	1.5E+06	--	--	--	NA

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Table 5-5. Ravenna Facility Wide CUGs for Surface Water (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
RDX	µg/L	15,330	153,300	1,084	10,839	108,394	NA
Tetrachloroethene	µg/L	4,473	44,726	19.9	199	1,991	NA
Trichloroethene	µg/L	70.1	701	7.82	78.2	782	NA
beta-BHC	µg/L	--	--	66.2	662	6,624	NA
cis-1,2-Dichloroethene	µg/L	51,100	511,000	--	--	--	NA
<b>Hunter/Trapper</b>							
<i>Inorganics</i>							
Aluminum	µg/L	3.1E+06	3.1E+07	--	--	--	3,370
Antimony	µg/L	308	3,078	--	--	--	0
Arsenic	µg/L	2,176	21,764	113	1,128	11,285	3.2
Barium	µg/L	468,194	4.7E+06	--	--	--	47.5
Cadmium	µg/L	198	1,984	--	--	--	0
Chromium	µg/L	1,190	11,902	--	--	--	0
Chromium, hexavalent	µg/L	1,190	11,902	--	--	--	NA
Copper	µg/L	250,490	2.5E+06	--	--	--	7.9
Iron	µg/L	1.2E+06	1.2E+07	--	--	--	2,560
Manganese	µg/L	66,778	667,784	--	--	--	391
Mercury	µg/L	702	7,023	--	--	--	0
Nickel	µg/L	207,536	2.1E+06	--	--	--	0
Nitrate	µg/L	1.6E+07	1.6E+08	--	--	--	NA
Silver	µg/L	31,311	313,113	--	--	--	0
Thallium	µg/L	779	7,790	--	--	--	0
Vanadium	µg/L	2,777	27,772	--	--	--	0
Zinc	µg/L	2.0E+06	2.0E+07	--	--	--	42
<i>Organics</i>							
1,1,2,2-Tetrachloroethane	µg/L	200,646	2.0E+06	51.1	511	5,105	NA
1,2-Dichloroethene	µg/L	31,085	310,853	--	--	--	NA
1,4-Dichlorobenzene	µg/L	--	--	795	7,949	79,492	NA
2,4,6-Trinitrotoluene	µg/L	6,388	63,875	9,936	99,361	993,611	NA
2,4-Dimethylphenol	µg/L	50,827	508,268	--	--	--	NA
2,4-Dinitrotoluene	µg/L	10,974	109,737	188	1,883	18,827	NA
2,6-Dinitrotoluene	µg/L	6,724	67,244	231	2,307	23,074	NA
2-Amino-4,6-dinitrotoluene	µg/L	2,555	25,550	--	--	--	NA
2-Nitrotoluene	µg/L	127,750	1.3E+06	1,296	12,960	129,601	NA
4,4'-DDT	µg/L	29.6	296	4.06	40.6	406	NA
4-Amino-2,6-dinitrotoluene	µg/L	2,555	25,550	--	--	--	NA
4-Methylphenol	µg/L	17,048	170,481	--	--	--	NA
4-Nitrotoluene	µg/L	127,750	1.3E+06	17,534	175,343	1.8E+06	NA
Aldrin	µg/L	142	1,420	6.5	65.0	650	NA
Benz(a)anthracene	µg/L	--	--	0.536	5.36	53.6	NA
Benzo(a)pyrene	µg/L	--	--	0.031	0.313	3.13	NA
Benzo(b)fluoranthene	µg/L	--	--	0.308	3.08	30.8	NA
Benzo(k)fluoranthene	µg/L	--	--	4.083	40,833	408,333	NA
Bis(2-ethylhexyl)phthalate	µg/L	1,679	16,791	140	1,399	13,992	NA
Chloroform	µg/L	9,551	95,507	142	1,423	14,234	NA
Chrysene	µg/L	--	--	53.6	536	5,362	NA
Dibenz(a,h)anthracene	µg/L	--	--	0.02	0.203	2.03	NA
HMX	µg/L	638,750	6.4E+06	--	--	--	NA
Heptachlor Epoxide	µg/L	166	1,661	32.8	328	3,276	NA
Indeno(1,2,3-cd)pyrene	µg/L	--	--	0.308	3.08	30.8	NA
Methylene Chloride	µg/L	193,621	1.9E+06	5,156	51,559	515,594	NA
PCB-1254	µg/L	255.5	2,555	745	7,452	74,521	NA

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Table 5-5. Ravenna Facility Wide CUGs for Surface Water (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Pentachlorophenol	µg/L	1692	16,921	11.0	110	1,097	NA
Pyrene	µg/L	383,250	3.8E+06	--	--	--	NA
RDX	µg/L	38,325	383,250	2,710	27,098	270,985	NA
Tetrachloroethene	µg/L	8,648	86,479	38.7	387	3,869	NA
Trichloroethene	µg/L	129	1,292	13.8	138	1,380	NA
beta-BHC	µg/L	--	--	166	1,656	16,560	NA
cis-1,2-Dichloroethene	µg/L	127,750	1.3E+06	--	--	--	NA
<b>Juvenile Trespasser</b>							
<i>Inorganics</i>							
Aluminum	µg/L	124,905	1.2E+06	--	--	--	3,370
Antimony	µg/L	14.4	144	--	--	--	0
Arsenic	µg/L	70.5	705	11.0	110	1,097	3.2
Barium	µg/L	19,738	197,382	--	--	--	47.5
Cadmium	µg/L	9.49	94.9	--	--	--	0
Chromium	µg/L	57.0	570	--	--	--	0
Chromium, hexavalent	µg/L	57.0	570	--	--	--	NA
Copper	µg/L	8,514	85,140	--	--	--	7.9
Iron	µg/L	47,228	472,284	--	--	--	2,560
Manganese	µg/L	2,978	29,775	--	--	--	391
Mercury	µg/L	29.6	296	--	--	--	0
Nickel	µg/L	5,862	58,622	--	--	--	0
Nitrate	µg/L	451,935	4.5E+06	--	--	--	NA
Silver	µg/L	1,064	10,643	--	--	--	0
Thallium	µg/L	22.6	226	--	--	--	0
Vanadium	µg/L	133	1,329	--	--	--	0
Zinc	µg/L	66,185	661,854	--	--	--	42
<i>Organics</i>							
1,1,2,2-Tetrachloroethane	µg/L	6,318	63,177	9.93	99.3	993	NA
1,2-Dichloroethene	µg/L	1,087	10,872	--	--	--	NA
1,4-Dichlorobenzene	µg/L	--	--	76.6	766	7,658	NA
2,4,6-Trinitrotoluene	µg/L	164	1642.5	766.5	7665	76,650	NA
2,4-Dimethylphenol	µg/L	1,764	17,636	--	--	--	NA
2,4-Dinitrotoluene	µg/L	321	3,212	16.5	165	1,653	NA
2,6-Dinitrotoluene	µg/L	192	1,923	19.8	198	1,980	NA
2-Amino-4,6-dinitrotoluene	µg/L	65.7	657	--	--	--	NA
2-Nitrotoluene	µg/L	3,285	32,850	100	1,000	9,998	NA
4,4'-DDT	µg/L	0.84	8.4	0.346	3.46	34.6	NA
4-Amino-2,6-dinitrotoluene	µg/L	65.7	657	--	--	--	NA
4-Methylphenol	µg/L	588	5,877	--	--	--	NA
4-Nitrotoluene	µg/L	3,285	32,850	1,353	13,526	135,265	NA
Aldrin	µg/L	3.88	38.8	0.533	5.33	53.3	NA
Benz(a)anthracene	µg/L	--	--	0.046	0.457	4.57	NA
Benzo(a)pyrene	µg/L	--	--	0.003	0.027	0.267	NA
Benzo(b)fluoranthene	µg/L	--	--	0.026	0.263	2.63	NA
Benzo(k)fluoranthene	µg/L	--	--	315	3,150	31,500	NA
Bis(2-ethylhexyl)phthalate	µg/L	47.7	477	11.9	119	1,192	NA
Chloroform	µg/L	353	3,527	31.6	316	3,160	NA
Chrysene	µg/L	--	--	4.57	45.7	457	NA
Dibenz(a,h)anthracene	µg/L	--	--	0.002	0.017	0.173	NA
HMX	µg/L	16,425	164,250	--	--	--	NA
Heptachlor Epoxide	µg/L	4.27	42.7	2.53	25.3	253	NA
Indeno(1,2,3-cd)pyrene	µg/L	--	--	0.026	0.263	2.63	NA

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Table 5-5. Ravenna Facility Wide CUGs for Surface Water (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Methylene Chloride	µg/L	8,436	84,357	855	8,549	85,490	NA
PCB-1254	µg/L	6.57	65.7	57.5	575	5,749	NA
Pentachlorophenol	µg/L	48.1	481	0.935	9.35	93.5	NA
Pyrene	µg/L	9,855	98,550	--	--	--	NA
RDX	µg/L	985.5	9,855	209	2,090	20,905	NA
Tetrachloroethene	µg/L	285	2,853	3.75	37.5	375	NA
Trichloroethene	µg/L	4.61	46.1	1.95	19.5	195	NA
beta-BHC	µg/L	--	--	12.8	128	1277.5	NA
cis-1,2-Dichloroethene	µg/L	3,285	32,850	--	--	--	NA
<b>National Guard Dust/Fire Control Worker</b>							
<i>Inorganics</i>							
Aluminum	µg/L	734,195	7.3E+06	--	--	--	3,370
Antimony	µg/L	89.6	896	--	--	--	0
Arsenic	µg/L	387	3865	24.1	241	2,405	3.2
Barium	µg/L	118,053	1.2E+06	--	--	--	47.5
Cadmium	µg/L	60.0	600	--	--	--	0
Chromium	µg/L	360	3,599	--	--	--	0
Chromium, hexavalent	µg/L	360	3,599	--	--	--	NA
Copper	µg/L	47,315	473,148	--	--	--	7.9
Iron	µg/L	271,809	2.7E+06	--	--	--	2,560
Manganese	µg/L	18,222	182,217	--	--	--	391
Mercury	µg/L	177	1,771	--	--	--	0
Nickel	µg/L	31,032	310,324	--	--	--	0
Nitrate	µg/L	2.4E+06	2.4E+07	--	--	--	NA
Silver	µg/L	5,914	59,144	--	--	--	0
Thallium	µg/L	120	1,204	--	--	--	0
Vanadium	µg/L	840	8,397	--	--	--	0
Zinc	µg/L	366,046	3.7E+06	--	--	--	42
<i>Organics</i>							
1,1,2,2-Tetrachloroethane	µg/L	43,781	437,814	5.98	59.8	598	NA
1,2-Dichloroethene	µg/L	6,954	69,542	--	--	--	NA
1,4-Dichlorobenzene	µg/L	--	--	249	2,493	24,931	NA
2,4,6-Trinitrotoluene	µg/L	852	8,517	1,590	15,898	158,978	NA
2,4-Dimethylphenol	µg/L	12,040	120,397	--	--	--	NA
2,4-Dinitrotoluene	µg/L	2,079	20,793	42.8	428	4,281	NA
2,6-Dinitrotoluene	µg/L	1,189	11,891	49.0	490	4,896	NA
2-Amino-4,6-dinitrotoluene	µg/L	341	3,407	--	--	--	NA
2-Nitrotoluene	µg/L	17,033	170,333	207	2,074	20,736	NA
4,4'-DDT	µg/L	7.57	75.7	1.25	12.5	125	NA
4-Amino-2,6-dinitrotoluene	µg/L	341	3,407	--	--	--	NA
4-Methylphenol	µg/L	3,811	38,107	--	--	--	NA
4-Nitrotoluene	µg/L	17,033	170,333	2,805	28,055	280,549	NA
Aldrin	µg/L	27.2	272	1.49	14.9	149	NA
Benz(a)anthracene	µg/L	--	--	0.165	1.65	16.5	NA
Benzo(a)pyrene	µg/L	--	--	0.01	0.097	0.966	NA
Benzo(b)fluoranthene	µg/L	--	--	0.095	0.952	9.52	NA
Benzo(k)fluoranthene	µg/L	--	--	653	6533	65,333	NA
Bis(2-ethylhexyl)phthalate	µg/L	429	4,294	42.9	429	4,294	NA
Chloroform	µg/L	2,577	25,769	15.8	158	1,580	NA
Chrysene	µg/L	--	--	16.5	165	1,654	NA
Dibenz(a,h)anthracene	µg/L	--	--	0.006	0.063	0.626	NA
HMX	µg/L	85,167	851,667	--	--	--	NA



