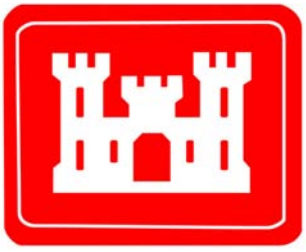
REVISED FINAL

TECHNICAL MEMORANDUM
HUMAN HEALTH AND ECOLOGICAL RISK ASSESSMENT APPROACH

FOR THE

LOAD LINE 1 AND LOAD LINE 12
PHASE II REMEDIAL INVESTIGATIONS,
RAVENNA ARMY AMMUNITION PLANT,
RAVENNA, OHIO

PREPARED FOR



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SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

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Prepared by

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION
800 Oak Ridge Turnpike, P.O. Box 2502
Oak Ridge, Tennessee 37831

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TABLES

ACRONYMS

ADD	average daily dose
AOC	area of concern
BAF	bioaccumulation factors
COC	chemical of concern
COEC	chemical of ecological concern
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
CSF	cancer slope factor
EDQL	Ecological Data Quality Levels
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
GAF	gastrointestinal absorption factor
HHBRA	human health baseline risk assessment
HI	Hazard Index
HQ	hazard quotient
ILCR	incremental lifetime cancer risk
LL1	Load Line 1
LL12	Load Line 12
LOAEL	lowest observed adverse effect level
NOAEL	no observed adverse effect level
OHARNG	Ohio Army National Guard
Ohio EPA	Ohio Environmental Protection Agency
PRG	preliminary remediation goal
RAGS	Risk Assessment Guidance for Superfund
RfD	reference dose
RI	Remedial Investigation
RME	reasonable maximum exposure
RVAAP	Ravenna Army Ammunition Plant
SRC	site-related chemical
SVOC	semivolatile organic compound
T&E	threatened and endangered
TRV	toxicity reference value
USACE	U.S. Army Corps of Engineers
UCL	upper confidence limit
VOC	volatile organic compound
WBG	Winklepeck Burning Grounds

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1.0 INTRODUCTION

This technical memorandum briefly documents the methods and assumptions that will be used in conducting the Phase II Remedial Investigation (RI) Human Health Risk Baseline Risk Assessment (HHBRA) and Screening Ecological Risk Assessment (ERA) for the Load Line 1 (LL1) and Load Line 12 (LL12) areas at the Ravenna Army Ammunition Plant (RVAAP). The risk assessment approach follows U.S. Environmental Protection Agency (EPA) guidance (1989a, 1992a, 1997) for conducting the human health and ecological risk assessments as described in the *Sampling and Analysis Plan Addendum No. 2 for the Phase II Remedial Investigation of Load Line 1 at the Ravenna Army Ammunition Plant, Ravenna Ohio* (USACE 2000a) and *Sampling and Analysis Plan Addendum No. 1 for the Phase II Remedial Investigation of Load Line 12 at the Ravenna Army Ammunition Plant, Ravenna, Ohio* (USACE 2000b).

A draft version of this technical memorandum was issued in January 2001, and was reviewed and commented on by the Ohio Environmental Protection Agency (Ohio EPA) and the Louisville District of the U.S. Army Corps of Engineers (USACE). A final revision was issued in March 2001, which incorporated responses to reviewer comments on the draft version. The Ohio EPA reviewed the final revision and provided additional comments in June 2002. This August 2002 revised final document includes responses to comments received on the final technical memorandum in order to maintain a record of consensus reached during the course of discussions on the risk assessment approaches to be employed for LL1 and LL12. Changes to the risk assessment protocols necessitated by the resolution of comments to the final technical memorandum will be addressed through changes to the LL1 and LL12 Phase II RI reports; the content of this August 2002 revised final technical memorandum remains the same as the March 2001 final revision. Additionally, where resolution of comments dictates programmatic changes to risk assessment protocols at RVAAP, they will be addressed in context of the Facility-Wide Risk Assessment Work Plan, which is currently in preparation by the USACE.

Section 2 of this technical memorandum presents the critical steps in the HHBRA and Section 3 addresses the ERA. Separate sections are appended that tabulate comment response and resolution documentation for both the January 2001 draft version (Appendix A) and March 2001 final version (Appendix B) of the report.

2.0 HUMAN HEALTH RISK ASSESSMENT

The HHBRA consists of four steps:

- Data Evaluation – Section 2.1
- Exposure Assessment – Section 2.2
- Toxicity Assessment – Section 2.3
- Risk Characterization – Section 2.4

2.1 DATA EVALUATION

The purpose of the data evaluation is to develop a set of chemical data suitable for use in the HHBRA. Data are evaluated to establish a list of site-related chemicals of potential concern (COPCs) using screening criteria.

Selection of COPCs begins with the identification of site-related chemicals (SRCs). These SRCs are selected based on: (1) a frequency-of-detection/weight-of-evidence screen, (2) comparison to facility-wide background criteria, and (3) screening of essential nutrients as described below.

2.1.1 Frequency-of-Detection

Chemicals that are never detected will be eliminated as SRCs. For sample aggregations with greater than 20 samples and a frequency-of-detection of less than 5 percent, a weight-of-evidence approach will be used to determine if the chemical is site-related. The magnitudes and locations (e.g., clustering) of the detections and the potential source of the chemical will be evaluated. If the detected results show no clustering, the chemical is not an SRC in any other medium, the concentrations are not substantially elevated relative to the detection limit, and if the chemical was not used in the area under investigation, then the chemical will be eliminated from further consideration. Note that the LL1 and LL12 Sampling and Analysis Plan Addenda (USACE 2000a and 2000b) erroneously stated that the frequency-of-detection/weight-of-evidence screen will only be applied to inorganic chemicals. This screen will be applied to all organic and inorganic chemicals with the exception of explosives and propellants. All detected explosives and propellants will be included in the list of SRCs regardless of their frequency of detection.

2.1.2 Background Screen

If the maximum concentration of a constituent passing the frequency-of-detection screen exceeds the background value using the screening process outlined in USACE 2000a and 2000b, the constituent is considered a SRC.

2.1.3 Essential Nutrients

Eight chemicals are considered essential nutrients (calcium, chloride, iodine, iron, magnesium, potassium, phosphorus, and sodium) and will not be evaluated as COPCs so long as they are (1) present at low concentrations (i.e., only slightly elevated above naturally occurring levels), and (2) toxic only at very high doses (i.e., much higher than those that could be associated with contact at the site).

2.1.4 Risk-Based Screen

Following the identification of SRCs, constituents are subjected to a risk-based screen to select COPCs. If the maximum concentration of a constituent exceeds the EPA Region 9 preliminary remediation goal (PRG) for a cancer risk of 10^{-7} or a hazard quotient of 0.1, it will be considered a COPC.

2.2 EXPOSURE ASSESSMENT

The exposure assessment includes three steps:

- identify potential exposure media, potentially exposed populations, and exposure pathways;
- calculate exposure point concentrations; and
- estimate intake.

2.2.1 Potential Exposure Media, Exposed Populations, and Exposure Pathways

Potentially contaminated exposure media at LL1 and LL12 are surface soil (0-1 feet bgs), subsurface soil (1-5 feet bgs), and groundwater, surface water, and sediment (0-0.5 feet bgs).

Eight potentially exposed populations are included in the calculations of cancer risks and hazard quotients (HQs) at LL1 and LL12: maintenance workers/security guards, military personnel [specifically Ohio Army National Guard (OHARNG) training personnel], hunters/trappers, trespassers, industrial workers, recreational users, adult resident farmers, and child resident farmers. These populations fall into five land use categories:

- Modified Caretaker/Managed Recreational – includes the maintenance worker/security guard, hunter/trapper, and trespasser.
- National Guard/Managed Recreational – includes military personnel (specifically OHARNG training personnel), hunters/trappers, and trespassers.
- Open Recreational – includes recreational users.
- Open Industrial – includes industrial workers.
- Open Residential – includes the adult and child resident farmers.

The most likely pathways that will be quantified for exposures to contaminants at LL1 and LL12 are soil ingestion, dermal contact with soil, and inhalation of soil particles. Potable water is currently obtained from municipal supplies; however, ingestion, dermal contact, and inhalation of VOCs (if present) from groundwater will be evaluated for the National Guard and resident scenarios. For the future resident farmer, ingestion of foodstuff (e.g., beef, dairy products) will also be addressed. Additional pathways may be quantified as needed, depending on the COPCs identified (e.g., inhalation of volatiles). Potential exposure pathways for each of the media and receptor populations are summarized in Table 1.

2.2.2 Exposure Point Concentrations

The LL1 and LL12 HHBRAs will evaluate the reasonable maximum exposure (RME). The RME is an estimate of the highest exposure reasonably expected to occur at the site. Because of the uncertainty associated with any estimate of exposure concentration, the upper confidence limit (UCL_{95}) for either a normal or lognormal distribution is the recommended statistic for evaluating the RME. In cases where the UCL_{95} exceeds the maximum detected concentration, the maximum concentration will be used as an estimate of the RME.

The sampling data will be grouped into exposure units based on historical usage patterns at the site (e.g., areas that are believed to be uncontaminated because no chemicals were handled there will be evaluated separately from areas where contamination is likely because of past activities).

At LL1, surface and subsurface soil data will be grouped into seven exposure units [former Buildings CB-3 and CB-801; CB-4/4A and CA-6/6A; CB-13 and CB-10; CB-14, CB-17, and CA-15; Water Tower; Change Houses (CB-12, -23, -8, -22); and the perimeter area]. Surface water and sediment data will be aggregated by conveyance with five conveyances identified at the site. One AOC-wide exposure unit will be evaluated for groundwater.

At LL12, surface and subsurface soil data will be grouped into two exposure units (east and west of the primary drainage divide). One surface water/sediment exposure unit will be evaluated (AOC-wide). Also, one AOC-wide exposure unit will be evaluated for groundwater.

Table 1. Conceptual Exposure Model for LL1 and LL12, RVAAP

Pathway	Modified Caretaker – Managed Recreational			National Guard – Managed Recreational			Open Recreational	Open Industrial	Open Residential[a]	
	Security Guard (1)	Hunter/ Trapper (2)	Trespasser (3)	National Guard Trainee (4)	Hunter/ Trapper (2)	Trespasser (3)	Recreator (5)	Industrial Worker (6)	Resident Farmer – Adult (7)	Resident Farmer – Child (8)
Surface Soil										
Incidental soil ingestion	●	●	●	●	●	●	●	●	●	●
Dermal contact with soil	●	●	●	●	●	●	●	●	●	
Inhalation of VOCs and dust	●	●	●	●	●	●	●	●	●	
Subsurface Soil										
Incidental sediment ingestion				●				●	●	●
Dermal contact with sediment				●				●	●	
Inhalation of VOCs and dust				●				●	●	
Sediment										
Incidental soil ingestion		●	●	●	●	●	●		●	●
Dermal contact with soil		●	●	●	●	●	●		●	
Inhalation of VOCs and dust		●	●	●	●	●	●		●	
Surface Water										
Incidental ingestion while swimming		●	●	●	●	●	●		●	
Dermal contact while swimming		●	●	●	●	●	●		●	
Inhalation of VOCs		●	●	●	●	●	●		●	
Groundwater										
Ingestion				●					●	
Dermal contact				●					●	
Inhalation of VOCs				●					●	
Foodstuff										
Ingestion of venison, game		●			●				●	
Ingestion of beef, pork									●	
Ingestion of milk products									●	●
Ingestion of vegetables									●	
Ingestion of fish		●			●				●	

[a]A conservative approach is taken to evaluate the open residential land use. In most cases, since the adult farmer produces larger risks and hazards than the child farmer, the adult is predominantly evaluated. In scenarios where the child receptor results in greater exposures than the adult receptor, the child is also evaluated. Consequently, the noncarcinogenic effects for a child and adult are evaluated for soil/sediment ingestion, as well as for the ingestion of milk products (the child ingestion rates are higher than the adult ingestion rates for these exposures). The carcinogenic effects for these exposures are evaluated using a weighted average of the child and adult parameter values (which results in a larger exposure than evaluating only the adult).

Exposure concentrations for direct contact with environmental media (soils, sediment, groundwater, surface water) are based on the sampling results of the media. Exposure concentrations for contaminants that have migrated into secondary media (beef, milk, venison, fish, and vegetables) will be modeled from the equations presented in Appendix C of the Sampling Plan Addenda for LL1 and LL12, using the RME or maximum concentration of COPCs in the starting media (e.g., soil).

2.2.3 Exposure Parameters and Calculations for Estimating Intakes

As stated in the LL1 and LL12 Sampling Plan Addenda (USACE 2000a and 2000b), standard intake equations from EPA guidance (EPA 1989a) for ingestion, dermal contact, and inhalation of chemicals in soil, surface water, sediment, groundwater, and foodstuff will be used along with the exposure parameters shown in Tables 2 and 3.

2.3 TOXICITY ASSESSMENT

The toxicity assessment will be performed using standard USEPA-derived toxicity factors taken from the *Integrated Risk Information System* and, secondarily, from the *Health Effects Assessment Summary Tables*. Oral and inhalation cancer slope factors (CSF) and reference doses (RfDs) are currently available. Dermal CSFs and RfDs will be estimated from the oral toxicity values using chemical-specific gastrointestinal absorption factors (GAFs) to calculate the total absorbed dose. Chemical-specific GAF values available from EPA Region V (USACE 2000c) will be used (rounded to one significant figure) whenever possible. Not all COPCs have specific GAF values. When quantitative data are insufficient, a default GAF is used. A default value of 1.0 for organic chemicals will be used (USACE 2000c).

2.4 RISK CHARACTERIZATION

Risks will be calculated from toxicity information and from the results of the exposure assessment. For carcinogens, incremental lifetime cancer risks (ILCRs), or the increased lifetime probability of cancer, will be estimated. In addition to estimated cancer risks, potential non-cancer toxic effects of COPCs will be evaluated by calculating a HQ for each COPC and a total Hazard Index (HI) for all COPCs combined. Chemicals of concern (COCs) will be identified as those COPCs that exceed acceptable risk criteria for each receptor and pathway. The COCs will be specific to media and receptor. These chemicals represent the main contributors to human health risks at the site that will need to be addressed during remedial action.

3.0 SCREENING ECOLOGICAL RISK ASSESSMENT

The screening ERA consists of five parts:

- Problem Formulation – Section 3.1
- Exposure Assessment – Section 3.2
- Effects Assessment – Section 3.3
- Risk Characterization – Section 3.4
- Uncertainty Analysis – Section 3.5

Each is discussed in the following sections.

Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at LL1 and LL12, RVAAP

Parameter	Units	Security Guard/ Maintenance Worker (1)	Hunter/ Trapper (2)	Child Trespasser (3)	National Guard Trainee (4)	Open Recreator (5)	Open Industrial Worker (6)	Resident Farmer (child/adult) (7)
Pathway								
Surface Soil								
Incidental ingestion								
Soil ingestion rate (Adult)	kg/day	0.0001[a]	0.0001[a]	NA	0.0001[a]	0.0001[a]	0.0001[a]	0.0001[a]
Soil ingestion rate (Child)	kg/day	NA	NA	0.0002[a]	NA	NA	NA	0.0002[a]
Exposure time	hours/day	1[b]	2[b]	2[q]	8[b]	1[b]	NA	NA
Exposure frequency	days/year	250[a]	90[b]	50[q]	180[b]	75[b]	250[a]	350[a]
Exposure duration (Adult)	years	25[a]	30[b]	NA	25[b]	30[a]	25[a]	24[a]
Exposure duration (Child)	years	NA	NA	10[q]	NA	NA	NA	6[a]
Body weight (Adult)	kg	70[a]	70[a]	NA	70[a]	70[a]	70[a]	70[a]
Body weight (Child)	kg	NA	NA	45[r]	NA	NA	NA	15[a]
Carcinogen averaging time	days	25550[a]	25550[a]	25550[a]	25550[a]	25550[a]	25550[a]	25550[a]
Noncarcinogen averaging time (Adult)	days	9125[a]	10950[a]	NA	9125[a]	10950[a]	9125[a]	8760[a]
Noncarcinogen averaging time (Child)	days	NA	NA	3650[a]	NA	NA	NA	2190[a]
Fraction ingested	unitless	1[b]	1[b]	1[b]	1[b]	1[b]	1[b]	1[b]
Conversion factor	days/hour	0.042	0.042	0.042	0.042	0.042	NA	NA
Dermal contact								
Skin area	m^2/event	0.33[d]	0.57[d]	0.815[e]	0.33[d]	0.57[d]	0.33[d]	0.57[d]
Adherence factor	mg/cm^2	0.7[c]	0.07[c]	0.2[c]	0.3[c]	0.07[c]	0.2[c]	0.4[c]
Absorption fraction	unitless	chemical-specific (Default values: VOCs = 1%, SVOCs = 10%, inorganics = 0.1%)[r]						
Exposure frequency	events/year	250[a]	90[b]	50[p]	180[b]	75[c]	250[a]	350[a]
Exposure duration	years	25[a]	30[b]	10[p]	25[b]	30[a]	25[a]	30[a]
Body weight	kg	70[a]	70[a]	45[q]	70[a]	70[a]	70[a]	70[a]
Carcinogen averaging time	days	25550[a]	25550[a]	25550[a]	25550[a]	25550[a]	25550[a]	25550[a]
Noncarcinogen averaging time	days	9125[a]	10950[a]	3650[a]	9125[a]	10950[a]	9125[a]	10950[a]
Conversion factor	$(kg\text{-}cm^2)/(mg\text{-}m^2)$	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Inhalation of VOCs and dust								
Inhalation rate	m^3/day	20[a]	20[a]	20[a]	20[a]	20[a]	20[a]	20[a]
Exposure time	hours/day	1[b]	2[b]	2[p]	8[b]	1[b]	NA	NA

Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at LL1 and LL12, RVAAP (continued)

Parameter	Units	Security Guard/ Maintenance Worker (1)	Hunter/ Trapper (2)	Child Trespasser (3)	National Guard Trainee (4)	Open Recreator (5)	Open Industrial Worker (6)	Resident Farmer (child/adult) (7)
Exposure frequency	days/year	250[a]	90[b]	50[p]	180[b]	75[c]	250[a]	350[a]
Exposure duration	years	25[a]	30[b]	10[p]	25[b]	30[a]	25[a]	30[a]
Body weight	kg	70[a]	70[a]	45[q]	70[a]	70[a]	70[a]	70[a]
Carcinogen averaging time	days	25550[a]	25550[a]	25550[a]	25550[a]	25550[a]	25550[a]	25550[a]
Noncarcinogen averaging time	days	9125[a]	10950[a]	3650[a]	9125[a]	10950[a]	9125[a]	10950[a]
Conversion factor	days/hour	0.042	0.042	0.042	0.042	0.042	NA	NA
Subsurface Soil								
Incidental ingestion								
Soil ingestion rate (Adult)	kg/day	NA	NA	NA	0.0001[a]	NA	0.0001[a]	0.0001[a]
Soil ingestion rate (Child)	kg/day	NA	NA	NA	NA	NA	NA	0.0002[a]
Exposure time	hours/day	NA	NA	NA	8[b]	NA	NA	NA
Exposure frequency	days/year	NA	NA	NA	28[b]	NA	250[a]	350[a]
Exposure duration (Adult)	years	NA	NA	NA	25[b]	NA	25[a]	24[a]
Exposure duration (Child)	years	NA	NA	NA	NA	NA	NA	6[a]
Body weight (Adult)	kg	NA	NA	NA	70[a]	NA	70[a]	70[a]
Body weight (Child)	kg	NA	NA	NA	NA	NA	NA	15[a]
Carcinogen averaging time	days	NA	NA	NA	25550[a]	NA	25550[a]	25550[a]
Noncarcinogen averaging time (Adult)	days	NA	NA	NA	9125[a]	NA	9125[a]	8760[a]
Noncarcinogen averaging time (Child)	days	NA	NA	NA	NA	NA	NA	2190[a]
Fraction ingested	unitless	NA	NA	NA	1[b]	NA	1[b]	1[b]
Conversion factor	days/hour	NA	NA	NA	0.042	NA	NA	NA
Dermal contact								
Skin area	m^2/event	NA	NA	NA	0.33[d]	NA	0.33[d]	0.57[d]
Adherence factor	mg/cm^2	NA	NA	NA	0.3[c]	NA	0.2[c]	0.4[c]
Absorption fraction	unitless	NA	NA	NA	chem spec[r]	NA	chemical-specific[r]	
Exposure frequency	events/year	NA	NA	NA	28[b]	NA	250[a]	350[a]
Exposure duration	years	NA	NA	NA	25[b]	NA	25[a]	30[a]
Body weight	kg	NA	NA	NA	70[a]	NA	70[a]	70[a]
Carcinogen averaging time	days	NA	NA	NA	25550[a]	NA	25550[a]	25550[a]
Noncarcinogen averaging time	days	NA	NA	NA	9125[a]	NA	9125[a]	10950[a]

Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at LL1 and LL12, RVAAP (continued)

Parameter	Units	Security Guard/ Maintenance Worker (1)	Hunter/ Trapper (2)	Child Trespasser (3)	National Guard Trainee (4)	Open Recreator (5)	Open Industrial Worker (6)	Resident Farmer (child/adult) (7)
Conversion factor	$(kg\text{-}cm^2)/(mg\text{-}m^2)$	NA	NA	NA	0.01	NA	0.01	0.01
Inhalation of VOCs and dust								
Inhalation rate	m^3/day	NA	NA	NA	20[a]	NA	20[a]	20[a]
Exposure time	hours/day	NA	NA	NA	8[b]	NA	NA	NA
Exposure frequency	days/year	NA	NA	NA	28[b]	NA	250[a]	350[a]
Exposure duration	years	NA	NA	NA	25[b]	NA	25[a]	30[a]
Body weight	kg	NA	NA	NA	70[a]	NA	70[a]	70[a]
Carcinogen averaging time	days	NA	NA	NA	25550[a]	NA	25550[a]	25550[a]
Noncarcinogen averaging time	days	NA	NA	NA	9125[a]	NA	9125[a]	10950[a]
Conversion factor	days/hour	NA	NA	NA	0.042	NA	NA	NA
Sediment								
Incidental ingestion								
Soil ingestion rate (Adult)	kg/day	NA	0.0001[a]	NA	0.0001[a]	0.0001[a]	NA	0.0001[a]
Soil ingestion rate (Child)	kg/day	NA	NA	0.0002[a]	NA	NA	NA	0.0002[a]
Exposure time	hours/day	NA	2[b]	2[p]	8[b]	1[b]	NA	NA
Exposure frequency	days/year	NA	90[b]	50[p]	28[b]	75[c]	NA	350[a]
Exposure duration (Adult)	years	NA	30[b]	NA	25[b]	30[a]	NA	24[a]
Exposure duration (Child)	years	NA	NA	10[p]	NA	NA	NA	6[a]
Body weight (Adult)	kg	NA	70[a]	NA	70[a]	70[a]	NA	70[a]
Body weight (Child)	kg	NA	NA	45[q]	NA	NA	NA	15[a]
Carcinogen averaging time	days	NA	25550[a]	25550[a]	25550[a]	25550[a]	NA	25550[a]
Noncarcinogen averaging time (Adult)	days	NA	10950[a]	NA	9125[a]	10950[a]	NA	8760[a]
Noncarcinogen averaging time (Child)	days	NA	NA	3650[a]	NA	NA	NA	2190[a]
Fraction ingested	unitless	NA	1[b]	1[b]	1[b]	1[b]	NA	1[b]
Conversion factor	days/hour	NA	0.042	0.042	0.042	0.042	NA	NA
Dermal contact								
Skin area	m^2/event	NA	0.57[d]	0.815[e]	0.33[d]	0.57[d]	NA	0.57[d]
Adherence factor	mg/cm^2	NA	0.07[c]	0.2[c]	0.3[c]	0.07[c]	NA	0.4[c]
Absorption fraction	unitless	NA	chemical-specific[r]				NA	chem spec[r]
Exposure frequency	events/year	NA	90[b]	50[p]	28[b]	75[c]	NA	350[a]

Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at LL1 and LL12, RVAAP (continued)

Parameter	Units	Security Guard/ Maintenance Worker (1)	Hunter/ Trapper (2)	Child Trespasser (3)	National Guard Trainee (4)	Open Recreator (5)	Open Industrial Worker (6)	Resident Farmer (child/adult) (7)
Exposure duration	years	NA	30[b]	10[p]	25[b]	30[a]	NA	30[a]
Body weight	kg	NA	70[a]	45[q]	70[a]	70[a]	NA	70[a]
Carcinogen averaging time	days	NA	25550[a]	25550[a]	25550[a]	25550[a]	NA	25550[a]
Noncarcinogen averaging time	days	NA	10950[a]	3650[a]	9125[a]	10950[a]	NA	10950[a]
Conversion factor	$(kg\text{-}cm^2)/(mg\text{-}m^2)$	NA	0.01	0.01	0.01	0.01	NA	0.01
Inhalation of VOCs and dust								
Inhalation rate	m^3/day	NA	20[a]	20[a]	20[a]	20[a]	NA	20[a]
Exposure time	hours/day	NA	2[b]	2[p]	8[b]	1[b]	NA	NA
Exposure frequency	days/year	NA	90[b]	50[p]	28[b]	75[c]	NA	350[a]
Exposure duration	years	NA	30[b]	10[p]	25[b]	30[a]	NA	30[a]
Body weight	kg	NA	70[a]	45[q]	70[a]	70[a]	NA	70[a]
Carcinogen averaging time	days	NA	25550[a]	25550[a]	25550[a]	25550[a]	NA	25550[a]
Noncarcinogen averaging time	days	NA	10950[a]	3650[a]	9125[a]	10950[a]	NA	10950[a]
Conversion factor	days/hour	NA	0.042	0.042	0.042	0.042	NA	NA
Surface Water								
Incidental ingestion while swimming/wading/showering								
Drinking water ingestion rate	L/day	NA	NA	NA	NA	NA	NA	2[a]
Incidental water ingestion rate	L/hour	NA	0.05[f]	0.05[f]	0.05[f]	0.05[f]	NA	NA
Exposure time	hours/day	NA	2[b]	2[p]	8[b]	1[b]	NA	NA
Exposure frequency	days/year	NA	90[b]	50[p]	28[b]	45[b]	NA	350[a]
Exposure duration	years	NA	30[b]	10[p]	25[b]	30[a]	NA	30[a]
Body weight	kg	NA	70[a]	45[q]	70[a]	70[a]	NA	70[a]
Carcinogen averaging time	days	NA	25550[a]	25550[a]	25550[a]	25550[a]	NA	25550[a]
Noncarcinogen averaging time	days	NA	10950[a]	3650[a]	9125[a]	10950[a]	NA	10950[a]
Dermal contact while swimming/wading/showering								
Skin area	m^2	NA	0.57[d]	1.733[h]	0.57[d]	1.94[d]	NA	1.94[d]
Exposure time	hours/day	NA	2[b]	2[p]	8[b]	1[b]	NA	0.25[c]
Exposure frequency	days/year	NA	90[b]	50[p]	28[b]	45[b]	NA	350[a]
Exposure duration	years	NA	30[b]	10[p]	25[b]	30[a]	NA	30[a]
Body weight	kg	NA	70[a]	45[q]	70[a]	70[a]	NA	70[a]

Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at LL1 and LL12, RVAAP (continued)

Parameter	Units	Security Guard/ Maintenance Worker (1)	Hunter/ Trapper (2)	Child Trespasser (3)	National Guard Trainee (4)	Open Recreator (5)	Open Industrial Worker (6)	Resident Farmer (child/adult) (7)
Carcinogen averaging time	days	NA	25550[a]	25550[a]	25550[a]	25550[a]	NA	25550[a]
Noncarcinogen averaging time	days	NA	10950[a]	3650[a]	9125[a]	10950[a]	NA	10950[a]
Conversion factor	(m/cm)(L/m^3)	NA	10	10	10	10	NA	10
Inhalation of VOCs								
Inhalation rate	m^3/day	NA	20[a]	20[a]	20[a]	20[a]	NA	20[a]
Exposure time	hours/day	NA	2[b]	2[q]	8[b]	1[b]	NA	NA
Exposure frequency	days/year	NA	90[b]	50[q]	28[b]	45[b]	NA	350[a]
Exposure duration	years	NA	30[b]	10[q]	25[b]	30[a]	NA	30[a]
Body weight	kg	NA	70[a]	45[r]	70[a]	70[a]	NA	70[a]
Carcinogen averaging time	days	NA	25550[a]	25550[a]	25550[a]	25550[a]	NA	25550[a]
Noncarcinogen averaging time	days	NA	10950[a]	3650[a]	9125[a]	10950[a]	NA	10950[a]
Conversion factor	days/hour	NA	0.042	0.042	0.042	0.042	NA	NA
Volatilization factor	L/m^3	NA	0.5[a]	0.5[a]	0.5[a]	0.5[a]	NA	0.5[a]
Groundwater								
Drinking water ingestion								
Drinking water ingestion rate	L/day	NA	NA	NA	1[a]	NA	NA	2[a]
Exposure frequency	days/year	NA	NA	NA	180[b]	NA	NA	350[a]
Exposure duration	years	NA	NA	NA	25[b]	NA	NA	30[a]
Body weight	kg	NA	NA	NA	70[a]	NA	NA	70[a]
Carcinogen averaging time	days	NA	NA	NA	25550[a]	NA	NA	25550[a]
Noncarcinogen averaging time	days	NA	NA	NA	9125[a]	NA	NA	10950[a]
Dermal contact while showering								
Skin area	m^2	NA	NA	NA	1.94[h]	NA	NA	1.94[h]
Exposure time	hours/day	NA	NA	NA	0.25[c]	NA	NA	0.25[c]
Exposure frequency	days/year	NA	NA	NA	180[b]	NA	NA	350[a]
Exposure duration	years	NA	NA	NA	25[b]	NA	NA	30[a]
Body weight	kg	NA	NA	NA	70[a]	NA	NA	70[a]
Carcinogen averaging time	days	NA	NA	NA	25550[a]	NA	NA	25550[a]
Noncarcinogen averaging time	days	NA	NA	NA	9125[a]	NA	NA	10950[a]
Conversion factor	(m/cm)(L/m^3)	NA	NA	NA	10	NA	NA	10

Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at LL1 and LL12, RVAAP (continued)

