NEW MEXICO ENVIRONMENT DEPARTMENT

Risk Assessment Guidance for Site Investigations and Remediation

Volume II
Soil Screening Guidance for Ecological Risk Assessments

2017 Revised

EXECUTIVE SUMMARY

This guidance document is being developed in coordination with the New Mexico Environment Department's (NMED) Hazardous Waste Bureau (HWB) and the Ground Water Quality Bureau.

This guidance document sets forth recommended approaches based on current State and Federal practices and intended for used as guidance for employees of NMED and for facilities within the State of New Mexico.

In the past, the material contained within this document existed in three separate guidance and/or position papers. To streamline the risk assessment process and ensure consistency between guidance/position papers, these documents have been combined into one document: *Risk Assessment Guidance for Site Investigations and Remediation*.

The *Risk Assessment Guidance for Site Investigations and Remediation* dated February 2017 replaces and supersedes previous versions of this document as well as the following documents:

- *Technical Background Document for Development of Soil Screening Levels*, Revision 6.0, 2012,
- *New Mexico Environment Department TPH Screening Guidelines*, October 2006, and
- *Risk-Based Remediation of Polychlorinated Biphenyls at RCRA Corrective Action Sites*, NMED Position Paper, March 2000.
- *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment*, 2008 (Parts 1-3).

This *Risk Assessment Guidance for Site Investigations and Remediation* is organized into two volumes.

- Volume I –Soil Screening Guidance for Human Health Risk Assessments
- Volume II - Soil Screening Guidance for Ecological Risk Assessments

Volume I contains information related to conducting screening level human health risk assessments. Previously, the soil screening levels (SSLs) were available in the *Technical Background Document for Development of Soil Screening Levels* while the screening levels for total petroleum hydrocarbons (TPH) were found in the *New Mexico Environment Department TPH Screening Guidelines*. Now both are contained in Volume I. Volume I also summarizes SSLs for select Aroclors, congeners of polychlorinated biphenyls (PCBs) and chemicals of emerging concern.

Volume II provides guidance for conducting ecological risk assessments and contains guidance that was previously provided in the *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment*, 2008 (Parts 1-3).

SUMMARY OF CHANGES

The following table summarizes changes to the "Risk Assessment Guidance for Investigations and Remediation," Volume II. Specific changes are as follows:

Item	Section	Change
VOLUME II SOIL SCREENING GUIDANCE FOR ECOLOGICAL RISK ASSESSMENTS		
November 2014		
1	Global	Updating of references
2	Global	General editorial corrections
3	Section 3	Additional clarification of Screening Level Ecological Risk Assessments (SLERA) for Phase I – revised Tier 1 assessments and added updated methodologies and equations
4	Section 4	Added Tier 2 SLERA methodologies and equations
5	Section 5	Site-specific ecological risk assessments added as Tier 3 process
July 2015		
6	Section 4	Added references to the toxicity reference values (TRVs) and Ecological Screening Levels (ESLs) provided in Attachment C
7	Section 4	Added Equation 8 for derivation of the screening level hazard quotient (SLHQ)using site concentrations and the ESLs (added as Attachment C)
8	Attachment C	Added new tables listing TRVs for Tier 1 and Tier 2 key ecological receptors and ESLs for Tier 1 key receptors
January 2017		
9	General	Editorial updates
10	Scoping Assessment Checklist	Checklist is now listed as an optional tool to use; it is not a requirement
11	Section 3	Clarified soil exposure intervals; to include revision of non-burrowing receptors soil exposure interval
12	Section 3	Added guidance on aquatic receptors
13	Section 4	Corrected Equations 13-17 for wet weight conversion factor
14	Section 5	Updated to include Tier 3 guidance from *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment. Volume II replaces the previous document (parts 1-3)*