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Table 5-5. Ravenna Facility Wide CUGs for Surface Water (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Heptachlor Epoxide	µg/L	22.1	221	5.24	52.4	524	NA
Indeno(1,2,3- <i>cd</i> )pyrene	µg/L	--	--	0.095	0.95	9.5	NA
Methylene Chloride	µg/L	24,768	247,676	657	6572	65,721	NA
PCB-1254	µg/L	34.1	341	119	1,192	11,923	NA
Pentachlorophenol	µg/L	434	4,336	3.37	33.7	337	NA
Pyrene	µg/L	51,100	511,000	--	--	--	NA
RDX	µg/L	5,110	51,100	434	4,336	43,358	NA
Tetrachloroethene	µg/L	1,859	18,593	10.5	105	1,049	NA
Trichloroethene	µg/L	34.2	342	2.34	23.4	234	NA
beta-BHC	µg/L	--	--	26.5	265	2,650	NA
<i>cis</i> -1,2-Dichloroethene	µg/L	17,033	170,333	--	--	--	NA
<b>National Guard Trainee</b>							
<i>Inorganics</i>							
Aluminum	µg/L	73,445	734,449	--	--	--	3,370
Antimony	µg/L	6.45	64.5	--	--	--	0
Arsenic	µg/L	67.0	670	4.17	41.7	417	3.2
Barium	µg/L	10,640	106,401	--	--	--	47.5
Cadmium	µg/L	4.08	40.8	--	--	--	0
Chromium	µg/L	24.5	245	--	--	--	0
Chromium, hexavalent	µg/L	24.5	245	--	--	--	NA
Copper	µg/L	7,199	71,992	--	--	--	7.9
Iron	µg/L	31,296	312,959	--	--	--	2,560
Manganese	µg/L	1,449	14,488	--	--	--	391
Mercury	µg/L	16.0	160	--	--	--	0
Nickel	µg/L	8,258	82,579	--	--	--	0
Nitrate	µg/L	584,936	5.8E+06	--	--	--	NA
Silver	µg/L	900	8,999	--	--	--	0
Thallium	µg/L	29.2	292	--	--	--	0
Vanadium	µg/L	57.2	572	--	--	--	0
Zinc	µg/L	58,216	582,164	--	--	--	42
<i>Organics</i>							
1,1,2,2-Tetrachloroethane	µg/L	5,706	57,064	0.395	3.95	39.5	NA
1,2-Dichloroethene	µg/L	809	8,092	--	--	--	NA
1,4-Dichlorobenzene	µg/L	--	--	24.6	246	2,460	NA
2,4,6-Trinitrotoluene	µg/L	328	3,276	611	6,115	61,145	NA
2,4-Dimethylphenol	µg/L	1,299	12,986	--	--	--	NA
2,4-Dinitrotoluene	µg/L	356	3,556	7.32	73.2	732	NA
2,6-Dinitrotoluene	µg/L	232	2,324	9.57	95.7	957	NA
2-Amino-4,6-dinitrotoluene	µg/L	131	1,310	--	--	--	NA
2-Nitrotoluene	µg/L	6,551	65,513	79.8	798	7,975	NA
4,4'-DDT	µg/L	1.2	12.0	0.197	1.97	19.7	NA
4-Amino-2,6-dinitrotoluene	µg/L	131	1,310	--	--	--	NA
4-Methylphenol	µg/L	448	4,477	--	--	--	NA
4-Nitrotoluene	µg/L	6,551	65,513	1,079	10,790	107,903	NA
Aldrin	µg/L	6.23	62.3	0.342	3.42	34.2	NA
Benz( <i>a</i> )anthracene	µg/L	--	--	0.032	0.322	3.22	NA
Benzo( <i>a</i> )pyrene	µg/L	--	--	0.002	0.019	0.189	NA
Benzo( <i>b</i> )fluoranthene	µg/L	--	--	0.019	0.185	1.85	NA
Benzo( <i>k</i> )fluoranthene	µg/L	--	--	251	2513	25,128	NA
Bis(2-ethylhexyl)phthalate	µg/L	67.9	679	6.79	67.9	679	NA
Chloroform	µg/L	226	2,255	1.02	10.2	102	NA
Chrysene	µg/L	--	--	3.22	32.2	322	NA

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Table 5-5. Ravenna Facility Wide CUGs for Surface Water (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Dibenz(a,h)anthracene	µg/L	--	--	0.001	0.011	0.112	NA
HMX	µg/L	32,756	327,564	--	--	--	NA
Heptachlor Epoxide	µg/L	8.52	85.2	2.02	20.2	202	NA
Indeno(1,2,3-cd)pyrene	µg/L	--	--	0.017	0.171	1.71	NA
Methylene Chloride	µg/L	2,027	20,274	46.4	464	4,642	NA
PCB-1254	µg/L	13.1	131	45.9	459	4,586	NA
Pentachlorophenol	µg/L	78.0	780	0.607	6.07	60.7	NA
Pyrene	µg/L	19,654	196,538	--	--	--	NA
RDX	µg/L	1,965	19,654	167	1,668	16,676	NA
Tetrachloroethene	µg/L	172	1,718	1.01	10.1	101	NA
Trichloroethene	µg/L	2.9	29.0	0.161	1.61	16.1	NA
beta-BHC	µg/L	--	--	10.2	102	1,019	NA
cis-1,2-Dichloroethene	µg/L	6,551	65,513	--	--	--	NA
<b>Resident Farmer Adult</b>							
<i>Inorganics</i>							
Aluminum	µg/L	63,895	638,950	--	--	--	3,370
Antimony	µg/L	17.1	171	--	--	--	0
Arsenic	µg/L	21.2	212	1.1	11.0	110	3.2
Barium	µg/L	12,131	121,306	--	--	--	47.5
Cadmium	µg/L	15.1	151	--	--	--	0
Chromium	µg/L	90.3	903	--	--	--	0
Chromium, hexavalent	µg/L	90.3	903	--	--	--	NA
Copper	µg/L	2,788	27,876	--	--	--	7.9
Iron	µg/L	20,000	200,000	--	--	--	2,560
Manganese	µg/L	2,476	24,759	--	--	--	391
Mercury	µg/L	18.2	182	--	--	--	0
Nickel	µg/L	1,445	14,447	--	--	--	0
Nitrate	µg/L	115,159	1.2E+06	--	--	--	NA
Silver	µg/L	348	3,484	--	--	--	0
Thallium	µg/L	5.76	57.6	--	--	--	0
Vanadium	µg/L	211	2,107	--	--	--	0
Zinc	µg/L	21,002	210,022	--	--	--	42
<i>Organics</i>							
1,1,2,2-Tetrachloroethane	µg/L	2,874	28,737	0.853	8.53	85.3	NA
1,2-Dichloroethene	µg/L	480	4,799	--	--	--	NA
1,4-Dichlorobenzene	µg/L	--	--	18.7	187	1,874	NA
2,4,6-Trinitrotoluene	µg/L	36.5	365	56.8	568	5,678	NA
2,4-Dimethylphenol	µg/L	899	8,985	--	--	--	NA
2,4-Dinitrotoluene	µg/L	116	1,160	1.99	19.9	199	NA
2,6-Dinitrotoluene	µg/L	62.1	621	2.13	21.3	213	NA
2-Amino-4,6-dinitrotoluene	µg/L	14.6	146	--	--	--	NA
2-Nitrotoluene	µg/L	730	7,300	7.41	74.1	741	NA
4,4'-DDT	µg/L	0.743	7.43	0.102	1.02	10.2	NA
4-Amino-2,6-dinitrotoluene	µg/L	14.6	146	--	--	--	NA
4-Methylphenol	µg/L	261	2,611	--	--	--	NA
4-Nitrotoluene	µg/L	730	7,300	100	1,002	10,020	NA
Aldrin	µg/L	1.59	15.9	0.073	0.726	7.26	NA
Benz(a)anthracene	µg/L	--	--	0.014	0.136	1.36	NA
Benzo(a)pyrene	µg/L	--	--	8.0E-04	0.008	0.08	NA
Benzo(b)fluoranthene	µg/L	--	--	0.008	0.079	0.786	NA
Benzo(k)fluoranthene	µg/L	--	--	23.3	233	2,333	NA
Bis(2-ethylhexyl)phthalate	µg/L	41.9	419	3.49	34.9	349	NA