Parameter	Units	Security Guard/ Maintenance Worker (1)	Hunter/ Trapper (2)	Child Trespasser (3)	National Guard Trainee (4)	Open Recreator (5)	Open Industrial Worker (6)	Resident Farmer (child/adult) (7)
Inhalation of VOCs during household water use								
Inhalation rate	m^3/day	NA	NA	NA	20[a]	NA	NA	20[a]
Exposure frequency	days/year	NA	NA	NA	180[b]	NA	NA	350[a]
Exposure duration	years	NA	NA	NA	25[b]	NA	NA	30[a]
Body weight	kg	NA	NA	NA	70[a]	NA	NA	70[a]
Carcinogen averaging time	days	NA	NA	NA	25550[a]	NA	NA	25550[a]
Noncarcinogen averaging time	days	NA	NA	NA	9125[a]	NA	NA	10950[a]
Volatilization factor	L/m^3	NA	NA	NA	0.5[a]	NA	NA	0.5[a]
Foodstuffs								
Ingestion of venison								
Conversion factor	unitless	NA	1.25	NA	NA	NA	NA	1.25
Browse ingestion rate	kg dry weight/day	NA	0.87[b]	NA	NA	NA	NA	0.87[b]
Fraction browse ingested from site	unitless	NA	0.46[b]	NA	NA	NA	NA	0.46[b]
Fat ratio (venison to beef)	unitless	NA	0.20	NA	NA	NA	NA	0.20
Venison ingestion rate	kg/day	NA	0.03[b]	NA	NA	NA	NA	0.03[b]
Fraction ingested	unitless	NA	1[b]	NA	NA	NA	NA	1[b]
Exposure frequency	days/year	NA	365[b]	NA	NA	NA	NA	365[b]
Exposure duration	years	NA	30[b]	NA	NA	NA	NA	30[a]
Body weight	kg	NA	70[a]	NA	NA	NA	NA	70[a]
Carcinogen averaging time	days	NA	25550[a]	NA	NA	NA	NA	25550[a]
Noncarcinogen averaging time	days	NA	10950[a]	NA	NA	NA	NA	10950[a]
Ingestion of beef, pork								
Resuspension multiplier	unitless	NA	NA	NA	NA	NA	NA	0.25[i]
Quantity of pasture ingested	kg dry weight/day	NA	NA	NA	NA	NA	NA	7.2[j]
Fraction of year cow is on-site	unitless	NA	NA	NA	NA	NA	NA	1[b]
Fraction of cow's food from on-site	unitless	NA	NA	NA	NA	NA	NA	0.9[b]
Quantity of soil ingested by cow	kg/day	NA	NA	NA	NA	NA	NA	1[k]
Beef ingestion rate	kg/day	NA	NA	NA	NA	NA	NA	0.075[l]
Fraction ingested	unitless	NA	NA	NA	NA	NA	NA	1[b]

Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at LL1 and LL12, RVAAP (continued)

Parameter	Units	Security Guard/ Maintenance Worker (1)	Hunter/ Trapper (2)	Child Trespasser (3)	National Guard Trainee (4)	Open Recreator (5)	Open Industrial Worker (6)	Resident Farmer (child/adult) (7)
Exposure frequency	days/year	NA	NA	NA	NA	NA	NA	365[b]
Exposure duration	years	NA	NA	NA	NA	NA	NA	30[a]
Body weight	kg	NA	NA	NA	NA	NA	NA	70[a]
Carcinogen averaging time	days	NA	NA	NA	NA	NA	NA	25550[a]
Noncarcinogen averaging time	days	NA	NA	NA	NA	NA	NA	10950[a]
Ingestion of milk products								
Resuspension multiplier	unitless	NA	NA	NA	NA	NA	NA	0.25[i]
Quantity of pasture ingested	kg dry weight/day	NA	NA	NA	NA	NA	NA	16.1[j]
Fraction of year cow is on-site	unitless	NA	NA	NA	NA	NA	NA	1[b]
Fraction of cow's food from on-site	unitless	NA	NA	NA	NA	NA	NA	0.6[b]
Quantity of soil ingested by cow	kg/day	NA	NA	NA	NA	NA	NA	1[k]
Milk ingestion rate (Adult)	kg/day	NA	NA	NA	NA	NA	NA	0.305[l]
Milk ingestion rate (Child)	kg/day	NA	NA	NA	NA	NA	NA	0.509[m]
Fraction ingested	unitless	NA	NA	NA	NA	NA	NA	1[b]
Exposure frequency	days/year	NA	NA	NA	NA	NA	NA	365[b]
Exposure duration (Adult)	years	NA	NA	NA	NA	NA	NA	24[a]
Exposure duration (Child)	years	NA	NA	NA	NA	NA	NA	6[a]
Body weight (Adult)	kg	NA	NA	NA	NA	NA	NA	70[a]
Body weight (Child)	kg	NA	NA	NA	NA	NA	NA	15[a]
Carcinogen averaging time	days	NA	NA	NA	NA	NA	NA	25550[a]
Noncarcinogen averaging time (Adult)	days	NA	NA	NA	NA	NA	NA	8760[a]
Noncarcinogen averaging time (Child)	days	NA	NA	NA	NA	NA	NA	2190[a]
Ingestion of vegetables								
Resuspension multiplier	unitless	NA	NA	NA	NA	NA	NA	0.26[n]
Vegetable ingestion rate	kg/day	NA	NA	NA	NA	NA	NA	0.2[l]
Fraction ingested	unitless	NA	NA	NA	NA	NA	NA	0.4[l]
Exposure frequency	days/year	NA	NA	NA	NA	NA	NA	365[b]
Exposure duration	years	NA	NA	NA	NA	NA	NA	30[a]
Body weight	kg	NA	NA	NA	NA	NA	NA	70[a]

Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at LL1 and LL12, RVAAP (continued)

Parameter	Units	Security Guard/ Maintenance Worker (1)	Hunter/ Trapper (2)	Child Trespasser (3)	National Guard Trainee (4)	Open Recreator (5)	Open Industrial Worker (6)	Resident Farmer (child/adult) (7)
Carcinogen averaging time	days	NA	NA	NA	NA	NA	NA	25550[a]
Noncarcinogen averaging time	days	NA	NA	NA	NA	NA	NA	10950[a]
Ingestion of fish								
Fish ingestion rate	kg/day	NA	0.054[o]	NA	NA	NA	NA	0.054[o]
Fraction ingested	unitless	NA	1[b]	NA	NA	NA	NA	1[b]
Exposure frequency	days/year	NA	365[b]	NA	NA	NA	NA	365[b]
Exposure duration	years	NA	30[b]	NA	NA	NA	NA	30[a]
Body weight	kg	NA	70[a]	NA	NA	NA	NA	70[a]
Carcinogen averaging time	days	NA	25550[a]	NA	NA	NA	NA	25550[a]
Noncarcinogen averaging time	days	NA	10950[a]	NA	NA	NA	NA	10950[a]

NA = not applicable for this scenario.
[a] RAGS, Part B (EPA 1991a).
[b] Site-specific (value assumed for site or value obtained from site personnel).
[c] Security Guard/Maintenance Worker = Adult Groundskeeper (95th percentile); Hunter/Trapper = Residential Default; Child Trespasser = Child Default and Teen Soccer (95th percentile); National Guard Trainee = Construction Worker (95th percentile); Open Recreator = Adult Soccer (95th percentile); Open Industrial Worker = Industrial Default; Resident Farmer = Adult Farmer (95th percentile) (Dermal Guidance, Draft, January 2000, from Mark Johnson, USEPA Region V).
[d] Security Guard/Maintenance Worker, National Guard Trainee, and Open Industrial = Industrial Default; Hunter/Trapper, Open Recreator, and Resident Farmer = Adult Residential Default.
[e] Average surface area for head, hands, forearms, torso, and lower legs for a child (EPA 1992b).
[f] RAGS, Part A (EPA 1989a).
[g] Average total body surface area for an adult (EPA 1992b).
[h] Average total body surface area for a child (EPA 1992b).
[I] Plant mass loading factor for pasture (Hinton 1992).
[j] International Atomic Energy agency 1994.
[k] Soil ingestion by dairy cattle (Darwin 1990).
[l] *Exposure Factors Handbook* (EPA 1989b).
[m] Pao et al. (1982).
[n] Plant mass loading factor for vegetables (Pinder 1989).
[o] Standard default Exposure Factors (EPA 1991b).
[p] OEPA personal communication, June 1999, assumes exposure age 8-18.
[q] Average body weight for children ages 8-18 (EPA 1992b)
[r] Chemical-specific ABS values available from EPA Region V (and provided in Table 3 of this memo) will be used whenever possible. When chemical-specific values are not available, the following default values will be used: SVOCs = 10 percent (Dermal Guidance, Draft, January 2000, from Mark Johnson, USEPA Region V).
VOCs = 1 percent, inorganics = 0.1 percent (USEPA Region 4 Supplemental Guidance to RAGS: Region 4 Bulletins).

Table 3. Chemical-Specific and Default Dermal Absorption Fractions for Use in LL1 and LL12 Human Health Risk Assessment, RVAAP Ohio[a]

Chemical	Dermal Absorption Fraction (ABS)
Arsenic	0.03
Cadmium	0.001
Chlordane	0.04
2,4-Dichorophenoxyacetic acid	0.05
DDT	0.03
TCDD and other dioxins if soil organic content is > 10%	0.03 0.001
Lindane	0.04
Benzo(a)pyrene and other PAHs	0.13
Aroclors 1254/1242 and other PCBs	0.14
Pentachlorophenol	0.25
Generic defaults for other chemicals	
Semivolatile Organic Compounds (SVOCs)	0.1
Volatile Organic Compounds (VOCs)[b]	0.01
Inorganics[b]	0.001

[a] From Dermal Guidance, Draft January 2000, from Mark Johnson, USEPA Region V, unless otherwise noted.
[b] From USEPA Region 4 Supplemental Guidance to RAGS: Region 4 Bulletins.

3.1 PROBLEM FORMULATION

Problem formulation includes the selection of chemicals of potential ecological concern (COPECs) based on a pre-screening activity, identification of exposure media and potential receptor organisms, description of existing habitat and wildlife, and definition of the ecological assessment and measurements endpoints. Note that biological field studies are being conducted at Winklepeck Burning Grounds (WBG) at RVAAP from which some of the knowledge developed may be useful once extrapolated to LL1 and LL12. The nature of such extrapolations will be the subject of discussions and resolutions later in 2001 and may influence such topics as the weight-of-evidence analysis at LL1 and LL12.

3.1.1 Chemicals of Potential Ecological Concern

The COPEC selection process for the ERA begins with the SRCs identified using the background and frequency of detection/weight of evidence screens described in Section 2.1. The essential human nutrient screen is not applied for the ERA. These SRCs are then pre-screened by comparing the maximum detected concentration to screening values specified by Ohio EPA to produce the final list of COPECs to be carried through ERA. This pre-screen uses conservative values for a rapid and early look at which chemicals have such low concentrations that they can be dismissed and which chemicals may show risk as further demonstrated in the screening ERA.

Regarding the pre-screening levels for generic life, the hierarchy of use is as follows:

For soil, the hierarchies of the ecotox thresholds are Efroymson et al. (1997a) for preliminary remediation goals, Efroymson et al. (1997b) for plants, and Efroymson et al. (1997c) for soil invertebrates, followed by Ecological Data Quality Level (EDQL) values from EPA Region 5 (EPA 1998). Note that the lower or lowest values from Efroymson et al. (1997b and 1997c) are published in Efroymson (1997a).

For sediment, the ecotox thresholds, in order of preference, are the compilation recently published by McDonald, Ingersoll, and Berger (2000) and the EDQLs from EPA Region 5 (EPA 1998).

For surface water screening values, the ecotox thresholds, in order of preference, are Chapters 3745-1 and 3745-2 of the Ohio Administrative Code for the Lake Erie Basin (Ohio EPA 1999), the Suter and Tsao (1996) compilation that has ambient water quality criteria and Tier II values, and the EDQLs from EPA Region 5 (EPA 1998).

For each medium, the first available value is used regardless that it may be higher or lower than other available numbers.

In summary, at each exposure unit, the maximum exposure point concentrations will be compared to the respective screening values, and chemicals that exceed screening values will be retained for further analysis using specific receptors and 95 percent UCL of the mean.

3.1.2 Potential Exposure Media, Exposed Populations, and Exposure Pathways

Potentially contaminated exposure media for ecological receptors at LL1 and LL12 are surface soil, sediment, and surface water.

Potential terrestrial receptor populations included in the ERA are plants (*various species*), earthworms (*various species*), short-tailed shrew (*Blarina brevicauda*), American robin (*Turdus migratorius*), deer mouse (*Peromyscus maniculatus*), white-tailed deer (*Odocoileus virginianus*), barn owl (*Tyto alba*), and red fox (*Vulpes vulpes*). These receptors were selected to represent a wide range of ecological niches, sensitivity to stressors, and management goals (e.g., protection of endangered species in the case of the barn owl) at RVAAP. Terrestrial receptors may be exposed to COPECs in soil via direct contact (plants and earthworms) or ingestion of soil and ingestion of food (birds and mammals).

Potential aquatic receptor populations included in the ERA are sediment-dwelling macroinvertebrates (*various species*), aquatic organisms (*fish and various species*), mink (*Mustela vison*), and great blue heron (*Ardea herodias*). Aquatic receptors may be exposed to COPECs in surface water and sediment via direct contact (sediment-dwelling organisms and aquatic organisms) or ingestion of sediment, water, and food (birds and mammals).

3.1.3 Habitat

Habitats mean the type of vegetation (e.g., field, forest) present on the AOC and also documentation of observed and likely wildlife.

3.1.4 Ecological Assessment and Measurement Endpoints

An assessment endpoint is an explicit expression of the environmental value to be protected. A measurement endpoint is a measurable ecological characteristic that is related to the valued characteristic selected as the assessment endpoint. Assessment and measurement endpoints are provided for each policy goal defined for LL1 and LL12 in Table 4.

Table 4. Policy Goals, Ecological Assessment Endpoints, Measurement Endpoints, and Decision Rules for LL1 and LL12

Policy Goals	Assessment Endpoint	Measurement Endpoint	Decision Rule
Policy Goal 1: The preservation and conservation of T&E species and their critical habitats.	**Assessment Endpoint 1:** Preservation of any state- or federally designated, threatened, or endangered species. Endpoint Species: barn owl.	**Measurement Endpoint 1:** Modeled contaminant concentrations in prey (shrews, robins, and rabbits) based on measured soil concentrations.	**Decision Rule for Assessment Endpoint 1:** If T&E species are not present, or RME concentrations in the media do not contribute to chronic NOAEL (this particular NOAEL will be adjusted by an intraspecies safety factor of 0.1 or 0.33 depending on the chemical as specified by Ohio EPA) exceedance (i.e., HQs <1), then that contaminant alone is unlikely to cause adverse ecological effects, and therefore the T&E species should be preserved. If the HQ >1, a weight-of-evidence evaluation will be conducted to determine the potential for ecological risk and the need for any additional measurements or calculations.
Policy Goal 2: The maintenance and protection of terrestrial populations and ecosystems.	**Assessment Endpoint 2:** Maintenance of plant community for erosion control and energy production. Endpoint Species: plants of various species.	**Measurement Endpoint 2:** Measured soil contaminant concentrations.	**Decision Rule for Assessment Endpoint 2:** If the HQ is <1, then that contaminant alone is unlikely to cause adverse ecological effects, and therefore the plant populations and communities are maintained. If the HQ >1, a weight-of-evidence evaluation will be conducted to determine the potential for ecological risk and the need for any additional measurements or calculations.
	Assessment Endpoint 3: Maintenance of soil-dwelling invertebrate community for nutrient and energy processing. Endpoint Species: earthworms.	**Measurement Endpoint 3:** Measured soil contaminant concentrations.	**Decision Rule for Assessment Endpoint 3:** If the HQ is <1, then that contaminant alone is unlikely to cause adverse ecological effects, and therefore the soil invertebrate community is maintained. If the HQ >1, a weight-of-evidence evaluation will be conducted to determine the potential for ecological risk and the need for any additional measurements or calculations.