Item	Section	Change
15	Appendix C	Updated TRVs

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Acronymns and Abbreviations

AUF	Area Use Factor
BAF	Bioaccumulation/Biomagnification Factor
bgs	below ground surface
COPEC	Constituent of Potential Ecological Concern
CSM	Conceptual Site Model
DQO	Data Quality Objective
EPC	Exposure Point Concentration
ESL	Ecological Screening Level
ft	foot
FOD	Frequency of Detection
HI	Hazard Index
HQ	Hazard Quotient
kg	kilogram
Kow	octanol-water partition coefficient
LOAEL	Lowest-observed adverse effect level
LULC	land use and land cover
mg	milligram
NMED	New Mexico Environment Department
NOAEL	No-observed adverse effect level
PCSEM	Preliminary Conceptual Site Exposure Model
PUF	Plant Uptake Factor
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SAP	Sampling and Analysis Plan
SLERA	Screening Level Ecological Risk Assessment
SLHQ	Screening Level Hazard Quotient
SSG	Soil Screening Guidance
SWMU	Solid Waste Management Unit
T&E	Threatened and Endangered
TRV	Toxicity Reference Value
UCL	Upper Confidence Level
US EPA	United States Environmental Protection Agency

1.0 INTRODUCTION

The purpose of an ecological risk assessment is to evaluate the potential adverse effects that chemical contamination has on the plants and animals that make up ecosystems. The risk assessment process provides a way to develop, organize and present scientific information so that it is relevant to environmental decisions.

The New Mexico Environment Department (NMED) has developed a tiered procedure for the evaluation of ecological risk. Volume II of this *Risk Assessment Guidance for Investigations and Remediation* (SSG) outlines the steps for conducting ecological risk assessments from the scoping assessment, to the screening assessment to the site-specific assessment. Phase I Assessments include a qualitative scoping assessment and a quantitative screening assessment, while Phase II assessments provide for more detailed (or site-specific) evaluations. analyses. This document replaces the guidance contained in the *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment* (NMED, 2008). Briefly, the tiers of the procedure are organized as follows:

PHASE I – SCOPING AND SCREENING ASSESSMENTS

- Scoping Assessment
- Screening Assessment (Tier 1 and 2)

PHASE II - SITE-SPECIFIC ASSESSMENTS

- Site-Specific Ecological Risk Assessment (Tier 3)

As discussed above and illustrated in Figure 1, the Scoping Assessment is the first phase of the Screening-Level Ecological Risk Assessment process. This document provides specific procedures to assist the facility in conducting the first phase (Scoping and Screening Assessments), of the Screening-Level Ecological Risk Assessment process. The purpose of the Scoping Assessment is to gather information, which will be used to determine if there is "any reason to believe that ecological receptors and/or complete exposure pathways exist at or in the locality of the site" (NMED, 2014). The scoping assessment step also serves as the initial information-gathering phase for sites clearly in need of a more detailed assessment of potential ecological risk. This document outlines the methodology for conducting a Scoping Assessment, and includes an optional Site Assessment Checklist (Attachment A), which can serve as tool for gathering information about the facility property and surrounding areas. The attached Site Assessment Checklist provides a user-friendly template, which both guides the user as to what information to collect and furnishes an organized structure in which to enter the information.

After a determination is made that ecological receptors may be present at the site, using either site knowledge or the Site Assessment Checklist, the assessor will use the collected information to generate a Scoping Assessment Report and Preliminary Conceptual Site Exposure Model (PCSEM). The Scoping Assessment Report and PCSEM are subsequently used to address the first in a series of Technical Decision Points of the tiered process. Technical Decision Points are questions which must be answered by the assessor after the completion of certain phases in the

process. The resulting answer to the question determines the next step to be undertaken by the facility. The first Technical Decision Point, as illustrated in Figure 1, is to decide: *Is Ecological Risk Suspected?*

If the answer to the first Technical Decision Point is "no" (that is, ecological risk is not suspected), the assessor may use the Exclusion Criteria Checklist and Decision Tree (Attachment B) to help confirm or deny that possibility. However, it is unlikely that any site containing potential ecological habitat or receptors will meet the Site Exclusion Criteria.

If ecological risk is suspected, the facility will usually be directed to proceed to the Tier 1 Screening Level Ecological Risk Assessment (SLERA) and, if needed, refined Tier 2 SLERA. A SLERA is a simplified risk assessment that can be conducted with limited site-specific data by defining assumptions for parameters that lack site-specific data (US EPA, 1997). Values used for screening are consistently biased in the direction of overestimating risk to ensure that sites that might pose an ecological risk are properly identified. While not required, the Site Assessment Checklist is a valuable source of information that can aid in the completion of the SLERA. Additional information on performing a SLERA can be found in several EPA guidance documents (e.g., US EPA, 1997; US EPA, 1998).