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Table 5-5. Ravenna Facility Wide CUGs for Surface Water (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Chloroform	µg/L	252	2,523	2.47	24.7	247	NA
Chrysene	µg/L	--	--	1.36	13.6	136	NA
Dibenz(a,h)anthracene	µg/L	--	--	5.2E-04	0.005	0.052	NA
HMX	µg/L	3,650	36,500	--	--	--	NA
Heptachlor Epoxide	µg/L	0.949	9.49	0.187	1.87	18.7	NA
Indeno(1,2,3-cd)pyrene	µg/L	--	--	0.008	0.078	0.785	NA
Methylene Chloride	µg/L	2,518	25,181	76.0	760	7597	NA
PCB-1254	µg/L	1.46	14.6	4.26	42.6	426	NA
Pentachlorophenol	µg/L	42.6	426	0.276	2.76	27.6	NA
Pyrene	µg/L	2,190	21,900	--	--	--	NA
RDX	µg/L	219	2,190	15.5	155	1,548	NA
Tetrachloroethene	µg/L	184	1840	0.83	8.3	83.0	NA
Trichloroethene	µg/L	3.64	36.4	0.301	3.01	30.1	NA
beta-BHC	µg/L	--	--	0.946	9.46	94.6	NA
cis-1,2-Dichloroethene	µg/L	730	7,300	--	--	--	NA
<b>Resident Farmer Child</b>							
<i>Inorganics</i>							
Aluminum	µg/L	14,827	148,274	--	--	--	3,370
Antimony	µg/L	4.91	49.1	--	--	--	0
Arsenic	µg/L	4.63	46.3	1.2	12.0	120	3.2
Barium	µg/L	2,901	29,007	--	--	--	47.5
Cadmium	µg/L	5.05	50.5	--	--	--	0
Chromium	µg/L	30.3	303	--	--	--	0
Chromium, hexavalent	µg/L	30.3	303	--	--	--	NA
Copper	µg/L	614	6,144	--	--	--	7.9
Iron	µg/L	4,527	45,269	--	--	--	2,560
Manganese	µg/L	633	6,326	--	--	--	391
Mercury	µg/L	4.35	43.5	--	--	--	0
Nickel	µg/L	312	3,116	--	--	--	0
Nitrate	µg/L	24,892	248,917	--	--	--	NA
Silver	µg/L	76.8	768	--	--	--	0
Thallium	µg/L	1.24	12.4	--	--	--	0
Vanadium	µg/L	70.6	706	--	--	--	0
Zinc	µg/L	4,617	46,167	--	--	--	42
<i>Organics</i>							
1,1,2,2-Tetrachloroethane	µg/L	781	7,806	0.945	9.45	94.5	NA
1,2-Dichloroethene	µg/L	123	1,232	--	--	--	NA
1,4-Dichlorobenzene	µg/L	--	--	36.6	366	3,663	NA
2,4,6-Trinitrotoluene	µg/L	7.82	78.2	60.8	608	6,083	NA
2,4-Dimethylphenol	µg/L	252	2,521	--	--	--	NA
2,4-Dinitrotoluene	µg/L	28.4	284	2.44	24.4	244	NA
2,6-Dinitrotoluene	µg/L	14.7	147	2.51	25.1	251	NA
2-Amino-4,6-dinitrotoluene	µg/L	3.13	31.3	--	--	--	NA
2-Nitrotoluene	µg/L	156	1,564	7.93	79.3	793	NA
4,4'-DDT	µg/L	0.4	4.0	0.274	2.74	27.4	NA
4-Amino-2,6-dinitrotoluene	µg/L	3.13	31.3	--	--	--	NA
4-Methylphenol	µg/L	67.8	678	--	--	--	NA
4-Nitrotoluene	µg/L	156	1,564	107	1,074	10,735	NA
Aldrin	µg/L	0.409	4.09	0.094	0.936	9.36	NA
Benz(a)anthracene	µg/L	--	--	0.037	0.375	3.75	NA
Benzo(a)pyrene	µg/L	--	--	0.002	0.022	0.22	NA
Benzo(b)fluoranthene	µg/L	--	--	0.022	0.217	2.17	NA

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Table 5-5. Ravenna Facility Wide CUGs for Surface Water (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Benzo(k)fluoranthene	µg/L	--	--	25	250	2,500	NA
Bis(2-ethylhexyl)phthalate	µg/L	22.3	223	9.27	92.7	927	NA
Chloroform	µg/L	90.4	904	2.68	26.8	268	NA
Chrysene	µg/L	--	--	3.75	37.5	375	NA
Dibenz(a,h)anthracene	µg/L	--	--	0.001	0.014	0.143	NA
HMX	µg/L	782	7,821	--	--	--	NA
Heptachlor Epoxide	µg/L	0.203	2.03	0.201	2.01	20.1	NA
Indeno(1,2,3-cd)pyrene	µg/L	--	--	0.022	0.217	2.17	NA
Methylene Chloride	µg/L	571	5,710	84.1	841	8,410	NA
PCB-1254	µg/L	0.313	3.13	4.56	45.6	456	NA
Pentachlorophenol	µg/L	22.9	229	0.743	7.43	74.3	NA
Pyrene	µg/L	469	4,693	--	--	--	NA
RDX	µg/L	46.9	469	16.6	166	1,659	NA
Tetrachloroethene	µg/L	64.0	640	1.48	14.8	148	NA
Trichloroethene	µg/L	1.53	15.3	0.408	4.08	40.8	NA
beta-BHC	µg/L	--	--	1.01	10.1	101	NA
cis-1,2-Dichloroethene	µg/L	156	1,564	--	--	--	NA

COPC = Chemical of potential concern.

CUG = Cleanup goal across all pathways (ingestion, dermal, and inhalation).

HI = Hazard index.

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.

NA = Not available.

PCB = Polychlorinated biphenyl.

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

-- = No CUG could be quantified based on lack of approved toxicity value.

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1 Table 5-6. Ravenna Facility Wide CUGs for Ingestion of Fish/Waterfowl from Surface Water

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
<b>Fisher Recreator</b>							
<i>Inorganics</i>							
Aluminum	µg/L	909	9,091	--	--	--	3,370
Antimony	µg/L	1.82	18.2	--	--	--	0
Arsenic	µg/L	0.455	4.55	0.024	0.236	2.36	3.2
Barium	µg/L	22,727	227,273	--	--	--	47.5
Cadmium	µg/L	1.14	11.4	--	--	--	0
Chromium	µg/L	6.82	68.2	--	--	--	0
Chromium, hexavalent	µg/L	6.82	68.2	--	--	--	NA
Copper	µg/L	90.9	909	--	--	--	7.9
Iron	µg/L	682	6,818	--	--	--	2,560
Manganese	µg/L	52.3	523	--	--	--	391
Mercury	µg/L	0.136	1.36	--	--	--	0
Nickel	µg/L	90.9	909	--	--	--	0
Nitrate	µg/L	4.85	48.5	--	--	--	NA
Silver	µg/L	455	4,545	--	--	--	0
Thallium	µg/L	0.004	0.036	--	--	--	0
Vanadium	µg/L	--	--	--	--	--	0
Zinc	µg/L	136	1,364	--	--	--	42
<i>Organics</i>							
1,1,2,2-Tetrachloroethane	µg/L	1,948	19,481	3.79	37.9	379	NA
1,2-Dichloroethene	µg/L	505	5,051	--	--	--	NA
1,4-Dichlorobenzene	µg/L	--	--	4.97	49.7	497	NA
2,4,6-Trinitrotoluene	µg/L	66.8	668	104	1,040	10,398	NA
2,4-Dimethylphenol	µg/L	758	7,576	--	--	--	NA
2,4-Dinitrotoluene	µg/L	136	1,357	2.33	23.3	233	NA
2,6-Dinitrotoluene	µg/L	54.8	548	1.88	18.8	188	NA
2-Amino-4,6-Dinitrotoluene	µg/L	17.5	175	--	--	--	NA
2-Amino-4,6-dinitrotoluene	µg/L	17.5	175	--	--	--	NA
2-Nitrotoluene	µg/L	379	3,788	3.84	38.4	384	NA
4,4'-DDT	µg/L	0.005	0.054	7.4E-04	0.007	0.074	NA
4-Amino-2,6-Dinitrotoluene	µg/L	17.5	175	--	--	--	NA
4-Amino-2,6-dinitrotoluene	µg/L	17.5	175	--	--	--	NA
4-Methylphenol	µg/L	367	3,666	--	--	--	NA
4-Nitrotoluene	µg/L	350	3,497	48.0	480	4,799	NA
Aldrin	µg/L	6.8E-04	0.007	3.1E-05	3.1E-04	0.003	NA
Benz(a)anthracene	µg/L	--	--	0.003	0.027	0.269	NA
Benzo(a)pyrene	µg/L	--	--	1.3E-04	0.001	0.013	NA
Benzo(b)fluoranthene	µg/L	--	--	0.003	0.026	0.259	NA
Benzo(k)fluoranthene	µg/L	--	--	0.015	0.145	1.45	NA
Bis(2-ethylhexyl)phthalate	µg/L	29.3	293	2.44	24.4	244	NA
Chloroform	µg/L	689	6,887	263	2634	26,344	NA
Chrysene	µg/L	--	--	0.246	2.46	24.6	NA
Dibenz(a,h)anthracene	µg/L	--	--	6.6E-05	6.6E-04	0.007	NA
HMX	µg/L	7,102	71,023	--	--	--	NA
Heptachlor Epoxide	µg/L	0.004	0.042	8.3E-04	0.008	0.083	NA
Indeno(1,2,3-cd)pyrene	µg/L	--	--	5.0E-04	0.005	0.05	NA
Methylene Chloride	µg/L	15,152	151,515	786	7,856	78,563	NA
PCB-1254	µg/L	6.5E-05	6.5E-04	1.9E-04	0.002	0.019	NA
Pentachlorophenol	µg/L	19.5	195	0.126	1.26	12.6	NA
Pyrene	µg/L	12.4	124	--	--	--	NA
RDX	µg/L	426	4261	30.1	301	3013	NA

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**Table 5-6. Ravenna Facility Wide CUGs for Ingestion of Fish/Waterfowl from Surface Water (continued)**

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Tetrachloroethene	µg/L	54.8	548	0.237	2.37	23.7	NA
Trichloroethene	µg/L	9.09	90.9	1.77	17.7	177	NA
beta-BHC	µg/L	--	--	0.019	0.19	1.9	NA
cis-1,2-Dichloroethene	µg/L	561	5,612	--	--	--	NA
<b>Hunter/Trapper</b>							
<i>Inorganics</i>							
Aluminum	µg/L	1,061	10,606	--	--	--	3,370
Antimony	µg/L	2.12	21.2	--	--	--	0
Arsenic	µg/L	0.53	5.3	0.027	0.275	2.75	3.2
Barium	µg/L	26,515	265,152	--	--	--	47.5
Cadmium	µg/L	1.33	13.3	--	--	--	0
Chromium	µg/L	7.95	79.5	--	--	--	0
Chromium, hexavalent	µg/L	7.95	79.5	--	--	--	NA
Copper	µg/L	106	1,061	--	--	--	7.9
Iron	µg/L	795	7955	--	--	--	2,560
Manganese	µg/L	61.0	610	--	--	--	391
Mercury	µg/L	0.159	1.59	--	--	--	0
Nickel	µg/L	106	1,061	--	--	--	0
Nitrate	µg/L	5.66	56.6	--	--	--	NA
Silver	µg/L	530	5,303	--	--	--	0
Thallium	µg/L	0.004	0.042	--	--	--	0
Vanadium	µg/L	--	--	--	--	--	0
Zinc	µg/L	159	1,591	--	--	--	42
<i>Organics</i>							
1,1,2,2-Tetrachloroethane	µg/L	2,273	22,727	4.42	44.2	442	NA
1,2-Dichloroethene	µg/L	589	5,892	--	--	--	NA
1,4-Dichlorobenzene	µg/L	--	--	5.79	57.9	579	NA
2,4,6-Trinitrotoluene	µg/L	78.0	780	121	1,213	12,131	NA
2,4-Dimethylphenol	µg/L	884	8,838	--	--	--	NA
2,4-Dinitrotoluene	µg/L	158	1,583	2.72	27.2	272	NA
2,6-Dinitrotoluene	µg/L	63.9	639	2.19	21.9	219	NA
2-Amino-4,6-Dinitrotoluene	µg/L	20.4	204	--	--	--	NA
2-Amino-4,6-dinitrotoluene	µg/L	20.4	204	--	--	--	NA
2-Nitrotoluene	µg/L	442	4,419	4.48	44.8	448	NA
4,4'-DDT	µg/L	0.006	0.063	8.7E-04	0.009	0.087	NA
4-Amino-2,6-Dinitrotoluene	µg/L	20.4	204	--	--	--	NA
4-Amino-2,6-dinitrotoluene	µg/L	20.4	204	--	--	--	NA
4-Methylphenol	µg/L	428	4,277	--	--	--	NA
4-Nitrotoluene	µg/L	408	4,079	56.0	560	5,599	NA
Aldrin	µg/L	8.0E-04	0.008	3.6E-05	3.6E-04	0.004	NA
Benzo(a)anthracene	µg/L	--	--	0.003	0.031	0.314	NA
Benzo(a)pyrene	µg/L	--	--	1.5E-04	0.002	0.015	NA
Benzo(b)fluoranthene	µg/L	--	--	0.003	0.03	0.303	NA
Benzo(k)fluoranthene	µg/L	--	--	0.017	0.17	1.7	NA
Bis(2-ethylhexyl)phthalate	µg/L	34.2	342	2.85	28.5	285	NA
Chloroform	µg/L	803	8,035	307	3073	30,735	NA
Chrysene	µg/L	--	--	0.287	2.87	28.7	NA
Dibenz(a,h)anthracene	µg/L	--	--	7.7E-05	7.7E-04	0.008	NA
HMX	µg/L	8286	82,860	--	--	--	NA
Heptachlor Epoxide	µg/L	0.005	0.049	9.7E-04	0.01	0.097	NA