Table 4. Policy Goals, Ecological Assessment Endpoints, Measurement Endpoints, and Decision Rules for LL1 and LL12 (continued)

Policy Goals	Assessment Endpoint	Measurement Endpoint	Decision Rule
	Assessment Endpoint 4: Maintenance of populations of herbivorous animals. Endpoint Species: deer mouse and deer.	**Measurement Endpoint 4:** Modeled contaminant concentrations in food chain based on measured soil contaminant concentrations.	**Decision Rule for Assessment Endpoint 4:** If the HQ is <1, then that contaminant alone is unlikely to cause adverse ecological effects, and therefore populations of the herbivores (e.g., voles, cottontail rabbits, and deer) are maintained. If the HQ >1, a weight-of-evidence evaluation will be conducted to determine the potential for ecological risk and the need for any additional measurements or calculations.
	Assessment Endpoint 5: Maintenance of worm-eating and/or insectivorous animals. Endpoint Species: mammal – shrew; bird – robin.	**Measurement Endpoint 5:** Modeled contaminant concentrations in earthworms and other prey based on measured soil contaminant concentrations.	**Decision Rule for Assessment Endpoint 5:** If the HQ is <1, then that contaminant alone is unlikely to cause adverse ecological effects, and therefore populations of worm-eating and/or insectivorous animals are maintained. If the HQ >1, a weight-of-evidence evaluation will be conducted to determine the potential for ecological risk and the need for any additional measurements or calculations.
	Assessment Endpoint 6: Maintenance of terrestrial predators. Endpoint Species: mammal – red fox; bird – barn owl from Policy Goal 1 serves as avian predator.	**Measurement Endpoint 6:** Modeled contaminant concentrations in prey (shrews and robins) based on measured soil contaminant concentrations.	**Decision Rule for Assessment Endpoint 6:** If the HQ is <1, then that contaminant alone is unlikely to cause adverse ecological effects, and therefore populations of terrestrial predators are maintained. If the HQ >1, a weight-of-evidence evaluation will be conducted to determine the potential for ecological risk and the need for any additional measurements or calculations.

Table 4. Policy Goals, Ecological Assessment Endpoints, Measurement Endpoints, and Decision Rules for LL1 and LL12 (continued)

Policy Goals	Assessment Endpoint	Measurement Endpoint	Decision Rule
Policy Goal 3: The maintenance and protection of aquatic populations and ecosystems.	**Assessment Endpoint 5:** Maintenance of sediment-dwelling organisms. Endpoint Species: sediment-dwelling organisms.	**Measurement Endpoint 5:** Measured sediment contaminant concentrations.	**Decision Rule for Assessment Endpoint 5:** If the HQ is <1, then that contaminant alone is unlikely to cause adverse ecological effects, and therefore populations of sediment-dwelling organisms are maintained. If the HQ >1, a weight-of-evidence evaluation will be conducted to determine the potential for ecological risk and the need for any additional measurements or calculations.
	Assessment Endpoint 6: Maintenance of aquatic organisms, according to Ohio EPA chemical-specific criteria or, when appropriate, according to biological criteria as specified by Section 3745-1 of the Ohio Administrative Code. Endpoint Species: fish and other aquatic organisms.	**Measurement Endpoint 6:** Measured surface water contaminant concentrations.	**Decision Rule for Assessment Endpoint 6:** If the HQ is <1, then that contaminant alone is unlikely to cause adverse ecological effects, and therefore populations of aquatic organisms are maintained. If the HQ >1, a weight-of-evidence evaluation will be conducted to determine the potential for ecological risk and the need for any additional measurements or calculations.
	Assessment Endpoint 7: Maintenance of aquatic organism and fish-eating predator population for population regulation. Endpoint Species: mink and great blue heron.	**Measurement Endpoint 7:** Modeled contaminant concentrations in prey fish based on measured surface water concentrations.	**Decision Rule for Assessment Endpoint 7:** If the HQ is <1, then that contaminant alone is unlikely to cause adverse ecological effects, and therefore populations of terrestrial predators are maintained. If the HQ >1, a weight-of-evidence evaluation will be conducted to determine the potential for ecological risk and the need for any additional measurements or calculations.

RME = Reasonable maximum exposure.
T&E = Threatened and endangered.
NOAEL = No observed adverse effects level.
HQ = Hazard (risk) quotient.

3.2 EXPOSURE ASSESSMENT

The exposure assessment includes:

- identification of exposure pathways;
- calculation of exposure point concentrations; and
- estimation of intake.

3.2.1 Identification of Exposure Pathways

Terrestrial receptors may be exposed to COPECs in soil via the following exposure pathways:

- Plants – direct contact with soil;
- Soil-dwelling organisms (earthworms) – direct contact with and ingestion of soil;
- Mammalian herbivores (deer mouse, white-tailed deer) – ingestion of plants and soil;
- Insectivorous mammals and birds (short-tailed shrew, American robin) – ingestion of insects and soil-dwelling organisms and ingestion of soil;
- Top predators [red fox, barn owl (a threatened and endangered species)] – ingestion of prey (both species) and of soil (fox only).

Aquatic receptors may be exposed to COPECs in surface water and sediment via the following exposure pathways:

- Sediment-dwelling macroinvertebrates (e.g., crayfish) – direct exposure to sediment and sediment-pore water and ingestion of food;
- Aquatic organisms (e.g., fish and other aquatic animals) – direct exposure to surface water and ingestion of food;
- Aquatic predators (mink, great blue heron) – ingestion of fish.

3.2.2 Exposure Point Concentrations

The LL1 and LL12 ERAs will evaluate the RME as represented by the UCL_{95} of the mean. If the UCL_{95} exceeds the maximum detected concentration, the maximum concentration will be used as an estimate of the RME.

Exposure concentrations from direct contact with environmental media (soils, sediment, and surface water) are based on the sampling results of these media. Food-chain modeling will use the measured RME concentrations in biotic media (e.g., plants, fish).

3.2.3 Estimating Intakes

The exposure of ecological receptors is quantified as the average daily dose (ADD) for mammalian herbivores (deer mouse, white-tailed deer), insectivorous mammals and birds (short-tailed shrew, American robin), top terrestrial predators (red fox, barn owl), and aquatic predators (mink, great blue heron). The ADD is

calculated using exposure parameters for both the transfer of constituents from environmental media into food and the quantity of food and soil/water ingested daily, according to standard EPA-accepted sources (i.e., EPA 1993, Sample and Suter 1994).

Exposures will be evaluated for terrestrial plants, soil-dwelling organisms, sediment-dwelling invertebrates, and aquatic organisms by direct comparison of environmental (abiotic) media concentrations to benchmark concentrations and toxicity reference values.

All chemicals have been represented as statistics relative to sample size. If there is only one measurement, then it becomes the basis for the ADD. If there are many measurements, then the RME becomes the basis for the ADD. Regarding inputs to ingestion rates, ingestion rates per se for the receptors are rather well known. Likewise, ingestion fractions for plants, animals, and soil are reasonably reliable. The biggest source of error is bioaccumulation factors (BAFs), and reasonable default values are assumed for them when there is no measurement. Mention of the uncertainties associated with BAFs will be made in Section 3.5.

Additional considerations are that the exposure units have been defined and presented at a meeting on February 13 and 14, 2001, at Ravenna. Allometric conversion, using a 0.75 factor, will be done for mammals, but no allometric conversion will be done for birds. Area use factors will be developed for the deer, fox, mink, and heron based, of course, on the relative sizes of the areas of exposure units and on conservative home ranges of each ecological receptor.

3.3 EFFECTS ASSESSMENT

The effects assessment provides toxicity information for evaluating the potential effects of exposures to COPECs. Toxicity information is provided as:

- Benchmark Values, which are screening concentrations for soil, surface water, and sediment used to evaluate direct exposure to plants and soil-/sediment-/surface water-dwelling organisms.

- Toxicity Reference Values (TRVs), which are estimated average daily dose values that are not expected to have an adverse effect on the receptor population. TRVs are derived from published No Observed Adverse Effect Level (NOAELs) or Lowest Observed Adverse Effect Level (LOAELs).

No Observed Adverse Effect Level (NOAEL), especially chronic NOAELs, from controlled laboratory/field exposure studies will be the appropriate toxicological data for toxicity reference values in the food web modeling of the screening ecological risk assessment. When chronic NOAELs are not available and subchronic NOAELs are available, a conversion factor of 10 will be used to convert subchronic to chronic NOAEL. When no NOAEL is available and a LOAEL is available, a conversion factor of 10 will be used to convert a LOAEL to a NOAEL. Compilation sources, such as Sample, Opresko, and Suter (1996) and McDonald, Ingersoll, and Berger (2000), will be used.

3.4 RISK CHARACTERIZATION

Potential risks to plants, soil-dwelling organisms, sediment-dwelling organisms, and aquatic organisms will be evaluated by comparison of exposure media (soil, sediment, surface water) concentrations of COPECs to benchmark values.

Potential risks to mammalian herbivores, insectivorous mammals and birds, top terrestrial predators, and aquatic predators will be estimated using a HQ approach. The HQ is the ratio of the ADD to the TRV. COPEC will be identified as having a HQ>1 for this screening level ERA.

A brief weight-of-evidence will be developed in which the quantity and quality are evaluated for both exposure and ecological effects data. See Table 4 and the decision rule to better understand the role of the weight-of-evidence analysis. This weight-of-evidence analysis will be in addition to the uncertainty section. Also, extrapolation from WBG may be useful at LL1 and LL12. It is expected that the brief weight-of-evidence analysis and possible extrapolation will result in a recommendation that the screening ERA is sufficient or that further work is needed to resolve technical issues about protection of ecological receptors.

3.5 UNCERTAINTIES

This work will be organized by the four major steps in the screening ERA: problem formulation, exposure assessment, effects assessment, and risk characterization. In each step, the major unknowns will be identified and defined as an overestimate or as an underestimate of that particular piece of information.

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APPENDIX A

DRAFT TECHNICAL MEMORANDUM (JANUARY 2001) COMMENT RESPONSE TABLE

Comment No.	Page or Section	Comment	Response
		Dr. Dave Brancato, CELRL-ED-EE	
1	4	Conceptual Site Model, column labeled Resident Farmer/Child has no solid dots confirming GW exposure via ingestion, dermal, and inhalation. Please clarify, as their exposure should be no different than the Resident Farmer/Adult.	Clarification. The exposure model is correct and consistent with that depicted in the Winklepeck Phase II RI. Only pathways that are different from the adult receptor will be evaluated. No changes required.
2	5	Table 2 does not mention surface soil, please include all parameters on surface soil exposure for all 8 receptors.	Agreed. The missing page has been included in the final version.
3	Table 2 (all)	Please identify all chemical specific absorption fractions for dermal contact. This one piece of empirical data if not agreed to up front can jeopardize the integrity of the characterization.	Agreed. This information has been included in the final version.
4	Table 2 (all)	The agreed to exposure frequency for National Guard Trainee is 124. Has there been a change, via communication with Col Tadsen, to drop the frequency to 28?	Clarification. The exposure frequency should be 28 per previous agreements reached during the Winklepeck Phase II RI. No changes required.
5	5	The adult soil ingestion rate should be 0.00005 kg/day instead of 0.0001 kg/day (prior agreement on Winklepeck)	Clarification. The ingestion rate should be 0.0001 kg/day per previous agreements reached during the Winklepeck Phase II RI. No changes required.
6	6	Prior agreements for the **child trespasser** included: **Sediment/Incidental Ingestion**: Exposure time (hr/d)…….1 not 2 Exposure Frequency (adult) (d/yr)…..24 not 50 Exposure Frequency (child) (d/yr)…..6 not 10 Body Weigh Child (kg)……15 not 45 Noncancer Average Time, child (days)….2190 not 3650 **Sediment/dermal contact**: Adherence Factor (mg/cm2)…..1 not 0.2 Exposure Frequency (d/yr)…..24 not 50 Exposure Duration (d/yr)…..6 not 10 Body Weigh Child (kg)……15 not 45 Noncancer Average Time(days)….2190 not 3650 **Sediment/Inhalation of VOCs and Dust** Exposure time (hr/d)…….1 not 2 Exposure Frequency (d/yr)…..24 not 50 Exposure Duration (d/yr)…..6 not 10 Body Weigh Child (kg)……15 not 45 Noncancer Average Time, child (days)….2190 not 3650 **Incidental Ingestion While Swimming/Wading/Showering** Exposure time (hr/d)…….1 not 2	Clarification. The values listed in Table 2 reflect the input of Ohio EPA in comments to the Winklepeck Phase II RI. It was agreed during preparation of the Phase II RI for WBG that the values provided by Ohio EPA would be included in future risk assessments at RVAAP. No changes required.

Comment No.	Page or Section	Comment	Response
		Exposure Frequency (d/yr)…..24 not 50 Exposure Duration (d/yr)…..6 not 10 Body Weigh Child (kg)……15 not 45 Noncancer Average Time, child (days)….2190 not 3650 **Dermal Contact While Swimming/Wading/Showering** Exposure time (hr/d)…….1 not 2 Exposure Frequency (d/yr)…..24 not 50 Exposure Duration (d/yr)…..6 not 10 Body Weigh Child (kg)……15 not 45 Noncancer Average Time, child (days)….2190 not 3650 **Inhalation of VOCs** Exposure time (hr/d)…….1 not 2 Exposure Frequency (d/yr)…..24 not 50 Exposure Duration (d/yr)…..6 not 10 Body Weigh Child (kg)……15 not 45 Noncancer Average Time, child (days)….2190 not 3650	
Elizabeth Ferguson, CELRL-ED-EE			
1		Comment: Make sure that any necessary verbiage is added to allow for use of the WBG results. Recommendation: This is a screening ERA so it fits into the plan well (step 3) of WBG plan. Do we want to start with a soil screen with Ohio SSLs? (Step 1 in flow diagram?) Step 2 in flow diagram is in question so we won't address that yet.	Agreed. Necessary language has been added to the text to keep open the doors to using the decision guide being developed and based on WBG biological measurements and extrapolated to other Ravenna AOCs. For example, we plan to compare maximum concentrations at the AOC geographical scale (and automatically the exposure unit geographical scale) to Ohio EPA soil screening levels. By contrast, we do not plan to perform a background screen.
2	Page 14	Comment: under exposure point concentrations. Correct sentences Recommendation: "The LL1 and LL12 ERAs will evaluate the RME as represented by the UCL_{95}. If the UCL_{95} exceeds….	Agreed. The dependent clause has been added as requested.