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**Table 5-6. Ravenna Facility Wide CUGs for Ingestion of Fish/Waterfowl from Surface Water  
(continued)**

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Indeno(1,2,3- <i>cd</i> )pyrene	µg/L	--	--	5.8E-04	0.006	0.058	NA
Methylene Chloride	µg/L	17,677	176,768	917	9,166	91,657	NA
PCB-1254	µg/L	7.6E-05	7.6E-04	2.2E-04	0.002	0.022	NA
Pentachlorophenol	µg/L	22.7	227	0.147	1.47	14.7	NA
Pyrene	µg/L	14.5	145	--	--	--	NA
RDX	µg/L	497	4,972	35.2	352	3,515	NA
Tetrachloroethene	µg/L	63.9	639	0.276	2.76	27.6	NA
Trichloroethene	µg/L	10.6	106	2.06	20.6	206	NA
beta-BHC	µg/L	--	--	0.022	0.222	2.22	NA
<i>cis</i> -1,2-Dichloroethene	µg/L	655	6,547	--	--	--	NA

COPC = Chemical of potential concern.

CUG = Cleanup goal across all pathways (ingestion of fish).

HI = Hazard index.

HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.

NA = Not available.

PCB = Polychlorinated biphenyl.

RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.

-- = No CUG could be quantified based on lack of approved toxicity value.

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Table 5-7. Ravenna Facility Wide CUGs for Sediment

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
<b>Adult Trespasser</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	1.0E+06	1.0E+06	--	--	--	13,900
Antimony	mg/kg	111	1,114	--	--	--	0
Arsenic	mg/kg	58.3	583	3.03	30.3	303	19.5
Barium	mg/kg	156,890	1.0E+06	--	--	--	123
Cadmium	mg/kg	144	1,441	69,950	699,502	1.0E+06	0
Chromium	mg/kg	820	8,196	10,493	104,925	1.0E+06	18.1
Chromium, hexavalent	mg/kg	820	8,196	10,493	104,925	1.0E+06	NA
Copper	mg/kg	85,523	855,230	--	--	--	27.6
Iron	mg/kg	434,278	1.0E+06	--	--	--	28,200
Manganese	mg/kg	22,029	220,293	--	--	--	1,950
Mercury	mg/kg	250	2,498	--	--	--	0.059
Nickel	mg/kg	40,609	406,093	--	--	--	17.7
Silver	mg/kg	8,111	81,111	--	--	--	0
Thallium	mg/kg	87.5	875	--	--	--	0.89
Vanadium	mg/kg	1,009	10,090	--	--	--	26.1
Zinc	mg/kg	517,905	1.0E+06	--	--	--	532
<i>Organics</i>							
2,4,6-Trinitrotoluene	mg/kg	210	2,095	326	3,259	32,593	NA
2,4-Dinitrotoluene	mg/kg	283	2,828	4.85	48.5	485	NA
2-Amino-4,6-dinitrotoluene	mg/kg	310	3,095	--	--	--	NA
4-Amino-2,6-dinitrotoluene	mg/kg	310	3,095	--	--	--	NA
Benz(a)anthracene	mg/kg	--	--	1.13	11.3	113	NA
Benzo(a)pyrene	mg/kg	--	--	0.113	1.13	11.3	NA
Benzo(b)fluoranthene	mg/kg	--	--	1.13	11.3	113	NA
Benzo(k)fluoranthene	mg/kg	--	--	11.3	113	1,129	NA
Dibenz(a,h)anthracene	mg/kg	--	--	0.113	1.13	11.3	NA
Dieldrin	mg/kg	54.7	547	1.6	16.0	160	NA
HMX	mg/kg	17,113	171,132	--	--	--	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	1.13	11.3	113	NA
Nitroglycerin	mg/kg	--	--	1,502	15,019	150,187	NA
PCB-1016	mg/kg	7.28	72.8	1.21	12.1	121	NA
PCB-1254	mg/kg	2.08	20.8	1.21	12.1	121	NA
PCB-1260	mg/kg	--	--	1.21	12.1	121	NA
RDX	mg/kg	2,403	24,028	170	1,699	16,990	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>Fisher Recreator</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	1.0E+06	1.0E+06	--	--	--	13,900
Antimony	mg/kg	2,159	21,592	--	--	--	0
Arsenic	mg/kg	1,172	11,719	60.7	607	6075	19.5
Barium	mg/kg	1.0E+06	1.0E+06	--	--	--	123
Cadmium	mg/kg	2,959	29,595	524,627	1.0E+06	1.0E+06	0
Chromium	mg/kg	15,424	154,237	78,694	786,940	1.0E+06	18.1
Chromium, hexavalent	mg/kg	15,424	154,237	78,694	786,940	1.0E+06	NA
Copper	mg/kg	934,756	1.0E+06	--	--	--	27.6
Iron	mg/kg	1.0E+06	1.0E+06	--	--	--	28,200
Manganese	mg/kg	349,421	1.0E+06	--	--	--	1,950
Mercury	mg/kg	3,936	39,356	--	--	--	0.059
Nickel	mg/kg	455,347	1.0E+06	--	--	--	17.7
Silver	mg/kg	100,855	1.0E+06	--	--	--	0
Thallium	mg/kg	1,267	12,669	--	--	--	0.89



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Table 5-7. Ravenna Facility Wide CUGs for Sediment (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Vanadium	mg/kg	20,716	207,162	--	--	--	26.1
Zinc	mg/kg	1.0E+06	1.0E+06	--	--	--	532
<i>Organics</i>							
2,4,6-Trinitrotoluene	mg/kg	3,837	38,371	5,969	59,688	596,883	NA
2,4-Dinitrotoluene	mg/kg	5,814	58,139	100	997	9,975	NA
2-Amino-4,6-dinitrotoluene	mg/kg	3,927	39,267	--	--	--	NA
4-Amino-2,6-dinitrotoluene	mg/kg	3,927	39,267	--	--	--	NA
Benz(a)anthracene	mg/kg	--	--	24.3	243	2,435	NA
Benzo(a)pyrene	mg/kg	--	--	2.43	24.3	243	NA
Benzo(b)fluoranthene	mg/kg	--	--	24.3	243	2,435	NA
Benzo(k)fluoranthene	mg/kg	--	--	243	2,435	24,347	NA
Dibenz(a,h)anthracene	mg/kg	--	--	2.43	24.3	243	NA
Dieldrin	mg/kg	792	7,918	23.1	231	2,309	NA
HMX	mg/kg	323,145	1.0E+06	--	--	--	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	24.3	243	2,435	NA
Nitroglycerin	mg/kg	--	--	21,737	217,368	1.0E+06	NA
PCB-1016	mg/kg	152	1,522	25.4	254	2,536	NA
PCB-1254	mg/kg	43.5	435	25.4	254	2,536	NA
PCB-1260	mg/kg	--	--	25.4	254	2,536	NA
RDX	mg/kg	38,261	382,612	2,705	27,053	270,534	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>Hunter/Trapper</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	1.0E+06	1.0E+06	--	--	--	13,900
Antimony	mg/kg	4,961	49,612	--	--	--	0
Arsenic	mg/kg	2,754	27,543	143	1,428	14,276	19.5
Barium	mg/kg	1.0E+06	1.0E+06	--	--	--	123
Cadmium	mg/kg	7,058	70,580	874,378	1.0E+06	1.0E+06	0
Chromium	mg/kg	34,813	348,127	131,157	1.0E+06	1.0E+06	18.1
Chromium, hexavalent	mg/kg	34,813	348,127	131,157	1.0E+06	1.0E+06	NA
Copper	mg/kg	1.0E+06	1.0E+06	--	--	--	27.6
Iron	mg/kg	1.0E+06	1.0E+06	--	--	--	28,200
Manganese	mg/kg	721,868	1.0E+06	--	--	--	1,950
Mercury	mg/kg	8,105	81,050	--	--	--	0.059
Nickel	mg/kg	830,144	1.0E+06	--	--	--	17.7
Silver	mg/kg	189,728	1.0E+06	--	--	--	0
Thallium	mg/kg	2,517	25,172	--	--	--	0.89
Vanadium	mg/kg	49,406	494,061	--	--	--	26.1
Zinc	mg/kg	1.0E+06	1.0E+06	--	--	--	532
<i>Organics</i>							
2,4,6-Trinitrotoluene	mg/kg	8,526	85,258	13,262	132,623	1.0E+06	NA
2,4-Dinitrotoluene	mg/kg	13,877	138,768	238	2,381	23,808	NA
2-Amino-4,6-dinitrotoluene	mg/kg	7,436	74,360	--	--	--	NA
4-Amino-2,6-dinitrotoluene	mg/kg	7,436	74,360	--	--	--	NA
Benz(a)anthracene	mg/kg	--	--	60.1	601	6,012	NA
Benzo(a)pyrene	mg/kg	--	--	6.01	60.1	601	NA
Benzo(b)fluoranthene	mg/kg	--	--	60.1	601	6,012	NA
Benzo(k)fluoranthene	mg/kg	--	--	601	6,012	60,120	NA
Dibenz(a,h)anthracene	mg/kg	--	--	6.01	60.1	601	NA
Dieldrin	mg/kg	1,573	15,733	45.9	459	4,588	NA
HMX	mg/kg	730,835	1.0E+06	--	--	--	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	60.1	601	6,012	NA
Nitroglycerin	mg/kg	--	--	43,188	431,880	1.0E+06	NA