Comment No.	Page or Section	Comment	Response
3	Page 18	Under estimating intakes – Explain how any possible data gaps will be handled. If none are expected please state.	Clarification. All chemicals have been represented as a statistic relative to sample size. If there is only one measurement, then that becomes the basis for the ADD. If there are many measurements, then the RME becomes the basis for the ADD. Regarding inputs to ingestion rates, ingestion rates per se for the receptors are rather well known. Likewise, ingestion fractions for plants, animals, and soil are reasonably reliable. The biggest source of error is bioaccumulation factors (BAFs), and reasonable default values are assumed for them when there is no measurement. Mention of the uncertainties associated with BAFs will be made in the Uncertainty Section.
4	Page 18	Under estimating intakes – Please list source of benchmarks for aquatic receptors. If there is more than one, please list hierarchy of use.	Agreed. Benchmarks have been added to Section 3.1 on Problem Formulation because benchmarks are ecological effects type of data that are applied prior to the actual screening ERA and at the AOC geographical scale. Please see response to comment 6 for more information about the preferred order of screening values.
5	Page 18	Effects Assessment – List source of TRVs. If and how NOAELS could or would be converted to LOAEL values or vice versa	Agreed. The interconversion of LOAELs to NOAELs has been added. Regarding the sources of TRVs, the ORNL and other compilations will be used.
6	Page 18	Effects Assessment – benchmark values needs a hierarchy of use or decision tree of values.	Agreed**.** Here are two sets of "benchmarks." There are the screening levels for soil, sediment, and surface water that are used in the pre-screening at the AOC geographical scale for "generic" life. The others are the toxicity reference values used at the exposure-unit geographical scale for specific organisms. Regarding the screening levels for generic life, there is a hierarchy of use as follows: For soil, the hierarchy of the ecotox thresholds are Efroymson et al. (1997a) for preliminary remediation goals, Efroymson et al. (1997b) for plants, and Efroymson et al. (1997c) for soil invertebrates compilations of soil screening values, followed by Ecological Data Quality Levels (EDQLs) values from EPA Region 5 (EPA 1998). Note that Efroymson et al. (1997a) contains the majority of the thresholds from the 1997 publications. For sediment, the ecotox thresholds, in order of preference, are a new technical paper of compiled sediment values by McDonald, Ingersoll, and Berger and the EDQLs from EPA Region 5 (EPA 1998).

Comment No.	Page or Section	Comment	Response
			For surface water screening values, the ecotox thresholds, in order of preference, are Chapters 3745-1 and 3745-2 of the Ohio Administrative Code for the Lake Erie Basin (Ohio EPA 1999), a compilation (Suter and Tsao 1996) that has AWQCs and Tier II values, and the EDQLs from EPA Region 5 (EPA 1998). In every case, the first value has precedence (and not necessarily the lower or lowest value). In summary, the AOC-wide maximum exposure point concentrations will be compared to the respective screening values, and constituents that exceed screening values will be retained for further analysis at the Exposure Unit level. The second types are the toxicity reference values. For sediment and surface water, they are the same as for the pre-screening. For soil, it is NOAELs from the published literature, and especially ORNL compilation data. **References** Efroymson, R. A., G. W. Suter II, B. E. Sample, and D. S. Jones 1997a. *Preliminary Remediation Goals for Ecological Endpoints*. ES/ER/TM-162/R2. Efroymson, R. E., M. E. Will, and G. W. Suter II 1997b. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes: 1997 Revision*. ES/ER/TM-126/R2. Lockheed Martin Energy Systems. Oak Ridge National Laboratory, Oak Ridge, Tennessee. Efroymson, R. E., M. E. Will, G. W. Suter II, and A. C. Wooten 1997c. *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants*. ES/ER/TM-85/R3. Oak Ridge National Laboratory, Oak Ridge, Tennessee. 128 pp. EPA 1998a. *Ecological Data Quality Levels (EDQLs)*. *RCRA QAPP Instructions.* USEPA Region 5, Chicago, Illinois. April 1998. Rev. Ohio EPA 1999. *Division of Surface Water*. Ohio Administrative Code. Chapters 3745-1, 3745-2, May 11.

Comment No.	Page or Section	Comment	Response
7		Uncertainty issues should be further discussed, what is expected.	Agreed. A section on uncertainty has been added. This section in the RI will be organized by the four major steps in the Screening ERA: problem formulation, exposure assessment, effects assessment, and risk characterization. In each step, the major unknowns will be identified and defined as an overestimate or an underestimate of that particular piece of information.
		Brian Tucker, Ohio EPA	
General Comment		Due to the many comments and questions regarding the methods and input parameters for the various receptors, it may be necessary to review the revised document before the document can be approved. In addition, it is assumed that the reviewed text is the starting point for a facility wide risk assessment assumptions document as was planned in the fall of 1999.	Comment noted.
General Comment		The list or categories of receptors cited in the document is acceptable. However, many of the receptors have similar exposures to the various impacted media at the site. It may be appropriate to re-evaluate the receptors so less overlap would be present in the modeled receptors. The receptors used in the human health risk assessments should be specific enough to identify potential adverse health effects as the result from exposure to various media during specific activities. The decision to re-evaluate the receptors and exposure parameters would require additional work by the risk assessment team.	Clarification. The land use categories and receptors were developed to evaluate risks associated with (1) current and anticipated future activities (maintenance worker, National Guardsman, hunter, trespasser), (2) possible alternative future land use (recreator, industrial worker), and (3) baseline/free release (resident). The commenter is correct that this list of receptors results in overlap of exposure media and pathways; however, evaluating only one receptor for each exposure medium or pathway will not provide USACE/ONG with the information needed to evaluate possible alternatives for future use of the site.
1	Page 1	Section 1.0, Introduction, Page 1; Section 1.0 identifies the purpose of the technical memoranda as presenting the critical steps in the human health and ecological risk assessments for Load Lines 1 and 12. This document was reviewed with the assumption that the revised document may be appropriate for use as a facility wide risk assessment assumption document.	Clarification. The purpose of this technical memorandum is as stated to present the critical steps in the HHBRA and ERA for the Load Line 1 and Load Line 12 risk assessments to ensure that all parties understand and agree on the specifics of receptors and pathways prior to conducting these risk assessments. This memorandum builds on the risk assessments performed for the Winklepeck Burning Ground Phase II, OEPA comments on that risk assessment, the Sampling and Analysis Plans for the Phase II Remedial Investigations of Load Lines 1 and 12. This memorandum is not intended to serve as a comprehensive risk assessment workplan for the Load Lines or the Facility.

Comment No.	Page or Section	Comment	Response
2	Page 1	Section 2.1, Frequency-of-Detection, Page 1; The fifth sentence of section 2.1 states: "(t)his screen will be applied to all organic and inorganic chemicals with the exception of explosives and propellants." This exception should be expanded to include all chemicals expected to be present at the area of concern. Compounds that are detected infrequently and have been identified as being used in the area under investigation, should not be eliminated based on a frequency of detection screen. See section 5.9.3, Evaluate Frequency of Detection, in U.S. EPA, Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human health Evaluation Manual, (Part A), 1989, for specific text regarding anticipated compounds and the retention of these compounds when detected infrequently. The text should be revised to include the appropriate changes.	Agreed**.** The second and third sentences of this paragraph will be revised to read "The magnitudes and locations (e.g., clustering) of the detections and potential source of the chemical will be evaluated. If the detected results show no clustering, the chemical is not an SRC in any other medium, the concentrations are not substantially elevated relative to the detection limit, and if the chemical was not used in the area under investigation, the chemical will be eliminated from further consideration."
3	Page 2	Section 2.1, Background Screen, Page 2; Section 2.1 cites USACE 2000a and 2000b as the source of the process used to develop background values for inorganic compounds. The appropriate citation should be given as the Revised/approved Determination of Facility-Wide Background at Ravenna Army Ammunition Plant, Ravenna Ohio, 1998. Please identify the approved facility wide background document as the source of the background screening values if in fact this document has been finalized.	Clarification. The process used to screen against the background is described in USACE 2000a and 2000b (Sampling and Analysis Plans for the Phase II Remedial Investigations of Load Lines 1 and 12). The background data identified in these work plans are from the Revised/approved Determination of Facility-Wide Background at Ravenna Army Ammunition Plant.
4	Page 2	Section 2.1, Essential Nutrients, Page 2; Section 2.1 identifies that the eight essential nutrients will not be evaluated unless "grossly evaluated relative to background." The term grossly should be defined. Section 5.9.4 of RAGS, vol. 1, part A, gives the following three criteria for eliminating inorganic compounds from further consideration based on the fact that the chemical in question is: 1) an essential human nutrient; 2) present at low concentrations (*i.e.*, only slightly elevated above naturally occurring levels), and 3) toxic at very high doses (*i.e.*, much higher than those that could be associated with contact at the site). Please incorporate the appropriate text into the revised document.	Agreed**.** The text will be revised to read "Eight chemicals are considered essential nutrients (…) and will be not be evaluated as COPCs so 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 the site)."
5	Page 2	Section 2.1, Data Evaluation, Page 2; The last paragraph should be under a header such as "Concentration-Toxicity Screen" or another appropriate title.	Agreed. A subheading "Risk-Based Screen" will be added.

Comment No.	Page or Section	Comment	Response
6	Page 2	Section 2.2, Exposure Assessment, Potential Exposure Media, Exposed Populations, and Exposure Pathways, Page 2 The first two categories include the same hunters/trappers and trespassers receptor populations. There should only be one managed recreational exposure population. Please revise as necessary.	Clarification. Five current and future land use categories have been identified at RVAAP. Two of these categories represent the current (Modified Caretaker/Managed Recreational) and anticipated future (National Guard/Managed Recreational) land use at the facility. The other three categories represent alternative future land use options. The two managed recreational receptors (hunters/trappers and trespassers) are common to both the current Modified Caretaker/Managed Recreational and future National Guard/Managed Recreational land use.
7	Page 2	Section 2.2, Exposure Assessment, Potential Exposure Media, Exposed Populations, and Exposure Pathways, Page 2; The last paragraph on page 2 states: "(t)he most likely pathways that will be quantified for exposures to contaminants at LL1 and LL12 are soil ingestion, dermal contact with soil, and inhalation of soil particles." This list should be expanded to include ingestion of ground water, and if appropriate, dermal contact with ground water. If VOCs are detected in ground water it may also be appropriate to include exposure based on the inhalation of organic compounds resulting from ground water use or vapor intrusion into indoor air. Please include the additional pathways as appropriate.	Agreed**.** The paragraph will be revised to read "The most likely pathways that will be quantified for exposures to contaminants at LL1 and LL12 are soil ingestion, dermal contact with soil, and inhalation of soil particles. Potable water is currently obtained from municipal supplies; however, ingestion, dermal contact, and inhalation of VOCs (if present) from groundwater will be evaluated for the national guard and resident scenarios. For the future …"
8	Page 2	Section 2.2, Page 2, Exposure Assessment, Potential Exposure Media, Exposed Populations, and Exposure Pathways; Section 2.2 discusses the evaluation of the adverse effects of the ingestion of foodstuffs (*e.g.*, beef, dairy products). These pathways may not be likely given the local development of the land surrounding the RVAAP. It may be more appropriate to assume exposures typical for open residential land use and not include an evaluation based on the consumption of homegrown produce, meat, or dairy products. An evaluation of the surrounding areas may provide some justification for a more appropriate residential exposure scenario.	Clarification. The residential farmer scenario was developed, with OEPA input, because (1) it provides a comprehensive, worst-case baseline scenario, and (2) the area surrounding the facility includes family farms. The risk assessment reports provide separate risk results for each exposure medium and pathway so risk managers can see the contribution the food pathways make to the estimated residential risks.
9	Page 3	Section 2.3, TOXICITY ASSESSMENT, Page 3; The first sentence in section 2.3 should be changed to include "U.S." before EPA-derived toxicity factors. Also, the Integrated Risk Information System (IRIS) should be cited as the source for toxicity values. Toxicity values from other sources should be approved by Ohio EPA prior to use in a human health risk assessment.	Agreed**.** The text will be revised to read "The toxicity assessment will be performed using standard USEPA-derived toxicity factors taken from the Integrated Risk Information System (IRIS) and, secondarily, from the Health Effects Assessment Summary Tables (HEAST)."

Comment No.	Page or Section	Comment	Response
10	Page 3	Section 2.3, TOXICITY ASSESSMENT, Page 3; The third and fourth sentences of section 2.3 are not clear. Inhalation reference values developed from toxicity studies that employed test species exposed via the inhalation pathway do not take into consideration a fractional amount of contaminant absorbed by the membranes of the lung. This is also true with oral reference doses that have been developed by studies that have used administered doses. In addition, when Inhalation reference values are developed by extrapolation from oral reference doses, 100% absorption is generally considered for compounds respired into the lung. It is recommended that methodology used to extrapolate toxicity values be included in the text and approved prior to its use in human health risk assessments. Also, please remove or clarify the two sentences discussed above.	Agreed**.** The text will be revised to read "Oral and inhalation cancer slope factors (CSF) and reference doses (RfD) are currently available. Dermal CSFs and RfDs will be estimated from the oral toxicity values using chemical-specific gastrointestinal absorption factors (GAFs) to calculate the total absorbed dose."
11	Page 3	Section 2.3, TOXICITY ASSESSMENT, Page 3; Chemical specific GAF values should be used when available. Clarification should be given on how the chemical specific values will be used. One example is that chemical specific GAFs be rounded to one significant digit. Please clarify or add additional text on the specific use of chemical specific GAF values. The approach cited in draft U.S. EPA Region 5 Dermal Guidance for GI absorption is acceptable, as is the use of a default GAF of 1.0 for organic compounds for compounds without chemical specific gastrointestinal absorption values. The dermal absorption values should also be given in the text or in a table. Chemical specific dermal absorption values are preferred when available. See RAGS, Draft Supplemental Guidance, Dermal Risk Assessment, NCEA-W-0364, for a list of chemical specific dermal absorption values. Default Dermal Absorption factors for compounds which lack chemical specific values may include: semi-volatile organic compounds - 0.1 Inorganic compounds - 0.01	Agreed. Chemical-specific GAF values will be used when available. These values are provided in the draft USEPA Region 5 Dermal Guidance to 1 or 2 significant figures. These values will be rounded to one significant figure for the risk assessment. The text of the technical memorandum will be revised to read "Chemical-specific GAF values available from EPA Region V (USACE 2000) will be used (rounded to one significant figure) whenever possible." Clarification. The risk assessment will use chemical-specific ABS values from USEPA Region 5 when available and default values for COPCs without chemical-specific values. Chemical-specific values are not provided in the work plans or in this technical memorandum because the COPCs are not known. Default values are: SVOCs 10% (USEPA Region 5 Draft Dermal Guidance) VOCs 1% (USEPA Region 4 Supplemental Guidance to RAGS: Region 4 Bulletins) Inorganics 0.1% (USEPA Region 4 Supplemental Guidance to RAGS: Region 4 Bulletins)

Comment No.	Page or Section	Comment	Response
12	Table 1.	Table 1. Conceptual Exposure Model for Load Lines 1 and 12 at RVAAP; Exposure to ground water is not listed as a complete exposure pathway for the resident child receptor. Please include ground water as an exposure medium for the residential child receptor.	Clarification. The adult resident farmer is assumed to be exposed chronically to all media, including groundwater and foodstuffs. The child resident farmer is also evaluated for the ingestion of soil/sediment and ingestion of milk since child ingestion rates are higher than adult ingestion rates for these pathways. The child is not evaluated separately for other exposure pathways where lower ingestion rate/inhalation rate/surface area are offset by the smaller body weight of the child.
13	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP; The equations used to estimate intake from the various media should be included in the document. By including the equations some confusion regarding the various input parameters may be eliminated. In addition, if this document is intended for use as a template for the remaining AOCs at the Ravenna Army Ammunition Plant, the equations should be included in the document.	Clarification. This document is not intended as a facility-wide work plan. Equations for the Load Line 1 and 12 risk assessments are provided in the Sampling and Analysis Plans for the Phase II Remedial Investigations of Load Lines 1 and 12.
14	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP; Table 2 list a conversion factor in the units of days hour^{-1}. It is not clear when this conversion factor is to be applied. The conversion factor is not universally used as suggested by the table. The inclusion of the specific exposure equations may provide this information.	Clarification. The conversion factor of days/hours is used with the exposure time in hours/days.
15	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP; No parameters were given for surface soil. Therefore, the surface soil related parameters have not been reviewed. In addition, all point of compliance values should be given in the document. Values such as the depths of the various media considered; surface soils, subsurface soils, and sediment for each receptor should be included risk assessment approach document. Please include the appropriate information for review.	Clarification. The first page of the table, which provides exposure parameters for surface soil, is missing from the reviewer's copy of the memo. Agreed. The first sentence in the subsection titled *Potential Exposure Media, Exposed Populations, and Exposure Pathways* on page 2 will be revised to read "Potentially contaminated exposure media at LL1 and LL12 are surface soil (0-1 feet bgs), subsurface soil (1-5 feet bgs), groundwater, surface water, and sediment (0-0.5 feet bgs)."
16	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP; The Security Guard/Maintenance Worker exposure parameters are incomplete. As currently given in Table 2, the security guard/maintenance worker is not exposed to any medium. Please include the appropriate input parameters for the security guard/maintenance worker scenario.	Clarification. The security guard/maintenance worker is exposed to surface soil. The first page of the table, which provides exposure parameters for surface soil, is missing from the reviewer's copy of the memo.