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Table 5-7. Ravenna Facility Wide CUGs for Sediment (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
PCB-1016	mg/kg	367	3,674	61.2	612	6,123	NA
PCB-1254	mg/kg	105	1,050	61.2	612	6,123	NA
PCB-1260	mg/kg	--	--	61.2	612	6,123	NA
RDX	mg/kg	79,184	791,839	5,599	55,989	559,886	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>Juvenile Trespasser</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	959,740	1.0E+06	--	--	--	13,900
Antimony	mg/kg	134	1,339	--	--	--	0
Arsenic	mg/kg	72.5	725	11.3	113	1,128	19.5
Barium	mg/kg	154,679	1.0E+06	--	--	--	123
Cadmium	mg/kg	183	1,828	202,356	1.0E+06	1.0E+06	0
Chromium	mg/kg	980	9,803	30,353	303,534	1.0E+06	18.1
Chromium, hexavalent	mg/kg	980	9,803	30,353	303,534	1.0E+06	NA
Copper	mg/kg	59,457	594,570	--	--	--	27.6
Iron	mg/kg	357,930	1.0E+06	--	--	--	28,200
Manganese	mg/kg	23,903	239,026	--	--	--	1,950
Mercury	mg/kg	247	2,467	--	--	--	0.059
Nickel	mg/kg	28,938	289,380	--	--	--	17.7
Silver	mg/kg	6,386	63,855	--	--	--	0
Thallium	mg/kg	79.7	797	--	--	--	0.89
Vanadium	mg/kg	1,280	12,799	--	--	--	26.1
Zinc	mg/kg	397,112	1.0E+06	--	--	--	532
<i>Organics</i>							
2,4,6-Trinitrotoluene	mg/kg	239	2,386	1,114	11,137	111,367	NA
2,4-Dinitrotoluene	mg/kg	359	3,592	18.5	185	1,849	NA
2-Amino-4,6-dinitrotoluene	mg/kg	248	2,484	--	--	--	NA
4-Amino-2,6-dinitrotoluene	mg/kg	248	2,484	--	--	--	NA
Benz(a)anthracene	mg/kg	--	--	4.5	45.0	450	NA
Benzo(a)pyrene	mg/kg	--	--	0.45	4.5	45.0	NA
Benzo(b)fluoranthene	mg/kg	--	--	4.5	45.0	450	NA
Benzo(k)fluoranthene	mg/kg	--	--	45.0	450	4,499	NA
Dibenz(a,h)anthracene	mg/kg	--	--	0.45	4.5	45.0	NA
Dieldrin	mg/kg	49.8	498	4.36	43.6	436	NA
HMX	mg/kg	20,063	200,631	--	--	--	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	4.5	45.0	450	NA
Nitroglycerin	mg/kg	--	--	4,103	41,031	410,308	NA
PCB-1016	mg/kg	9.39	93.9	4.7	47.0	470	NA
PCB-1254	mg/kg	2.68	26.8	4.7	47.0	470	NA
PCB-1260	mg/kg	--	--	4.7	47.0	470	NA
RDX	mg/kg	2,397	23,968	508	5,084	50,842	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>National Guard Dust/Fire Control Worker</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	1.0E+06	1.0E+06	--	--	--	13,900
Antimony	mg/kg	1,030	10,297	--	--	--	0
Arsenic	mg/kg	573	5,735	35.7	357	3,565	19.5
Barium	mg/kg	810,909	1.0E+06	--	--	--	123
Cadmium	mg/kg	1,473	14,726	94,527	945,273	1.0E+06	0
Chromium	mg/kg	6,666	66,659	14,179	141,791	1.0E+06	18.1
Chromium, hexavalent	mg/kg	6,666	66,659	14,179	141,791	1.0E+06	NA
Copper	mg/kg	341,235	1.0E+06	--	--	--	27.6
Iron	mg/kg	1.0E+06	1.0E+06	--	--	--	28,200

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Table 5-7. Ravenna Facility Wide CUGs for Sediment (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Manganese	mg/kg	116,634	1.0E+06	--	--	--	1950
Mercury	mg/kg	1,659	16,586	--	--	--	0.059
Nickel	mg/kg	167,541	1.0E+06	--	--	--	17.7
Silver	mg/kg	38,421	384,211	--	--	--	0
Thallium	mg/kg	513	5,129	--	--	--	0.89
Vanadium	mg/kg	10,308	103,084	--	--	--	26.1
Zinc	mg/kg	1.0E+06	1.0E+06	--	--	--	532
<i>Organics</i>							
2,4,6-Trinitrotoluene	mg/kg	1,762	17,616	3,288	32,883	328,829	NA
2,4-Dinitrotoluene	mg/kg	2,896	28,957	59.6	596	5,962	NA
2-Amino-4,6-dinitrotoluene	mg/kg	1,507	15,069	--	--	--	NA
4-Amino-2,6-dinitrotoluene	mg/kg	1,507	15,069	--	--	--	NA
Benz(a)anthracene	mg/kg	--	--	15.1	151	1,513	NA
Benzo(a)pyrene	mg/kg	--	--	1.51	15.1	151	NA
Benzo(b)fluoranthene	mg/kg	--	--	15.1	151	1,513	NA
Benzo(k)fluoranthene	mg/kg	--	--	151	1513	15,129	NA
Dibenz(a,h)anthracene	mg/kg	--	--	1.51	15.1	151	NA
Dieldrin	mg/kg	321	3,206	11.2	112	1,122	NA
HMX	mg/kg	151,363	1.0E+06	--	--	--	NA
Indeno(1,2,3-cd)pyrene	mg/kg	--	--	15.1	151	1,513	NA
Nitroglycerin	mg/kg	--	--	10,560	105,602	1.0E+06	NA
PCB-1016	mg/kg	76.8	768	15.4	154	1,536	NA
PCB-1254	mg/kg	21.9	219	15.4	154	1,536	NA
PCB-1260	mg/kg	--	--	15.4	154	1,536	NA
RDX	mg/kg	16,214	162,136	1,376	13,757	137,570	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>National Guard Trainee</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	3,496	34,960	--	--	--	13,900
Antimony	mg/kg	175	1,753	--	--	--	0
Arsenic	mg/kg	114	1,140	2.78	27.8	278	19.5
Barium	mg/kg	351	3,506	--	--	--	123
Cadmium	mg/kg	329	3,292	10.9	109	1,093	0
Chromium	mg/kg	5.61	56.1	1.64	16.4	164	18.1
Chromium, hexavalent	mg/kg	5.61	56.1	1.64	16.4	164	NA
Copper	mg/kg	25,368	253,680	--	--	--	27.6
Iron	mg/kg	184,370	1.0E+06	--	--	--	28,200
Manganese	mg/kg	35.1	351	--	--	--	1,950
Mercury	mg/kg	172	1,722	--	--	--	0.059
Nickel	mg/kg	12,639	126,391	--	--	--	17.7
Silver	mg/kg	3,105	31,049	--	--	--	0
Thallium	mg/kg	47.7	477	--	--	--	0.89
Vanadium	mg/kg	2,304	23,045	--	--	--	26.1
Zinc	mg/kg	187,269	1.0E+06	--	--	--	532
<i>Organics</i>							
2,4,6-Trinitrotoluene	mg/kg	249	2,488	464	4,643	46,435	NA
2,4-Dinitrotoluene	mg/kg	652	6,519	13.4	134	1,342	NA
2-Amino-4,6-dinitrotoluene	mg/kg	124	1,237	--	--	--	NA
4-Amino-2,6-dinitrotoluene	mg/kg	124	1,237	--	--	--	NA
Benz(a)anthracene	mg/kg	--	--	4.77	47.7	477	NA
Benzo(a)pyrene	mg/kg	--	--	0.477	4.77	47.7	NA
Benzo(b)fluoranthene	mg/kg	--	--	4.77	47.7	477	NA
Benzo(k)fluoranthene	mg/kg	--	--	47.7	477	4,774	NA
Dibenz(a,h)anthracene	mg/kg	--	--	0.477	4.77	47.7	NA

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Table 5-7. Ravenna Facility Wide CUGs for Sediment (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Dieldrin	mg/kg	29.8	298	0.839	8.39	83.9	NA
HMX	mg/kg	23,464	234,645	--	--	--	NA
Indeno(1,2,3- <i>cd</i> )pyrene	mg/kg	--	--	4.77	47.7	477	NA
Nitroglycerin	mg/kg	--	--	982	9,818	98,183	NA
PCB-1016	mg/kg	19.2	192	3.46	34.6	346	NA
PCB-1254	mg/kg	5.49	54.9	3.46	34.6	346	NA
PCB-1260	mg/kg	--	--	3.46	34.6	346	NA
RDX	mg/kg	1,711	17,113	145	1,452	14,520	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>Resident Farmer Adult</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	52,923	529,229	--	--	--	13,900
Antimony	mg/kg	13.6	136	--	--	--	0
Arsenic	mg/kg	8.21	82.1	0.425	4.25	42.5	19.5
Barium	mg/kg	8,966	89,656	--	--	--	123
Cadmium	mg/kg	22.3	223	1,249	12,491	124,911	0
Chromium	mg/kg	90.4	904	187	1,874	18,737	18.1
Chromium, hexavalent	mg/kg	90.4	904	187	1,874	18,737	NA
Copper	mg/kg	2,714	27,138	--	--	--	27.6
Iron	mg/kg	19,010	190,104	--	--	--	28,200
Manganese	mg/kg	1,482	14,817	--	--	--	1,950
Mercury	mg/kg	16.5	165	--	--	--	0.059
Nickel	mg/kg	1,346	13,463	--	--	--	17.7
Silver	mg/kg	324	3,240	--	--	--	0
Thallium	mg/kg	4.76	47.6	--	--	--	0.89
Vanadium	mg/kg	156	1,558	--	--	--	26.1
Zinc	mg/kg	19,659	196,589	--	--	--	532
<i>Organics</i>							
2,4,6-Trinitrotoluene	mg/kg	21.1	211	32.8	328	3,283	NA
2,4-Dinitrotoluene	mg/kg	43.9	439	0.753	7.53	75.3	NA
2-Amino-4,6-dinitrotoluene	mg/kg	12.8	128	--	--	--	NA
4-Amino-2,6-dinitrotoluene	mg/kg	12.8	128	--	--	--	NA
Benz( <i>a</i> )anthracene	mg/kg	--	--	0.221	2.21	22.1	NA
Benzo( <i>a</i> )pyrene	mg/kg	--	--	0.022	0.221	2.21	NA
Benzo( <i>b</i> )fluoranthene	mg/kg	--	--	0.221	2.21	22.1	NA
Benzo( <i>k</i> )fluoranthene	mg/kg	--	--	2.21	22.1	221	NA
Dibenz( <i>a,h</i> )anthracene	mg/kg	--	--	0.022	0.221	2.21	NA
Dieldrin	mg/kg	2.97	29.7	0.087	0.867	8.67	NA
HMX	mg/kg	1,909	19,090	--	--	--	NA
Indeno(1,2,3- <i>cd</i> )pyrene	mg/kg	--	--	0.221	2.21	22.1	NA
Nitroglycerin	mg/kg	--	--	81.6	816	8,159	NA
PCB-1016	mg/kg	1.22	12.2	0.203	2.03	20.3	NA
PCB-1254	mg/kg	0.348	3.48	0.203	2.03	20.3	NA
PCB-1260	mg/kg	--	--	0.203	2.03	20.3	NA
RDX	mg/kg	163	1,632	11.5	115	1,154	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA
<b>Resident Farmer Child</b>							
<i>Inorganics</i>							
Aluminum	mg/kg	7,380	73,798	--	--	--	13,900
Antimony	mg/kg	2.82	28.2	--	--	--	0
Arsenic	mg/kg	2.02	20.2	0.524	5.24	52.4	19.5
Barium	mg/kg	1,413	14,129	--	--	--	123
Cadmium	mg/kg	6.41	64.1	2677	26,767	267,667	0

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Table 5-7. Ravenna Facility Wide CUGs for Sediment (continued)