Comment No.	Page or Section	Comment	Response
17	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP, Hunter/Trapper; The Hunter/Trapper receptor as listed by Table 2 is exposed to the following media: sediment (via incidental ingestion, dermal contact, inhalation of VOCs and dust(?)) surface water (swimming/wading/ showering), inhalation of VOCs, and ingestion of venison, and ingestion of fish. Are this the appropriate exposure media? Ingestion and dermal contact of surface soils was not included in the text. Please revise the receptor as necessary and provide the appropriate parameters for review.	Clarification. The hunter/trapper is exposed to surface soil. The first page of the table, which provides exposure parameters for surface soil, is missing from the reviewer's copy of the memo.
18	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP, Hunter/Trapper; The hunter/trapper receptor is exposed to surface water and sediment based on trapping activities, and presumably surface soils based on general hunting activities. Therefore, some of the input parameters may be confusing. It would be helpful to discuss the different exposure scenarios to help inform the readers what activities were being simulated by the various receptors. Please include additional text that describes the various receptors and how the receptors are intended to identify potential adverse health effects based on the anticipated activities and subsequent exposure to contaminated media.	Clarification. A complete discussion of receptors is provided in the Winklepeck Phase II report and will be included in the Load Lines 1 and 12 Phase II reports. The purpose of this memo is to clarify the specific parameters used to quantify exposures to previously agreed upon receptors.
19	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP, Hunter/Trapper; The skin surface area given for the Hunter/Trapper, Open Recreator, and Resident Farmer all use the same value of 0.53 m^2 $event^{-1}$. This value is acceptable however, the footnote for this parameter identifies the source as being the average surface area for head, hands, forearms, torso, and lower legs for a child. This is incorrect. Please correct the footnote/citation.	Agreed. Footnote "d" should be cited for this value. The table will be corrected accordingly.
20	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP, Hunter/Trapper; The foot note/citation for the incidental water ingestion rate is incorrect. Please provide and adequate reference/citation for the values	Agreed. Footnote "f" should be cited for this value. The table will be corrected accordingly.

Comment No.	Page or Section	Comment	Response
21	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP, Hunter/Trapper; The exposure time of 2 hours day^{-1} is given as the parameter for incidental ingestion of sediment, inhalation of VOCs and dust, incidental ingestion of surface water, and inhalation of VOCs in surface water. This value appears to only consider the trapper where short duration exposures to media are expected for a large number of days. This is in contrast to the hunter who spends fewer days at the site but also spends greater amounts of time (*e.g.*, 8 hours) per event. For the hunter receptor, it may be more precise to increase the exposure time and reduce the cited exposure frequency of 90 days $year^{-1}$. This composite receptor may need to be discussed and further refined, or additional justification is needed to support the exposure time of 2 hours per event.	Clarification. Exposure scenarios were developed during several discussions between USACE, ONG, OEPA, and SAIC personnel. The hunter/trapper scenario was designed to be protective of receptors engaged in three activities: Deer hunting – hunts are conducted for 6-12 weekends per year. Wildfowl hunting – hunts are conducted several weekends per year. Trapping – trapping takes place 3 months per year. Trappers are allowed to check and set traps daily during this period, but most do not. Total exposure times for these receptors may range from a minimum of a few hours for a hunter spending one day at the site to a reasonable maximum of 180 hours for a trapper checking his traps every day for 90 days (2 hrs/day for 90 days). An absolute worst case could be defined by a trapper who checks his traps every day and also hunts several weekends. However, interviews with site personnel indicate that 180 hours is a reasonable upper boundary because (1) while some trappers may hunt, they do not check their traps daily and (2) an individual hunter does not return for each of the allowed weekends due to bag limits. Since receptors engaged in all of these activities are potentially exposed to the same media via the same exposure pathways, it is not considered necessary to evaluate a separate trapper exposed 90 days/yr for 2 hrs/day (180 hrs/yr) and hunter exposed 12 days/yr for 8 hrs/day (96 hrs/yr).

Comment No.	Page or Section	Comment	Response
22	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP; The units of (m/cm)(L/m^3) given for the conversion factor under the dermal contact while swimming/wading/showering is not clear. Please identify in the specific equations where this conversion factor would be used in the human health risk assessment.	Clarification. This conversion factor is needed for the equation for dermal contact with water: DAD = (C_w)(PC)(ETw)(CF)(SAS)(EFT)(ED) / [(BW)(AT)], Where: DAD = average dermally absorbed dose of the COPC (mg/kg-day, calculated), C_w = concentration of chemicals of concern (COC) in water (mg/L), PC = permeability coefficient (cm/hour, chemical-specific), ET_w = time of exposure (hours/event), CF = conversion factor (0.01 m/cm x 1000 L/m^3) SAS = surface area of the skin available for contact with contaminated medium (m^2), EF_T = exposure frequency (events/year), ED = exposure duration (years), BW = body weight (kg), AT = averaging time (days).
23	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP, Hunter/ Trapper; The inhalation rate of 20 m^3 day^{-1} is the standard default value given for residential and commercial/industrial receptor. The activities involving hunting and trapping usually require more walking and other physical activities. It may be appropriate to increase the inhalation rate of the hunter/trapper and the National guard trainee. Please provide justification for the inhalation rate given in table 2.	Clarification. These receptors engage in a variety of activities. Hunters spend the majority of their time sitting in one spot (resting activity level) with short periods of walking (light activity) and, if they are lucky, walking while dragging a dead deer (moderate to heavy activity). Trappers spend their time at the site walking (light activity) and walking carrying traps and animals (light to moderate activity). National Guard trainees have a wider range of activities that may include sitting in a tank or driving equipment (resting to light activity), walking/hiking/carrying a load (light to moderate activity), and digging/running/carrying heavy loads (moderate to heavy activity). These activity mixes went into the development of the default 20 m^3/day inhalation rate.

Comment No.	Page or Section	Comment	Response
24	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP, Hunter/ Trapper; The section of Table 2 titled, Ingestion of venison, includes parameters for estimating contaminant concentrations in the deer meat, and values for estimating the dose of contaminants to the hunter/trapper receptor. The brows ingestion rate, presumably for the deer, appears to be low. Please see the table below for life history information for the White-tailed deer. (Table is included as Attachment 1 to this comment response table). In addition, the browse ingested from site can only be made on a site specific basis by comparing the known contaminated area with the home range of the receptor. The value of 0.46 will be modified for each area of concern. Please make the appropriate changes to the table. These changes should also be made to the same parameters for the Resident Farmer.	Clarification. The browse ingestion rate of 0.87 kg dry weight/day is calculated from the 1.74 kg wet weight/day given in Sample and Suter (1994) with an assumed moisture content of 50 percent. Agreed. Fraction browse ingested from site will be changed to "exposure area/home range (where home range = 175 ha)."
25	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP, Hunter/ Trapper; The footnote "p" cited for the fish ingestion rate is incorrect. The 54 g of fish ingested per day is the default value given by U.S. EPA in the Human Health Evaluation Manual, Supplemental Guidance, "Standard Default Exposure Factors", 25 March 1991. Please ensure that the footnotes given in Table 2 are correct.	Agreed. The citations to footnotes have been corrected.
26	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP, Child Receptor; The Child receptor may want to be re-evaluated. Specifically, the exposure to sediments by the child trespasser may be reconsidered. Generally, risked posed by contaminated sediments are evaluated by trespassers that are young adults. It is not common to use a child (<1-<6 years of age) for this evaluation. One other parameter to considered in the reevaluation includes the child trespasser inhalation rate.	Clarification. The child is age 8-18 as requested in OEPA comments on Winklepeck Phase II report.

Comment No.	Page or Section	Comment	Response
27	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP, National Guard Trainee; The total skin surface area value of 0.53 m^2 should be consistent with the adult resident and open recreator if swimming and bathing are expected. With the inclusion of the potable ground water use for the National Guard receptor this change in total skin surface area is also warranted. Please make the appropriate changes to the table and text.	Clarification. Dermal contact with surface water is assumed to occur as a result of the following activities: Hunter/Trapper and National Guard Trainee – wading, exposing head, hands, forearms, and lower legs. Child Trespasser/Open Recreator/Resident Farmer – swimming, exposing entire body. Dermal contact with groundwater during showering (whole body) is assumed for the National Guard trainee and Resident Farmer using groundwater as a potable water source.
28	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP, National Guard Trainee; The dermal contact, Skin surface area value of 0.316 should be consistent with the value of 0.53 m^2 $event^{-1}$ used for the Open Recreator and the resident farmer. Please provide justification for the value or change the value appropriately.	Clarification. The National Guard trainee is assumed to have less exposed skin because, unlike recreational users, he/she is assumed to be wearing long pants.
29	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP, Resident Farmer; The Noncarcinogen averaging time for the resident farmer should be changed from 10950 days to 8760 days if the exposure duration is 30 years.	Clarification. Where a child resident is evaluated separately (i.e., soil ingestion, milk ingestion), the averaging time is broken into 8,760 days (24 years) for the adult and 2,190 days (6 years) for the child. For other exposure pathways, an averaging time of 10,950 days (30 years) is used.
30	Table 2.	Table 2. Parameters Used to Quantify Exposures for Each Medium and Receptor at Load Line 1 and 12, RVAAP, Resident Farmer; The Skin surface area was not provided for the child resident under the "sub surface soil" heading. Please provide the appropriate value or clarify that this receptor is only exposed to subsurface soils.	Clarification. The adult resident farmer is assumed to be exposed chronically to all media by all exposure pathways. The child resident farmer is also evaluated for the ingestion of soil/sediment and ingestion of milk since child ingestion rates are higher than adult ingestion rates for these pathways. The child is not evaluated separately for other exposure pathways (e.g., dermal exposure to soil) where lower ingestion rate/inhalation rate/surface area are offset by the smaller body weight of the child.

Comment No.	Page or Section	Comment	Response
31	Construction Worker Scenario	Discussions during the 13 and 14 February 2001 meeting broached the topic of including a construction worker scenario when deep (*e.g.,* >10 feet) contamination is identified at an AOC. Below are the construction worker parameters used at other remedial sites in Ohio: Construction worker scenario: Exposure Duration = 1 year Exposure Frequency = 250 days/year Inhalation Rate = 2.5 m^3/hr Soil Ingestion Rate = 138 mg/day Soil to Skin Adherence = 0.5 mg/cm2 Particulate Emission Factor = 5.3 E+05 m^3/kg Skin Surface Area = 2700cm^2	Clarification. No soil samples were collected below 5 feet at Load Lines 1 or 12. The cited parameters may be employed for AOCs where characterization of deep soils is performed or in subsequent phases of work at AOCs where RIs are ongoing. No text changes required.
Ecorisk General comment		The specific methods for completing the ecological risk assessment were not included in the text and therefore could not be reviewed. Without the review of these methodologies prior to the completion of the risk assessment, additional comments are expected on the eventual risk assessment product.	Comment noted. The technical memorandum was not intended to function as a risk assessment work plan. Some of the specific methods are included in the Load Lines 1 and 12 SAP Addenda issued in September 2000. Additional methods determined in the teleconference between Ohio EPA, USACE, RVAAP, and SAIC on March 8, 2001, have been incorporated into the tech memo per responses as noted below.
Ecorisk Comment 1	Page 13	Section 3.1, Problem Formulation, Chemical of potential Ecological Concern, Page 13; Please remove "by the state of Ohio" from the last sentence of this section. There are many agencies, and divisions and programs within the State of Ohio that use various screening values, therefore this statement is not entirely accurate.	Agreed. The words "by the State of Ohio" have been removed.
Ecorisk Comment 2	Page 14	Section 3.2 Exposure Assessment, page 14; The eighth bulleted item in section 3.2 state: "(t)op predators (red-tailed hawk, barn owl, red fox)-ingestion of prey and soil (fox only)." The "fox only" reference is not clear. Please provide additional information on the meaning of the "fox only" statement.	Clarification. "Fox only" means that the fox ingests flesh and soil. The assumed soil fraction of diet is 0.028 for the fox. By contrast, the hawk and owl do not ingest soil and have a soil fraction of diet of 0.0.