COPC	Units	Non-carcinogenic CUG		Carcinogenic CUG			Background
		HI = 0.1	HI = 1	Risk = 10 <sup>-6</sup>	Risk = 10 <sup>-5</sup>	Risk = 10 <sup>-4</sup>	
Chromium	mg/kg	19.9	199	401.5	4,015	40,150	18.1
Chromium, hexavalent	mg/kg	19.9	199	402	4,015	40,150	NA
Copper	mg/kg	311	3,106	--	--	--	27.6
Iron	mg/kg	2,313	23,125	--	--	--	28,200
Manganese	mg/kg	293	2,927	--	--	--	1,950
Mercury	mg/kg	2.27	22.7	--	--	--	0.059
Nickel	mg/kg	155	1,552	--	--	--	17.7
Silver	mg/kg	38.6	386	--	--	--	0
Thallium	mg/kg	0.612	6.12	--	--	--	0.89
Vanadium	mg/kg	44.9	449	--	--	--	26.1
Zinc	mg/kg	2,321	23,209	--	--	--	532
<i>Organics</i>							
2,4,6-Trinitrotoluene	mg/kg	3.65	36.5	28.4	284	2,842	NA
2,4-Dinitrotoluene	mg/kg	12.8	128	1.1	11.0	110	NA
2-Amino-4,6-dinitrotoluene	mg/kg	1.54	15.4	--	--	--	NA
4-Amino-2,6-dinitrotoluene	mg/kg	1.54	15.4	--	--	--	NA
Benz( <i>a</i> )anthracene	mg/kg	--	--	0.65	6.5	65.0	NA
Benzo( <i>a</i> )pyrene	mg/kg	--	--	0.065	0.65	6.5	NA
Benzo( <i>b</i> )fluoranthene	mg/kg	--	--	0.65	6.5	65.0	NA
Benzo( <i>k</i> )fluoranthene	mg/kg	--	--	6.5	65.0	650	NA
Dibenz( <i>a,h</i> )anthracene	mg/kg	--	--	0.065	0.65	6.5	NA
Dieldrin	mg/kg	0.383	3.83	0.056	0.558	5.58	NA
HMX	mg/kg	359	3,594	--	--	--	NA
Indeno(1,2,3- <i>cd</i> )pyrene	mg/kg	--	--	0.65	6.5	65.0	NA
Nitroglycerin	mg/kg	--	--	52.5	525	5252	NA
PCB-1016	mg/kg	0.419	4.19	0.349	3.49	34.9	NA
PCB-1254	mg/kg	0.12	1.2	0.349	3.49	34.9	NA
PCB-1260	mg/kg	--	--	0.349	3.49	34.9	NA
RDX	mg/kg	22.7	227	8.03	80.3	803	NA
alpha-Chlordane	mg/kg	--	--	--	--	--	NA
gamma-Chlordane	mg/kg	--	--	--	--	--	NA

COPC = Chemical of potential concern.  
 CUG = Cleanup goal across all pathways (ingestion, dermal, and inhalation).  
 HI = Hazard index.  
 HMX = Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine.  
 NA = Not available.  
 PCB = Polychlorinated biphenyl.  
 RDX = Hexahydro-1,3,5-trinitro-1,3,5-triazine.  
 -- = No CUG could be quantified based on lack of approved toxicity value.

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**APPENDIX A**

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**WHITE PAPER**

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**White Paper  
Ravenna Army Ammunition Plant (RVAAP)  
Facility-Wide Human Health Cleanup Goal Development**

**Ravenna Army Ammunition Plant  
Ravenna, Ohio**

**May 2008**

**Contract No. W912QR-04-D-0019  
Delivery Order No. 008**

**Prepared for:**



**US Army Corps  
of Engineers®  
Louisville District**

**Prepared by:**



**Science Applications International Corporation  
151 Lafayette Drive  
Oak Ridge, Tennessee 37831**

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<b>1. REPORT DATE (DD-MM-YYYY)</b> 20-02-2008		<b>2. REPORT TYPE</b> Technical		<b>3. DATES COVERED (From - To)</b> October 2007 to February 2008	
<b>4. TITLE AND SUBTITLE</b> Draft White Paper Ravenna Army Ammunition Plant (RVAAP) Facility-Wide Human Health Cleanup Goal Development Ravenna Army Ammunition Plant Ravenna, Ohio				<b>5a. CONTRACT NUMBER</b> Contract No. W912QR-04-D-0019	
				<b>5b. GRANT NUMBER</b> NA	
				<b>5c. PROGRAM ELEMENT NUMBER</b> NA	
				<b>5d. PROJECT NUMBER</b> Delivery Order 008	
<b>6. AUTHOR(S)</b> Science Applications International Corporation, Inc.				<b>5e. TASK NUMBER</b> NA	
				<b>5f. WORK UNIT NUMBER</b> NA	
				<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> Science Applications International Corporation, Inc. 151 Lafayette Drive Oak Ridge, TN 37831	
<b>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> USACE - Louisville District U.S. Army Corps of Engineers, Louisville District 600 Martin Luther King, Jr. Place P.O. Box 59 Louisville, Kentucky 40202-0059				<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b> 08-016(E)	
				<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b> CELRL-ED-EE	
<b>12. DISTRIBUTION/AVAILABILITY STATEMENT</b> Reference Distribution Page.				<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b> NA	
				<b>13. SUPPLEMENTARY NOTES</b> None.	
<b>14. ABSTRACT</b> This draft concept paper (aka "white paper") describes the planned technical approach for developing facility-wide risk-based cleanup goals for environmental media and human receptors at the Ravenna Army Ammunition Plant.					
<b>15. SUBJECT TERMS</b> Remediation, human health risk, cleanup goals					
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b>	<b>18. NUMBER OF PAGES</b>	<b>19a. NAME OF RESPONSIBLE PERSON</b>
a. REPORT	b. ABSTRACT	c. THIS PAGE			<b>19b. TELEPHONE NUMBER (include area code)</b>

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BRACO – Base Realignment and Closure Technical Support Office.

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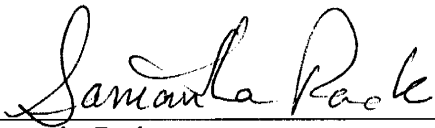
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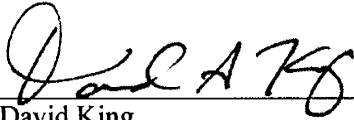
Science Applications International Corporation (SAIC) has completed the Draft White Paper for Facility-Wide Human Health Cleanup Goal Development at the Ravenna Army Ammunition Plant, Ravenna, Ohio. Notice is hereby given that an independent technical review has been conducted that is appropriate to the level of risk and complexity inherent in the project. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of data quality objectives; technical assumptions; methods, procedures, and materials to be used; the appropriateness of data used and level of data obtained; and reasonableness of the results, including whether the product meets the customer's needs consistent with law and existing Corps policy.



Samantha Pack  
Study/Design Team Leader

May 20, 2008

Date



David King  
Independent Technical Review Team Leader

May 20, 2008

Date

Significant concerns and the explanation of the resolution are as follows:

Internal SAIC Independent Technical Review comments are recorded on a Document Review Record per SAIC quality assurance procedure QAAP 3.1. This Document Review Record is maintained in the project file. Changes to the report addressing the comments have been verified by the Study/Design Team Leader. As noted above, all concerns resulting from independent technical review of the project have been considered.



Principal w/ A-E firm

May 20, 2008

Date

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**DRAFT  
WHITE PAPER  
RVAAP FACILITY-WIDE HUMAN HEALTH CLEANUP GOAL  
DEVELOPMENT**

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**May 2008**

6

**1.0 FORWARD**

7 The *Ravenna Army Ammunition Plant Facility-Wide Human Health Risk Assessor Manual, Amendment 1*  
8 (USACE 2005), herein referred to as the Risk Manual, requires that prior to commencing any risk  
9 assessment activities at the Ravenna Army Ammunition Plant (RVAAP), a White Paper be developed to  
10 ensure regulatory agreement with the processes proposed. This White Paper has been developed to  
11 comply with this requirement as the U. S. Army Corps of Engineers, Louisville District prepares to  
12 develop facility-wide risk-based cleanup goals.

13

**2.0 INTRODUCTION**

14 RVAAP utilizes an Installation Action Plan (IAP) to cover remedial investigations (RIs) and cleanup  
15 needed for closure of RVAAP. The purpose of the IAP is to outline the total multi-year restoration  
16 program for an Installation. The IAP defines Installation Restoration Program (IRP) requirements and  
17 proposes a comprehensive approach to investigation and cleanup of each area of concern (AOC) at the  
18 Installation. This effort to develop facility-wide cleanup goals is part of the path forward for identifying  
19 cleanup requirements for remaining AOCs. These goals will not be used to re-evaluate past decisions.

20 The purpose of this White Paper includes the following:

- 21
- 22 • Clarify technical issues related to developing facility-wide human health cleanup goals for RVAAP.  
23 Most of the technical requirements for performing this work have been clearly defined in the  
24 RVAAP Risk Manual. However, a few issues specific to developing cleanup goals must be agreed to  
prior to calculating these goals.
  - 25 • Define the exposure pathways and parameters pertinent to two newly identified future land uses: the  
26 Engineering School use and the Small Arms Range use.

27 Following RVAAP stakeholder input, this White Paper will be incorporated in its final form into a  
28 subsequent report that presents the final assumptions, methods, and calculated facility-wide cleanup  
29 goals.

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### 1 3.0 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN FOR CLEANUP GOAL 2 DEVELOPMENT

3 The first step in developing facility-wide cleanup goals is to define the universe of chemicals at RVAAP  
4 that may be encountered and may require a numeric cleanup goal. Two possible methods for identifying  
5 the universe of contaminants at the Installation were evaluated:

- 6 1. Consolidate the lists of chemicals of potential concern (COPCs) from completed RI reports.
- 7 2. Perform a new COPC screen against all chemicals in the Ravenna Environmental Information  
8 Management System.

9 Option 2 was selected as the best option for identifying a facility-wide list of COPCs because risk  
10 assessment requirements for RVAAP and risk model information (e.g., toxicity factors, chemical-specific  
11 factors, etc.) may have changed since the earliest RIs and a new COPC screen can accommodate any  
12 guidance updates and information changes.

13 The facility-wide COPC screen will follow the general guidance of the RVAAP Risk Manual  
14 (Sections 3.4 and 3.5) with few exceptions:

- 15 1. Because the facility-wide data set is likely to be large, chemicals meeting the <5% detection rule will  
16 not be screened out per Section 3.4.1 of the Risk Manual (5% of the large data set could represent a  
17 valid contamination issue).
- 18 2. A background screen will be used to eliminate chemicals from the facility-wide COPC list. The  
19 calculated cleanup goals and background values will be presented for naturally occurring chemicals.
- 20 3. Chemicals will be screened against the U. S. Environmental Protection Agency (EPA) Region 9  
21 preliminary remediation goals (PRGs). Any chemical for which the maximum detected value  
22 exceeds the PRG will be retained as a facility-wide COPC unless there is evidence that a single  
23 detection is a true anomaly. An explanation of the chemical anomaly will be presented for review.
- 24 4. Consistent with the Risk Manual, chemicals identified as essential nutrients will be screened out.  
25 Chemicals that are considered essential nutrients (e.g., calcium, chloride, iodine, iron, magnesium,  
26 potassium, phosphorous, and sodium) are an integral part of the human food supply and are often  
27 added to foods as supplements. EPA recommends that these chemicals not be evaluated as COPCs as  
28 long as they are: (1) present at low concentrations (i.e., only slightly elevated above naturally  
29 occurring levels), and (2) toxic at very high doses (i.e., much higher than those that could be  
30 associated with contact at an AOC).