Comment No.	Page or Section	Comment	Response
Ecorisk Comment 3	Page 14	Section 3.2 Exposure Assessment, Page 14; Section 3.2 discusses the receptors that are planned to be used in the ecological risk assessment. Please find below the list of generic receptors that are suggested for use in an ecological risk assessment. It should also be noted that any State or Federally listed threatened or endangered species will also be included in the ecological risk assessment if such a species is identified to likely use the area under investigation. (receptors are shown as Attachment 2 to this comment response table).	Agreed**.** The generic list of receptors and also the telephone conversation on March 8, 2001, have been used to select the following receptors: <u>Soil Associated Receptors</u> Direct soil contact: plants, earthworms herbivore: deer mouse, white-tailed deer carnivore: red fox, barn owl (T&E species) invertivore: short-tailed shrew, American robin <u>Surface Water and Wetland Associated Receptors</u> Direct surface water/sediment contact: sediment macroinvertebrates, fish herbivore: mallard duck (for pond only) piscivore: great blue heron, mink
Ecorisk Comment 4	Table, 3.	Table, 3. Policy Goals, Ecological Assessment Endpoints, Measurement Endpoints, and Decision Rules for WBG; The title of the table should be changed. This document is for either Load Lines 1 and 12 or a facility wide assumptions document. Please correct the title of Table 3.	Agreed. The caption has been changed to read Load Lines 1 and 12.
Ecorisk Comment 5	Table, 3.	Table, 3. Policy Goals, Ecological Assessment Endpoints, Measurement Endpoints, and Decision Rules for WBG; Under Assessment Endpoint, and next to Policy Goal 1, the endpoint species is listed as the Barn Owl. Please see comment number four above. This endpoint species will be any State or Federally listed threatened or endangered species identified to likely use the area under investigation for any purpose. Please correct as necessary.	Clarification. It is assumed that habitats at LL1 and LL12 could provide some cover and food for the barn owl, a T&E species. Therefore, the barn owl is retained as an avian carnivore and also as a threatened and endangered species.
Ecorisk Comment 6	Table, 3.	Table, 3. Policy Goals, Ecological Assessment Endpoints, Measurement Endpoints, and Decision Rules for WBG; The decision Rule for policy goal 1 should include the use of an intraspecies uncertainty factor of either one (1/10) or one half (1/3) order of magnitude based on a log scale, for the chronic NOAEL for State or Federally listed threatened or endangered species.	Agreed. The decision rule for an intraspecies uncertainty factor has been added. This rule is 0.1 or 0.33 of the chronic NOAEL for T&E species. The documentation provided by Ohio EPA will be used to distinguish which analytes need which adjustment.

Comment No.	Page or Section	Comment	Response
Ecorisk Comment 7	Table, 3.	Table, 3. Policy Goals, Ecological Assessment Endpoints, Measurement Endpoints, and Decision Rules for WBG; Policy goal 3, the maintenance and protection of aquatic populations and ecosystems should include the use of Ohio EPA chemical specific and when appropriate the biological criteria as specified by section 3745-1 of the Ohio Administrative Code.	Agreed. The application of both chemical and biological criteria seems most appropriate in a baseline ERA. In the screening ERA, we will engage in the chemical part of this. First, we plan to compare the correct chemical screening values for Lake Erie Basin conditions to the maximum concentration of the surface water. Second, we plan to use AWQC and Tier II chemical values to compute HQs, which is a comparison of the TRV to the 95 percent UCL of the mean. After these two activities, there may be a need for a baseline ERA, and biological criteria would be handled at that time.
Ecorisk Comment 8	Page 18	Section 3.2 Exposure Assessment, Estimating Intake, Page 18; If this document is to be made into a facility wide risk assessment assumptions document, then all appropriate equations should be included.	Agreed. A facility-wide ERA will include the pertinent equations.
Ecorisk Comment 9	Page 18	Section 3.3 Effects Assessment, page 18; The methods used to develop the TRVs should be included in the document. It is not clear how the TRVs are to be develop, what uncertainty factors are to be used, or if allometric techniques are to be considered in the development of TRVs. Please include the appropriate information for review.	Agreed**.** The hierarchy of screening values in the pre-screen of all media values follows: soil: Efromyson et al. PRGs, U.S. EPA Region 5 EDQLs sediment: McDonald, Ingersoll, and Berger paper, U.S. EPA Region 5 EDQLs surface water: Ohio Water Quality Criteria for Lake Erie Basin, AWQC, Tier II Also per the March 8, 2001, teleconference: For the actual screening ERA on an exposure-by-exposure unit basis and receptor-by-receptor basis, we will use TRVs from the ORNL and other compilations, such as the McDonald, Ingersoll, and Berger paper. The exposure units for soil and for sediment/surface water are presented elsewhere. Note that allometric conversion, using a 0.75 factor, will be done for mammals, but no allometric conversion will be done for birds. Area use factors will be developed for the fox, deer, heron, and mink based, of course, on the relative sizes of the areas of exposure unit and home ranges of each ecological receptor.

ATTACHMENT 1 – Brian Tucker HH Risk Comment No. 24

Parameter	Definition	Receptor: White-tailed deer (*Odocoileus virginianus*)	
		Value	**Reference / Notes**
BW	Body weight (g)	56500	Sample and Suter (1994)
IR_f	Food ingestion rate (g g_{bw}^{-1} d^{-1})	0.031	1.74 kg d^{-1} (Sample and Suter 1994) converted to g g_{bw}^{-1} $d^{-1}$by dividing by body weight of 56500 g
Pf	Plant fraction of diet	0.98	Exclusively herbivorous, assumed to be vegetative parts (Sample and Suter 1994)
Af	Animal fraction of diet	0	Assumed to be negligible
Sf	Soil fraction of diet	0.02	Sample and Suter 1994
IRw	Water ingestion rate (g g_{bw}^{-1} d^{-1})	0.065	3.7 L d-1 (Sample and Suter 1994) converted to g g_{bw}^{-1} $d^{-1}$by dividing by body weight of 56500 g
HR	Home range (ha)	175	Geometric mean of minimum (59) and maximum (520) reported in Sample and Suter 1994
TUF	Temporal use factor	1	Assumed to be present year-round

ATTACHMENT 2 – Brian Tucker Ecological Risk Assessment Comment No. 3

Generic Receptor List

Soil Associated Receptors

Direct Soil Contact	**Herbivore**	**Carnivore***
Plants	**Meadow vole**	**Red-tailed hawk**
Earthworms	**Deer mouse**	**American kestrel**
	Eastern cottontail	**Red fox**
	White-tailed deer*	

Invertivore
Short-tailed shrew
American woodcock
American robin
Spotted sandpiper**

Surface Water and Wetland Associated Receptors

Direct Surface Water/sediment Contact	**Herbivore**	**Piscivore***
Aquatic Plant	**Muskrat**	**Mink**
Macroinvertebrates	**Mallard duck**	**Belted kingfisher**
Fish		**Great blue heron**

*** White-tailed deer are only to be evaluated when public concerns have been raised regarding white-tailed deer populations.**
**** Suggested invertivore for wetland habitats.**
***** For use in evaluating PBT compounds.**

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APPENDIX B

FINAL TECHNICAL MEMORANDUM (MARCH 2001)
COMMENT RESPONSE TABLE

Comment No.	Page or Section	Comment	Response
		General Comments	
1.	General	Please be aware that the comments on the above-referenced document will have an impact upon the recently-received draft Load Line 1 Phase II Remedial Investigation (RI) report, and the Load Line 12 report that is in the process of preparation.	Comment noted. The technical memorandum will be reissued as a revised final, incorporating the final comment response table and brief introduction stating that comments to the final technical memorandum will be addressed in context of changes to the draft final RI reports for LL1 and LL12. Additionally, the introduction will note that the final technical memorandum was reviewed and commented on by Ohio EPA and that future changes will be addressed in a Facility-Wide Risk Assessment Work Plan under preparation by USACE.
		Human Health Risk Assessment	
2.	Sect. 2.2.1, p. 2	Section 2.2.1 lists the subsurface soil depth as 1-5 feet bgs. This depth of investigation or consideration is not appropriate for use in a residential or other scenarios for which the receptors are potentially exposed to soils found at depths greater than 5 feet bgs. In addition, the Superfund RI process that is being followed for all investigations at the Ravenna Army Ammunition Plant (RVAAP) requires that the extent of contamination be determined during the RI before the risk assessments are completed. The extent of contamination is required for all directions which include vertical depth. Therefore, subsurface soils are to be evaluated in order to determine both the horizontal and vertical depth of contamination. It is also required, for human health risk assessments that evaluate a residential exposure scenario, to include soil contaminant concentrations up to a depth of 10 feet. If site conditions are such that subsurface soils are not present at depths less than 10 feet in all areas of the location under investigation, then this evidence is required in the risk assessment report. If only limited areas have subsurface soils at depths up to 10 feet, then only those soils/depths would be required to be evaluated in a residential scenario. The most common differentiation of soils used in human health risk assessments is 0-2 feet bgs for surface soils and 2-10 feet bgs for subsurface soils. For unique exposure scenarios (e.g., National guard Trainee, construction worker) the exposure to subsurface soils has to	Agreed. Residential receptors will be evaluated using soil samples collected from 0 to up to 10 feet bgs. At LL1 and LL12, sampling was conducted to 5 feet bgs or less because (1) shallow bedrock was encountered, (2) field screening analysis indicated deeper sampling was not necessary, and (3) there was no information to support an assumption that concentrations would increase with depth below 5 feet. Phase II samples were collected from 0-1, 1-3, and 3-5 feet (where possible) per the approved workplan, which is consistent with previous RVAAP investigations. Additional soil sampling would have to be performed under subsequent investigations for LL1 and LL12. The National Guard Trainee scenario has been applied previously at RVAAP and was developed from extensive discussions/interviews with Col. Tadsen (ONG), as well as input from Mark Patterson (OSC); Dave Brancato (USACE); and Eileen Mohr, Todd Fisher, and Brian Tucker (OEPA). This and all site-specific information used to develop exposure scenarios are documented using references to these interviews.

Comment No.	Page or Section	Comment	Response
		be defined and justified. No justification has been given regarding the depth of soils that may be disturbed during training/exercises and preparation of the training facilities/areas. These should be included in the revised Technical Memorandum, RI report, or facility-wide risk assessment work plan. Additional information/justification is required to support the use of the listed soil depths and, additional evaluations may be required based on the standard depths for surface and subsurface soils used in the risk assessment process.	Intrusive activities included in the National Guard Trainee scenario (e.g., digging foxholes) are (1) limited in area (i.e., some areas of the AOC may never be dug into), (2) potentially limited to a subset of receptors (i.e., different groups of trainees will engage in different activities), and (3) are uncertain (i.e., intrusive activities are an option, they may never occur, or they may occur sometime in the future); therefore, it is important to evaluate exposure to both surface and subsurface soil. Separation of these two media also allows risk managers to make decisions regarding future use and depth/type of remediation.
3.	Sect. 2.2.2, p. 3	Non-detects should be eliminated from a data set if they are located outside a known or delineated area of contamination. All data should be evaluated before an exposure concentration is determined, to ensure that non-detects are not incorrectly included and, thus, dilute or affect the standard deviation of the data set. Please ensure that the data sets are handled appropriately.	Clarification. Exposure point concentrations were calculated using EPA guidance*, Supplemental Guidance to RAGS: Calculating the Concentration Term* (EPA 1992), this includes using ½ the detection limit for non-detects. Exposure point concentrations are calculated to represent exposure concentrations within each exposure unit. Exposure units were selected to include (1) specific potential source areas (e.g., a building), or (2) the areas in between and around source areas where contamination is not expected to be present (i.e., Perimeter Area). Source areas were investigated using primarily biased sampling designed to identify the highest contaminant concentrations. No text changes are required to the draft final RI reports.
4.	Table 1	The category headings of subsurface soil and sediment are incorrect with respect to the listed exposure pathway column. Please correct.	Agreed. The LL1 and LL12 draft final Phase II RI reports will be reviewed to ensure that this typographical error is not present.

Comment No.	Page or Section	Comment	Response
5.	Table 1	The following exposures in the Residential Farmer-Child scenario should be considered complete and, therefore, included in the risk assessment: a) dermal contact and inhalation of volatile organic compounds (VOCs) and dust from surface soil (0-10 feet bgs); and b) ingestion, dermal contact, and inhalation of VOCs from groundwater. The response to comment #12 on page 12 states in part: "(t)he child is not evaluated separately for other exposure pathways where lower ingestion rate/inhalation rate/surface area are offset by the smaller body weight of the child." By eliminating pathway evaluations, cumulative consideration of exposure via multiple pathways are not quantified and, therefore, not acceptable. Even though the values may be "off set," the cumulative exposure is reduced and not appropriately evaluated. Please include all complete exposure pathway evaluations in the risk assessment.	Agreed. A separate Resident Farmer – Child scenario will be evaluated for all pathways in the draft final RI reports for LL1 and LL12.
6.	Table 1	The footnote for Table 1 does not give enough information regarding the "weighted average of the adult and child parameter values." All appropriate exposure pathways are to be considered in the risk assessment for both the adult and child Resident Farmer receptors (see comment #4 above). Cumulative considerations of multiple chemical exposures for the two receptors would not be adequately evaluated using this weighted average approach. This approach is not acceptable. A complete evaluation for the adult and child receptors that includes consideration for all complete exposure pathways should be incorporated into the RI report.	Clarification. The weighted average approach is taken from RAGs Part B. "Because the soil ingestion rate is different for children and adults, the risk due to direct ingestion of soil is calculated using an age-adjusted ingestion factor. The age-adjusted soil ingestion factor takes into account the difference in daily soil ingestion rates, body weights, and exposure durations for two exposure groups – children of one to six years and others of seven to 31 years." The equation for calculating this age-adjusted soil ingestion factor is given in RAGs Part B as: $IF = (IR_{child} \times ED_{child})/BW_{child} + (IR_{adult} \times ED_{adult})/BW_{adult}$ Where IF = age-adjusted soil ingestion factor (mg-yr/kg-day) IR = soil ingestion rate for child or adult (mg/day) ED = exposure duration for child or adult (years) BW = body weight for child or adult (kg)

Comment No.	Page or Section	Comment	Response
			This weighted average approach is used to evaluate potential cancer risks from a 30-year residential exposure (i.e., 6 years as a child and 24 years as an adult). The Residential Farmer – Adult and Child scenarios will be evaluated separately for all complete pathways in the draft final reports for LL 1 and LL12.
7.	Table 2	Table 1. Surface Soil, lists 1 hour day^{-1} as the exposure time for the Security Guard/Maintenance Worker. This value should be 8 hours day^{-1} as this is considered an occupational exposure.	Clarification. Security patrols occur daily across the site but not within LL1 or LL12; patrolmen usually remain within their vehicles during these patrols. Although the security guard is not currently exposed to contaminated media at LL1 or LL12 on a daily basis, the potential exposure of this receptor is evaluated in the BHHRA. As a worst-case assumption, it is assumed that a security guard leaves his or her vehicle on a daily basis and is exposed to surface soil, sediment, and surface water. While a security guard is expected to work 8 hours/day at RVAAP, the exposure time of 1 hour/day at each of these load lines is a conservative estimate because, in reality, the security guard is expected to walk around the LL1 or LL12 areas rarely, if at all, and has no reason to spend all day at a single location. No text changes required in the draft final RI reports for LL1 and LL12.
8.	Table 2	The citation for the Exposure duration (child) value under the Child trespasser column (surface soil) appears as a "q." Please ensure that the correct citation is given.	Agreed. The LL1 and LL12 draft final Phase II RI reports will be reviewed to ensure that all footnotes on this table are correct.
9.	Table 2	The citation for the child body weight under Child Trespasser (surface soil) is incorrect. Please correct the citation.	Agreed. The LL1 and LL12 draft final Phase II RI reports will be reviewed to ensure that all footnotes on this table are correct.
10.	Table 2	No value was given for skin surface area or adherence factor for the child resident. The values used most recently by Ohio EPA include 0.22 m^2 for skin surface area and 0.2 mg cm^{-2} for soil to skin adherence factor. Please include the appropriate values to the table.	Agreed. Residential Farmer – Adult and Child scenarios will be evaluated separately for all complete pathways in the draft final revisions of the LL 1 and LL12 risk assessments using the requested parameters.