### 31 4.0 EXPOSURE ASSESSMENT CONSIDERATIONS IN CLEANUP GOAL DEVELOPMENT

32 When the RVAAP IRP began in 1989, RVAAP was identified as a 21,419-acre installation. The property  
33 boundary was resurveyed by the Ohio Army National Guard (OHARNG) over a 2-year period (2002 and  
34 2003) and the actual total acreage of the property was found to be 21,683.289 acres. As of February 2006,  
35 a total of 20,403 acres of the former 21,683-acre RVAAP have been transferred to the National Guard  
36 Bureau (NGB) and subsequently licensed to OHARNG for use as a military training site [Ravenna  
37 Training and Logistics Site (RTLS)]. When RVAAP was operational, RTLS did not exist and the entire  
38 21,683-acre parcel was a government-owned, contractor-operated industrial facility. The RVAAP IRP  
39 encompasses investigation and cleanup of contamination from past activities over the entire 21,683 acres

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1 of the former RVAAP. The current RVAAP consists of 1,280 acres in various parcels (including AOCs)  
2 throughout the OHARNG RTLS. At present, workers infrequently visit the RVAAP AOCs for  
3 maintenance purposes, such as mowing; to conduct environmental investigations; and to perform  
4 remediation activities. As cleanup of AOCs is completed, they will also be transferred to NGB.

5 Under these current and future planned land use scenarios, the Risk Manual identified human receptors  
6 and exposure pathways that must be evaluated in RVAAP risk assessments. The identified receptors  
7 include:

- 8 • Security and Maintenance Personnel,
- 9 • National Guard – Fire/Dust Suppression Worker,
- 10 • National Guard Trainee,
- 11 • Resident Farmer,
- 12 • Trespasser Adult/Juvenile, and
- 13 • Recreators – Hunter/Trapper/Fisher.

14 A full set of exposure pathways and exposure factors has been developed for each of these receptors, as  
15 documented in the Risk Manual. These assumptions will be carried into the development of the cleanup  
16 goals.

17 As planning for OHARNG training activities has progressed, two specific training activities have been  
18 identified that may not be adequately covered under the above receptor assumptions. These activities  
19 include:

- 20 • National Guard Engineering School, and
- 21 • National Guard Small Arms Range.

### 22 **4.1 LAND USE AND POTENTIAL RECEPTORS**

23 The objective of this section is to define the exposure assessment considerations (i.e., magnitude,  
24 frequency, and duration of potential human exposure to COPCs) for the two new training activities,  
25 keeping in mind that the current receptor scenarios may be adequate for one or both of the these two new  
26 land uses. The three primary steps in defining the considerations are listed below.

- 27 1. Identify the exposure setting for the proposed Engineering School and Small Arms Range and the  
28 human receptors associated with these land uses.
- 29 2. Identify exposure pathways associated with the land uses.
- 30 3. Quantify the receptor's potential intake of each COPC.

#### 31 **4.1.1 Engineering School**

32 To obtain information needed to quantify potential exposures for Engineering School land use, members  
33 of OHARNG were interviewed, and the detailed "Program of Instruction" (TRADOC 2007, Course 052-  
34 21E10(R), "Heavy Construction Equipment Operators Course," Engineering School) that defines the  
35 detailed processes for each training activities was reviewed. The purpose of the Engineering School is to  
36 train personnel in construction engineering, carpentry, and combat engineering. Activities resulting in a  
37 "reasonable maximum exposure" include dirt excavation during which trainees would move dirt down to  
38 36 to 42 in. deep for 10 to 12 hr/day (minus breaks) and would be trained on using heavy excavation

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1 equipment. The training sessions would typically last 2 weeks (10 to 14 days in the field, with 14 days  
2 representing a conservative maximum time in the field). For example, the Program of Instruction for the  
3 “Heavy Construction Equipment Operators Course” requires three, 40-hr training sessions (120 hr) on a  
4 Scoop Loader, a Small Emplacement Excavator, and a Hydraulic Excavator. These sessions are broken up  
5 into four primary parts: classroom, demonstration, hands-on, and testing, with 60 to 80% of the time in  
6 hands-on training [POI 052-21E10(R)]. Trainees could have follow-up training if they fail to meet course  
7 requirements for graduation, with a maximum three attempts to pass the course of instruction. Discussion  
8 with OHARNG on a reasonable number of years that a single trainee may serve in this type of training  
9 resulted in an estimate of three, 14-day training sessions.

10 The receptor of primary concern under this land use scenario is the training instructor. The instructor is  
11 assumed to be in the field at all times when excavation activities are taking place. Current plans include  
12 10, 2-week classes per year, resulting in a maximum number of days in the field of 140 days/year.  
13 Discussion with OHARNG on a reasonable number of years that a soldier would be qualified and  
14 participate as a trainer resulted in an estimate of 12 to 13 years maximum, assuming that the soldier  
15 would be qualified to serve as a trainer for one-half of the 25-year service.

16 Therefore, a National Guard Engineering School Instructor is considered to be the relevant receptor for  
17 this land use:

- 18 • This receptor is responsible for overseeing all excavation training activities in the field.
- 19 • The soldier performs these duties using a combination of walking through the field or driving in an  
20 all-terrain-vehicle-style vehicle to provide continuous instruction and driving the heavy equipment  
21 excavators to demonstrate their use. This soldier may also be responsible for returning the dirt  
22 moved during exercises to its original location.
- 23 • At a minimum, the soldier wears a short-sleeved shirt, long pants, and boots.
- 24 • The receptor is present at the Engineering School field site for a total of 180 days/year:  
25 140 days/year for 10, 2-week training sessions; 20 days of site refurbishing and maintenance work  
26 (1 day prior to and after each session); plus 20 additional days representing 2 work weeks of  
27 mobilization and demobilization activities prior to and after the annual training season.
- 28 • During training, it is assumed that the instructor is in the field 10 hr/day. During maintenance and  
29 mobilization work, it is assumed the instructor is in the field 8 hr/day. The total hours over the  
30 180-day period totals 1,730, or an average of 9.5 hr/day.
- 31 • This scenario assumes the same soldier performs these duties for half of his 25-year enlistment  
32 (12 years).
- 33 • For the dust inhalation exposure, the Engineering School Instructor is assumed to have an inhalation  
34 rate of 19.8 m<sup>3</sup>/day. This assumes the receptor spends 49% of their day in light activities, 5% of their  
35 day in moderate activities, 3% of their day in heavy activities, and 43% of their day at rest. The  
36 inhalation rate is a weighted average that accounts for the 49% of the day spent doing light activities  
37 at an inhalation rate of 1.0 m<sup>3</sup>/hr, 5% of the day spent doing moderate activities in the field at an  
38 inhalation rate of 1.6 m<sup>3</sup>/hr, 3% of the time doing heavy excavation activities at an inhalation rate of  
39 3.2 m<sup>3</sup>/hr, and 43% of the day at rest at an inhalation rate of 0.4 m<sup>3</sup>/hr. This results in an estimated  
40 point value of 0.83 m<sup>3</sup>/hr, which converts to a daily inhalation rate of 0.83 m<sup>3</sup>/hr × 24 hr/day =  
41 19.8 m<sup>3</sup>/day (see Figure 1). This breathing rate is a conservative daily inhalation rate compared to a  
42 recommendation rate of 15.2 m<sup>3</sup>/day for normal activities (EPA 1997).

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- 1 • To ensure that the various exposure factors do not multiply into an overly conservative scenario, the  
 2 fact that, for a portion of the year, there is no dust loading due to precipitation is accounted for. In an  
 3 interview with OHARNG staff, they indicated that during much of the training time there is mud  
 4 present. It is recommended that the particulate emission factor be modified to account for the fact  
 5 that, 32% of the time, there is precipitation >1 mm, the soil is wet, and there is no dust loading  
 6 (National Oceanic and Atmospheric Administration lists the mean precipitation days with  
 7 precipitation >1 mm for the Cleveland area as 115 days/year). The exposure days have been adjusted  
 8 by 68% (0.68) to indicate that only 250 days/year are dry enough for fugitive dusts.
- 9 • This scenario will be protective of the Engineering School trainees and part-time instructors who  
 10 will be present for a much shorter time periods.

<b>Engineering School Instructor</b>						
	<b>Hours Off Duty</b>	<b>Hours On Duty</b>	<b>Total</b>	<b>% of Day in Activity</b>	<b>Breathing Rate</b>	<b>Breathing Volume</b>
Rest	8	2.4	10.4	0.43	0.4	0.17
Light	4	7.8	11.8	0.49	1	0.49
Moderate		1.2	1.2	0.05	1.6	0.08
Heavy		0.6	0.6	0.03	3.2	0.08
<b>Total</b>	<b>12</b>	<b>12</b>	<b>24</b>	<b>1.00</b>		<b>0.83 m<sup>3</sup>/h</b>
						<b>19.8 m<sup>3</sup>/day</b>
<b>Range Maintenance Soldier</b>						
	<b>Hours in Office/Home</b>	<b>Hours in Field</b>	<b>Total</b>	<b>% of Day in Activity</b>	<b>Breathing Rate</b>	<b>Breathing Volume</b>
Rest	8	1.2	9.2	0.38	0.4	0.15
Light	10	3.9	13.9	0.58	1	0.58
Moderate		0.6	0.6	0.03	1.6	0.04
Heavy		0.3	0.3	0.01	3.2	0.04
<b>Total</b>	<b>18</b>	<b>6</b>	<b>24</b>	<b>1.00</b>		<b>0.81 m<sup>3</sup>/h</b>
						<b>19.5 m<sup>3</sup>/day</b>

11 **Figure 1. Process for Developing Inhalation Rates for the Engineering School Instructor**  
 12 **and the Range Maintenance Soldier**  
 13

### 14 4.1.2 Small Arms Range

15 Plans for the development of small arms ranges at the Ravenna Training and Logistics Site (RTLIS) are  
 16 currently underway. These ranges will utilize practice rounds, which will be 40 mm or less. There are no  
 17 plans to utilize high-explosive rounds.

18 A Mark 19 range land use scenario was developed and evaluated in the *Winklepeck Burning Ground*  
 19 *Focused Feasibility Study* (USACE 2004). The Mark 19 is a belt-fed, automatic, 40-mm grenade launcher  
 20 or grenade machine gun. In the process of developing the receptor exposure scenario for this land use, it  
 21 was determined that the relevant receptor was a National Guard Range Maintenance Soldier, or the  
 22 maintenance personnel responsible for maintaining the range throughout the training year. The Range  
 23 Maintenance Soldier activities would include target maintenance, range maintenance, and controlled  
 24 burns to clear the range impact area of woody growth and burn-off grasses.

25 Several additional receptors were considered including a National Guard Trainee and the Range  
 26 Construction receptor; however, the exposure duration and frequency associated with these potential  
 27 receptors was a small fraction of the time that the Range Maintenance Soldier would be exposed.

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1 For the facility-wide cleanup goal development, the National Guard Range Maintenance Soldier with a  
2 revised inhalation value (see below) is adopted:

- 3 • This receptor is assumed to be responsible for both routine maintenance of the range and targets and  
4 annual clearance of practice rounds.
- 5 • The soldier performs these duties using a combination of walking over the range, driving over the  
6 range in an all-terrain-vehicle-style vehicle, and driving on access roads in a closed vehicle, such as  
7 a pickup truck.
- 8 • At a minimum, the soldier wears a short-sleeved shirt, long pants, and boots.
- 9 • The receptor is assumed to be present at the range 85 days/year, for 6 hr/day (i.e., 42 weekends per  
10 year, 4 hr before use and 8 hr after use, plus 1 day for annual clearance). This equates to 12 hr over  
11 2 days (4 hr 1 day before use, plus 8 hr 1 day after use = 12 hr) or an average of 6 hr/day. The Range  
12 Maintenance Soldier spends the rest of the workday performing other duties at the RTLS. This  
13 scenario assumes the same soldier (or soldiers) performs these duties all year for a 25-year  
14 enlistment.
- 15 • For the small arms range, it is assumed that the receptor spends 58% of their time in light activities,  
16 3% of their time in moderate activities, 1% of their time in heavy activities, and 38% of their time at  
17 rest. This results in an estimated point value of 0.81 m<sup>3</sup>/hr and converts to a daily inhalation rate of  
18 19.5 m<sup>3</sup>/day (see Figure 1). This is a conservative daily inhalation rate compared to a  
19 recommendation rate of 15.2 m<sup>3</sup>/day for normal activities (EPA 1997).
- 20 • This scenario will be protective of users of the range who are present for a much shorter time.