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11.	Table 2	Values for the child resident receptor are required for the exposure duration and averaging times for dermal contact and inhalation of VOCs and dust. Please include this information in Table 2 and ensure that the risk and hazard calculations are completed for all appropriate media for the child receptor. Also, see comment #4 above for additional information.	Agreed. Residential Farmer – Adult and Child scenarios will be evaluated separately for all complete pathways in the draft final revisions of the LL 1 and LL12 risk assessments using the requested parameters.
12.	Table 2	The use and evaluation of multiple exposures should be re-evaluated. The rationale and input parameters used in the quantification of exposure to multiple media is not clear without the intended equations or algorithms. It appears that many of the receptors that are exposed to multiple media are being assessed very conservatively. For example, the Resident Farmer child is evaluated using the assumption that complete exposure pathways exist for surface soil, subsurface soil, and sediment. The soil ingestion rate for the Resident Farmer child for all three media is 200 mg day^{-1}, thereby estimating a total soil/sediment intake for the receptor at 600 mg day^{-1}. This evaluation is acceptable as being protective of human health. However, it may not be a realistic evaluation of potential intake and exposure. Additional discussion and evaluation of the input parameters should be considered prior to the completion of the human health risk assessment.	Clarification. We agree that applying the RME scenarios to multiple exposure media will result in overly conservative estimates of risk. For that reason, no cumulative exposure to multiple media is calculated, nor is it appropriate at this site. Throughout the LL1 and LL12 and previous assessments, potential exposures have been evaluated separately for each environmental medium. This previously agreed-to approach is appropriate at this site for the following reasons: • RME scenarios are evaluated. These RME scenarios include reasonable maximum exposure parameters and assumptions for each medium. For example, the child trespasser scenario assumes a receptor spends 2 hours/day, 50 days/year at LL 1 or LL12. This assumption is applied to exposure to surface soil, surface water, and sediment. These exposure media are evaluated separately. Combining these three exposure media would result in a trespasser spending 150 days/year at LL 1 or LL12. • A combined RME scenario (for multiple exposure media) may be developed (e.g., the trespasser spends 1/3 of his time at each type of media (soil, surface water, sediment). However, such a scenario tends to result in what ifs (e.g., what if the child only visits soil areas and does not like the water). • Media are not always co-located and many exposure units were evaluated. The LL 1 and LL12 RIs include the evaluation of multiple soil and surface water/sediment areas (samples grouped to address areas in close proximity, areas with similar operational histories, and

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			similar drainage features). For some of these surface water/sediment areas, a sediment sample was collected, but the corresponding surface water sample was not collected due to dry conditions. No text changes are required to the draft final RI reports for LL1 and LL12.
13.	Table 2	The exposure frequency for subsurface soil exposure for the National Guard Trainee is listed as 28 days year^{-1}. This is in contrast to the exposure frequency of 180 days year^{-1} used for surface soil exposures. Although these values for estimating activities may be appropriate, the use and evaluation of separate surface and subsurface exposures is not clear. The standard practice is to estimate how deeply soils will be disturbed by various activities and then evaluate only one depth or type of soil exposure. For example, it is generally considered that soils for home construction are disturbed to a depth of 10 feet (this is considered the depth to which soils are dug for the installation of a basement). Therefore, residential exposure to soil (note: there is no differentiation between surficial and subsurface soils) is assumed to be from soils from 0-10 feet, and the site is evaluated (sampled) to the appropriate depth. If the National Guard Trainees are exposed to soils only to a depth of 5 feet due to activities such as digging "fox holes," concealing armor, or other activities that involve digging into soil (this needs to be justified and documented in the risk assessment), then the most appropriate and consistent method of evaluating soil exposure would be to consider one depth of soil exposure from 0-5 feet bgs. If this cannot be justified, then modifications are required to the Technical Memorandum and planned risk assessments. The same rationale that is used for exposure to soil in the residential scenario (soil brought to the surface and therefore available for exposure) should be used in all scenarios that may include exposure to subsurface soils. If an argument can be made that National Guard Trainees are only exposed to specific strata of soil and that the subsurface soils are returned to their original depth/location (i.e., no mixing of soils occurs during	Clarification. The types of potential intrusive activities that may be conducted by National Guard Trainees are very different from a standard residential scenario. Intrusive activities included in the National Guard Trainee scenario (e.g., digging foxholes) are (1) limited in area (i.e., some areas of the AOC may never be dug into), (2) potentially limited to a subset of receptors (i.e., different groups of trainees will engage in different activities), and (3) are uncertain (i.e., intrusive activities are an option, they may never occur, or they may occur sometime in the future); therefore, it is important to evaluate exposure to both surface and subsurface soil. Separation of these two media also allows risk managers to make decisions regarding future use and depth/type of remediation. The National Guard Trainee scenario was developed from extensive discussions/interviews with Col. Tadsen (ONG), as well as input from Mark Patterson (OSC); Dave Brancato (USACE); and Eileen Mohr, Todd Fisher, and Brian Tucker (OEPA). This and all site-specific information used to develop exposure scenarios are documented using references to these interviews.

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		the removal and replacement of soils), then separate evaluations for surface and subsurface soils would be appropriate. Please correct/clarify the methods that will be used to evaluate exposure to surface and subsurface soils for the National Guard Trainee scenario.	
14.	Table 2	The inhalation rate for any of the receptors in the various scenarios that may be exposed to either surface or subsurface soils needs to be clarified/justified. The inhalation rate for all receptors is listed as 20 m^3day^{-1}. This value is acceptable for receptors that spend long periods of time at the site and are involved in light activities. This inhalation rate should not be used for receptors that are expected to be involved in heavy or energetic activities with limited exposure (i.e., short exposure durations). In addition, the inhalation rate for any receptor that is not spending 24 hours per day at a site should be given in units of m^3hour^{-1}. One example of a receptor that is involved in activities that are likely to produce inhalation rates greater than the resting rate include the construction worker scenario recently developed by Ohio EPA-DERR. An inhalation rate of 1.85 m^3hour^{-1} was selected as the default value. The inhalation rate is a weighted average that estimated one-fourth of the time at work is spent doing light activities at an inhalation rate of 1.0 m^3hour^{-1}; one-half of the time at work is spent doing moderate activities at an inhalation rate of 1.6 m^3hour^{-1}; and one-fourth of the time at work is spent doing strenuous activities at an inhalation rate of 3.2 m^3hour^{-1}. This results in an estimated point value of 1.85 m^3hour^{-1} (0.25(1.0) + 0.5(1.6) + 0.25(3.2) = 1.85). A similar technique should be used to develop an inhalation rate for the National Guard Trainee and possibly for the Hunter/Trapper whose current default value is 0.83 m3hour-1.	Clarification. Inhalation rate units of m^3/day are converted to m^3/day using a conversion factor in days/hour. The recently proposed construction worker inhalation rate will be applied to the National Guard in the draft final RI reports for LL1 and LL12. The hunter/trapper scenario does not involve strenuous activity. Hunters tend to walk into an area, sit down, and wait. Similarly, most of the trapper's time is spent walking or driving between traps.

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15.	Table 2	The soil to skin adherence factor for the Open Recreator and Hunter/Trapper (surface soil) of 0.07 mg cm^{-2} should be changed to something more consistent with the expected exposure at the site. The value was based on an appropriate activity (soccer playing). However, upon evaluation of the literature that was cited for the value, it was identified that two of the three groups of individuals that were playing soccer, from which the value was derived, were doing so on an artificial playing field made from sand and recycled/ground tires. Therefore, the "soil" adherence factor calculated from this study is not representative of actual soil exposure and should not be used. The soil to skin adherence factor of 0.2 mg cm-2 that is used for the Child Trespasser, or Open Industrial Worker, would be acceptable, or another value could be proposed. Please make the appropriate changes.	Per agreement in the July 17, 2002, comment resolution meeting, 0.07 mg cm^{-2} will be retained in the LL1 and LL12 RI reports for the open recreational and hunter/trapper scenarios. The reference for this value will be RAGS Part E.
16.	Table 2	In addition to the inappropriate use of Andelman's K constant to evaluate exposure to VOCs from contaminated surface water, the units given in Table 2 should be changed to better reflect the actual value. Andelman's K (0.0005) is a unitless constant. It is however commonly given with a conversion factor of 1000 Lm-3 that is used, so the resulting air concentration is expressed in units of mg m-3. When the use of Andelman's K is appropriate, it should be cited as given in the original paper, or the U.S. EPA, RAGS, Part B, Development of Risk-based Preliminary Remediation Goals, 1991, guidance document, which is 0.0005 × 1000 L m3.	Ohio EPA will provide box model equations for future reports to be used for a volume of air across a surface water source area with partitioning from the source to air, based on Henry's law. The LL1 and LL12 reports will address this issue qualitatively because few or no volatile compounds were identified in surface water or groundwater at these sites.

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17.	Table 2	No specific equations or algorithms were given in the technical memorandum regarding how the tissue contaminant concentrations were to be calculated. Therefore, some of the parameters are not clear in their use and cannot be verified as being acceptable. These parameters include: conversion factor (ingestion of venison), fat ratio (ingestion of venison), resuspension multiplier (ingestion of beef, pork), resuspension multiplier (ingestion of milk products), and resuspension multiplier (ingestion of vegetables). Animal and plant tissue contaminant concentrations should be estimated using the same methods that are used to estimate these values for evaluating possible ecological risk. Many of the parameters listed do not appear to be consistent with the ecological risk assessment methods. In addition, any "site-specific" citations should be given a source (person or department) and a rationale for why and/or how the values were estimated. Please make the appropriate changes to Table 2 to ensure the correct values are used in the subsequent risk assessments.	Clarification. The equations for calculating tissue concentrations were originally presented in the Sampling and Analysis Plan (SAP) for Winklepeck Burning Grounds (WBG) (1998). These equations are repeated in the LL1 and LL12 Phase II RI reports and the parameters used are referenced there. While it is desirable to have the ecological and human health risk evaluations agree whenever possible, differing levels of rigor do not always allow for this.
18.	Table 2	The browse rate for the white-tailed deer listed in Table 2 is given as a dry weight per day. For convenience, a browse rate factor of 1.74 kg day^{-1} (wet weight) is offered and should be used.	Agree. The browse ingestion rate of 0.87 kg dry weight/day reported in the Technical Memorandum and used in the LL1 and LL12 risk assessments was calculated from the 1.74 kg wet weight/day given in Sample and Suter (1994) with an assumed moisture content of 50%. This clarification will be included in the draft final RI reports for LL1 and LL12.
19.	Table 2	The venison ingestion rate of 0.03 kg day^{-1} given for the Hunter/Trapper and the Resident Farmer is consistent with an estimated intake of one meal per week. This value is acceptable. However, this value would not be consistent for use in the evaluation of a subsistence type exposure. If concerns are raised that a subsistence Hunter/Trapper should be evaluated, then this parameter will have to be increased accordingly. In addition, the value of 0.054 kg day^{-1} given for the "fish ingestion rate" is also considered a recreational exposure. Additional information regarding the type of exposure that is being evaluated (e.g., recreational exposure) should be described in detail in the risk assessments and RI reports.	Clarification. Any hunting and fishing activities at LL1 and LL12 will be recreational. Subsistence scenarios are not consistent with potential future use of this property. These assumptions will be noted in the LL1 and LL12 draft final RI reports.

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20.	Table 2	The value of 0.46 given for the "fraction browse ingested from site" should be recalculated based on the home range (175 ha) of the receptor (white-tailed deer) and the exposure area (area or extent of contamination) of the site. This was agreed upon in the response to comment but not changed in the final version of the technical memorandum. Please correct the value.	Agreed. The requested change will be made in the draft final RI reports for LL1 and LL12.
21.	Table 2	Please provide a copy of the reference cited for "quantity of soil ingested by cow," which was cited as Darwin, 1990.	Agreed. The reference will be supplied.
22.	Table 2	The title of section "ingestion of beef, pork," might be changed to reflect that only the cow is being evaluated as an exposure medium.	Agreed. The LL1 and LL12 draft final RI reports will refer only to beef ingestion.
23.	Table 2	An explanation is required for the values given for the "fraction of cow's food from on-site" in the categories entitled ingestion of beef and pork, and ingestion of milk products, that explains why the values given for them are not consistent for the two evaluations. It would seem logical that the values should be consistent in the absence of justification. Please provide a justification other than "site specific (value assumed for site or value obtained from site personnel)" in the risk assessment report.	Clarification. The fractions are correct. The values are sourced from the Risk Assessment Information Management System (University of Tennessee/Oak Ridge National Laboratory web site), which provides two different values derived from personal communication with the Roane County, Tennessee, Agricultural Extension Agent. A milk cow might be expected to receive more supplemental feed than a beef cow; therefore, the ratios of food from on-site versus off-site are different.
		Ecological Risk Assessment	
24.		Specific information regarding the ecological risk assessment process was not included in the Final Technical Memorandum, Human Health and Ecological Risk Assessment Approach for Load Line 1 and Load Line 12, Ravenna Army Ammunition Plant, Ravenna, Ohio. Therefore, no comments are given regarding the specific calculations of proposed risk assessment.	Comment noted.

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25.	Table 4	The Decision Rule given for Assessment Endpoint #6 "Maintenance of aquatic organisms, according to Ohio EPA chemical specific criteria or, when appropriate, according to biological criteria as specified by section 3745-01 of the Ohio Administrative Code" should be changed. No discussion of hazard quotient (HQ) values are appropriate when water quality criteria are used. The decision rule should state that surface waters will be in full attainment of the chemical specific and, when appropriate, biological criteria. This decision criteria will be used to determine whether a water body has been adversely impacted by site-related compounds. Please make the changes to the text.	Agreed. The decision rule for assessment endpoint 6, maintenance of aquatic organisms, will be revised in the draft final RI reports for LL1 and LL12 in order to delete discussion of hazard quotients (HQs) when water quality criteria state ARARs are used, and to mention that the surface waters will be in full attainment of the chemical-specific and, when appropriate, biological criteria.
26.	Sect. 3.2.3, p. 20	The second sentence of the second paragraph on page 20 states: "(a)llometric conversion, using a 0.75 factor, will be done for mammals, but no allometric conversion will be done for birds." Although allometric conversions of toxicity data will not be done for birds, adjustments to toxicity values for birds may need to be made based on the exposure periods (i.e., acute, sub-acute, sub-chronic, and chronic) used in the critical studies and taxonomic relationship (i.e., interspecies adjustments) of the test species to the target receptor. Please ensure that the appropriate adjustments are made to toxicity values for avian receptors.	Clarification. Avian, as well as mammal TRVs, were adjusted by two uncertainty factors: duration conversion factors to account for extrapolating from subchronic to chronic tests, and endpoint conversion factors to account for extrapolating from LOAELs to NOAELs. This clarification will be added to the text of the draft final RI reports for LL1 and LL12.
27.	Sect. 3.3, p. 20	Toxicity reference values (TRVs) are to be based on chronic NOAELs. When chronic NOAEL values are not available for any given receptor, then adjustments are to be made to extrapolate to a chronic NOAEL. See Attachment C of the Draft Level III Ecological Risk Assessment Guidance document for the preferred method of deriving acceptable toxicity criteria for use in ecological risk assessments. This draft guidance document also includes information on the appropriate use and selection of uncertainty factors.	Agreed. Text will be revised in the draft final RI reports for LL1 and LL12 to clarify that TRVs are to be based on chronic NOAELs, and if a chronic NOAEL is not available, adjustments are made via an endpoint conversion factor (0.1) to extrapolate the toxicity values to a chronic NOAEL.

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