### 21 4.2 IDENTIFY EXPOSURE PATHWAYS

22 The exposure pathways associated with the Engineering School Instructor and the National Guard Range  
23 Maintenance Soldier are shown in Table 1.

24 **Table 1. Conceptual Exposure Model for the Revised National Guard Range Maintenance Soldier at**  
25 **Winklepeck Burning Grounds**

Pathway	Engineering School Instructor	National Guard Range Maintenance Soldier
<i>Surface Soils Only (0 to 4 ft BGS)</i>		
Incidental soil ingestion	-	X
Dermal contact with soil	-	X
Inhalation of VOCs and dust	-	X
<i>Surface and Deep Soils (0 to 13 ft BGS)</i>		
Incidental soil ingestion	X	-
Dermal contact with soil	X	-
Inhalation of VOCs and dust	X	-

- 26 BGS = Below ground surface.  
27 VOC = Volatile organic compound.  
28 - = Pathway is not evaluated for cleanup goal development.  
29 X = Pathway is evaluated for cleanup goal development.



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### 1 4.3 QUANTIFY EXPOSURE PARAMETERS

2 Exposure parameters used to calculate intake for the Engineering School Instructor and the National  
3 Guard Range Maintenance Soldier are listed in Tables 2 and 3, respectively.

### 4 5.0 DEVELOP CLEANUP GOALS

5 Cleanup goals will be developed for each of the land use/receptor scenarios identified in the Risk Manual  
6 and for the Engineering School and Small Arms Range uses. These will be “back-calculated” using the  
7 equations presented in the Risk Manual, starting with the following remedial action objectives:

8 • cleanup of carcinogenic contaminants will be consistent with achieving a target risk of  $1 \times 10^{-4}$ ,  
9  $1 \times 10^{-5}$ , and  $1 \times 10^{-6}$ , respectively; and

10 • cleanup of non-carcinogenic contaminants will be consistent with achieving a target hazard index of  
11 0.1 and 3, respectively.

12 Once facility-wide cleanup goals have been developed, they will be tabulated to show cleanup goals for  
13 all land-use/receptor scenarios along with naturally occurring background values.

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**Table 2. Exposure Parameters for the Engineering School Instructor**

Parameter	Units	Value	Source
<b><i>Incidental Ingestion</i></b>			
Soil ingestion rate	kg/day	0.0001	RAGS Part B (EPA 1991) <sup>a</sup>
Exposure time	hr/day	9.5	Activity/land use-specific per OHARNG <sup>b</sup>
Exposure frequency	days/year	180	Activity/land use-specific per OHARNG <sup>b</sup>
Exposure duration	years	25	Assumed enlistment period <sup>a</sup>
Body weight	kg	70	RAGS Part B (EPA 1991) <sup>a</sup>
Carcinogen averaging time	days	25,550	RAGS Part B (EPA 1991) <sup>a</sup>
Non-carcinogen averaging time	days	9,125	RAGS Part B (EPA 1991) <sup>a</sup>
Fraction ingested	unitless	1	Conservative assumption <sup>a</sup>
Conversion factor	days/hr	0.042	
<b><i>Dermal Contact</i></b>			
Skin area	m <sup>2</sup> /event	0.33	Head, hands, and forearms, <i>Exposure Factors Handbook</i> (EPA 1997) <sup>a</sup>
Adherence factor	mg/cm <sup>2</sup>	0.3	Value for construction worker (95 <sup>th</sup> percentile); values from RAGS Part E (EPA 2004) <sup>a</sup>
Absorption fraction	unitless	chemical-specific	Chemical-specific absorption fraction values from RAGS Part E (EPA 2004) or default values from the FWHHRAM (USACE 2005): SVOCs = 10%; VOCs = 1%; and inorganics = 0.1 <sup>a</sup>
Exposure frequency	events/year	180	Activity/land use-specific per OHARNG <sup>b</sup>
Exposure duration	years	25	Assumed enlistment period <sup>a</sup>
Body weight	kg	70	RAGS Part B (EPA 1991) <sup>a</sup>
Carcinogen averaging time	days	25,550	RAGS Part B (EPA 1991) <sup>a</sup>
Non-carcinogen averaging time	days	9,125	RAGS Part B (EPA 1991) <sup>a</sup>
Conversion factor	(kg-cm <sup>3</sup> )/ (mg-m <sup>2</sup> )	0.01	
<b><i>Inhalation of VOCs and Dust</i></b>			
Inhalation rate	m <sup>3</sup> /day	19.8	Activity/land use-specific <sup>c</sup>
Exposure time	hr/day	9.5	Activity-specific per OHARNG <sup>b</sup>
Exposure frequency	days/year	180	Activity-specific per OHARNG <sup>b</sup>
Precipitation modifying factor	unitless	.68	Per NOAA, 250 days precipitation <1 mm/365 total days
Exposure duration	years	25	Assumed enlistment period <sup>a</sup>
Body weight	kg	70	RAGS Part B (EPA 1991) <sup>a</sup>
Carcinogen averaging time	days	25,550	RAGS Part B (EPA 1991) <sup>a</sup>
Non-carcinogen averaging time	days	9,125	RAGS Part B (EPA 1991) <sup>a</sup>
Particulate emission factor	m <sup>3</sup> /kg	1.67E+06	Default value for Cleveland, Ohio, assuming a 0.5-acre source area <sup>d</sup>
Conversion factor	days/hr	0.042	

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<sup>a</sup> Value is the same as that cited in the FWHHRAM for the National Guard Trainee.  
<sup>b</sup> Per OHARNG staff interviews and the detailed training “Programs of Instruction.”  
<sup>c</sup> The receptor spends 49% of their day in light activities, 5% of their day in moderate activities, 3% of their day in heavy activities, and 43% at rest.  
<sup>d</sup> A smaller particulate emission factor (PEF) value ( $1.67 \times 10^6$ ) is used for the Engineering School because the activities of this receptor are assumed to generate more dust. This PEF value was calculated from a dust loading factor (DLF) of 600 μg/m<sup>3</sup> (DOE 1993) as:  $PEF = 1/(DLF \times Conversion\ Factor) = 1/(600\ \mu g/m^3 \times 1E-09\ kg/\mu g) = 1.67E+06\ m^3/kg$ .  
 FWHHRAM = RVAAP Facility-Wide Human Health Risk Assessor’s Manual (USACE 2005).  
 NOAA = National Oceanic and Atmospheric Administration.  
 OHARNG = Ohio Army National Guard.  
 RAGS = Risk Assessment Guidance for Superfund.  
 SVOC = Semivolatile organic compound.  
 VOC = Volatile organic compound.

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**Table 3. Exposure Parameters for the National Guard Range Maintenance Soldier**

Parameter	Units	Value	Source
<b>Incidental Ingestion</b>			
Soil ingestion rate	kg/day	0.0001	RAGS Part B (EPA 1991) <sup>a</sup>
Exposure time	hr/day	6	Site-specific per LTC Tadsen <sup>b</sup>
Exposure frequency	days/year	85	Site-specific per LTC Tadsen <sup>b</sup>
Exposure duration	years	25	Assumed enlistment period <sup>a</sup>
Body weight	kg	70	RAGS Part B (EPA 1991) <sup>a</sup>
Carcinogen averaging time	days	25,550	RAGS Part B (EPA 1991) <sup>a</sup>
Non-carcinogen averaging time	days	9,125	RAGS Part B (EPA 1991) <sup>a</sup>
Fraction ingested	unitless	1	Conservative assumption <sup>a</sup>
Conversion factor	days/hr	0.042	
<b>Dermal Contact</b>			
Skin area	m <sup>2</sup> /event	0.33	Head, hands, and forearms, <i>Exposure Factors Handbook</i> (EPA 1997) <sup>a</sup>
Adherence factor	mg/cm <sup>2</sup>	0.3	Value for construction worker (95 <sup>th</sup> percentile); values from RAGS Part E (EPA 2004) <sup>a</sup>
Absorption fraction	unitless	chemical-specific	Chemical-specific absorption fraction values from RAGS Part E (EPA 2004) or default values from the FWHHRAM (USACE 2005): SVOCs = 10%; VOCs = 1%; and inorganics = 0.1 <sup>a</sup>
Exposure frequency	events/year	85	Site-specific per LTC Tadsen <sup>b</sup>
Exposure duration	years	25	Assumed enlistment period <sup>a</sup>
Body weight	kg	70	RAGS Part B (EPA 1991) <sup>a</sup>
Carcinogen averaging time	days	25,550	RAGS Part B (EPA 1991) <sup>a</sup>
Non-carcinogen averaging time	days	9,125	RAGS Part B (EPA 1991) <sup>a</sup>
Conversion factor	(kg-cm <sup>2</sup> )/ (mg-m <sup>2</sup> )	0.01	
<b>Inhalation of VOCs and Dust</b>			
Inhalation rate	m <sup>3</sup> /day	19.5	Activity/land use-specific <sup>c</sup>
Exposure time	hr/day	6	Site-specific per LTC Tadsen <sup>b</sup>
Exposure frequency	days/year	85	Site-specific per LTC Tadsen <sup>b</sup>
Exposure duration	years	25	Assumed enlistment period <sup>a</sup>
Body weight	kg	70	RAGS Part B (EPA 1991) <sup>a</sup>
Carcinogen averaging time	days	25,550	RAGS Part B (EPA 1991) <sup>a</sup>
Non-carcinogen averaging time	days	9,125	RAGS Part B (EPA 1991) <sup>a</sup>
Particulate emission factor	m <sup>3</sup> /kg	9.24E+08	Default value for Cleveland, Ohio, assuming a 0.5-acre source area <sup>d</sup>
Conversion factor	days/hr	0.042	

2 <sup>a</sup> Value is the same as that cited in the FWHHRAM for the National Guard Trainee.  
3 <sup>b</sup> Personal communication, LTC Tom Tadsen, Ohio Army National Guard - Ravenna Training and Logistics Site.  
4 <sup>c</sup> The receptor spends 58% of their time in light activities, 3% of their time in moderate activities, 1% of their time in heavy  
5 activities, and 38% of their time at rest.  
6 <sup>d</sup> Value is the same as that cited in FWHHRAM for all receptors except the National Guard Trainee. The lower National Guard  
7 Trainee value is not used because the Range Maintenance Soldier will not be generating large quantities of dust (i.e., there will be  
8 no tanks).  
9 FWHHRAM = RVAAP's *Facility-Wide Human Health Risk Assessor's Manual* (USACE 2005).  
10 RAGS = Risk Assessment Guidance for Superfund.  
11 SVOC = Semivolatile organic compound.  
12 VOC = Volatile organic compound.

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