2.0 SCOPING ASSESSMENT

The Scoping Assessment serves as the initial information gathering and evaluation for the Phase I process. A Scoping Assessment consists of the following steps:

- Compile and assess basic Site information,
- Conduct site visit,
- Identify preliminary contaminants of potential ecological concern (COPEC),
- Develop a PCSEM, and
- Prepare a scoping assessment.

The following subsections provide guidance for completing each step of the Scoping Assessment.

2.1 Compile and Assess Basic Site Information

The first step of the Scoping Assessment process is to compile and assess basic site information. Since the purpose of the Scoping Assessment is to determine if ecological habitats, receptors, and complete exposure pathways are likely to exist at the site, those items are the focus of the information gathering. The Site Assessment Checklist (Attachment A) is a tool that may be used to complete this step.

In many cases, a large portion of the Site Assessment Checklist can be completed using reference materials and general knowledge of the site. A thorough file search should be conducted to compile all potential reference materials. Resource Conservation and Recovery Act (RCRA)

Facility Assessment (RFA) and Facility Investigation (RFI) reports, inspection reports, RCRA Part B Permit Applications, and facility maps can all be good sources of the information needed for the Site Assessment Checklist.

Habitats and receptors which may be present at the site can be identified by contacting local and regional natural resource agencies. Habitat types may be determined by reviewing land use and land cover maps (LULC). Additional sources of general information for the identification of ecological receptors and habitats are listed in the introduction section of the Site Assessment Checklist (Attachment A).

2.2 Site Visit

When performing a Scoping Assessment, at least one site visit should be conducted to directly assess ecological features and conditions. The site visit allows for verification of the information obtained from the review of references and other information sources. The current land and surface water usage and characteristics at the site can be observed, as well as direct and indirect evidence of receptors. In addition to the site, areas adjacent to the site and all areas where ecological receptors are likely to contact site-related chemicals (i.e., all areas which may have been impacted by the release or migration of chemicals from the site) should be observed or visited. The focus of the habitat and receptor observations should be on a community level. That is, dominant plant and animal species and habitats (e.g., wetlands, wooded areas) should be identified during the site visit. Photographs should be taken during the site visit and attached to the Scoping Assessment summary. Photographs are particularly useful for documenting the nature, quality, and distribution of vegetation, other ecological features, potential exposure pathways, and any evidence of contamination or impact. While the focus of the survey is on the community level, the U.S. Fish and Wildlife Service and the New Mexico Natural Heritage Program should be contacted prior to the site visit. The intent is to determine if state listed and/or federal listed Threatened & Endangered (T&E) species or sensitive habitats may be present at the site, or if any other fish or wildlife species could occur in the area. A trained biologist or ecologist may need to conduct biota surveys to appropriately characterize major habitats and to determine whether T&E species are present or may potentially use the site. The site assessment should also include a general survey for T&E species and any sensitive habitats (e.g. wetlands, perennial waters, breeding areas), since federal and state databases might not be complete.

Site visits should be conducted at times of the year when ecological features are most apparent (i.e., spring, summer, early fall). Visits during winter might not provide as much evidence of the presence or absence of receptors and potential exposure pathways.

In addition to observations of ecological features, the assessor should note any evidence of chemical releases (including visual and olfactory clues), drainage patterns, areas with apparent erosion, signs of groundwater discharge at the surface (such as seeps or springs), and any natural or anthropogenic site disturbances.

2.3 Identify Contaminants of Potential Ecological Concern

COPECs are chemicals which may pose a threat to individual species or biological communities. For the purposes of the Scoping Assessment, all chemicals known or suspected of being released at the site are considered COPECs. The identification of COPECs is usually accomplished by the review of historical information in which previous site activities and releases are identified, or by sampling data which confirm the presence of contaminants in environmental media at the site. If any non-chemical stressors such as mechanical disturbances or extreme temperature conditions are known to be present at the site, they too are to be considered in the assessment.

After the COPECs have been identified, they should be summarized and organized (such as in table or chart form) for presentation in the Scoping Assessment summary.

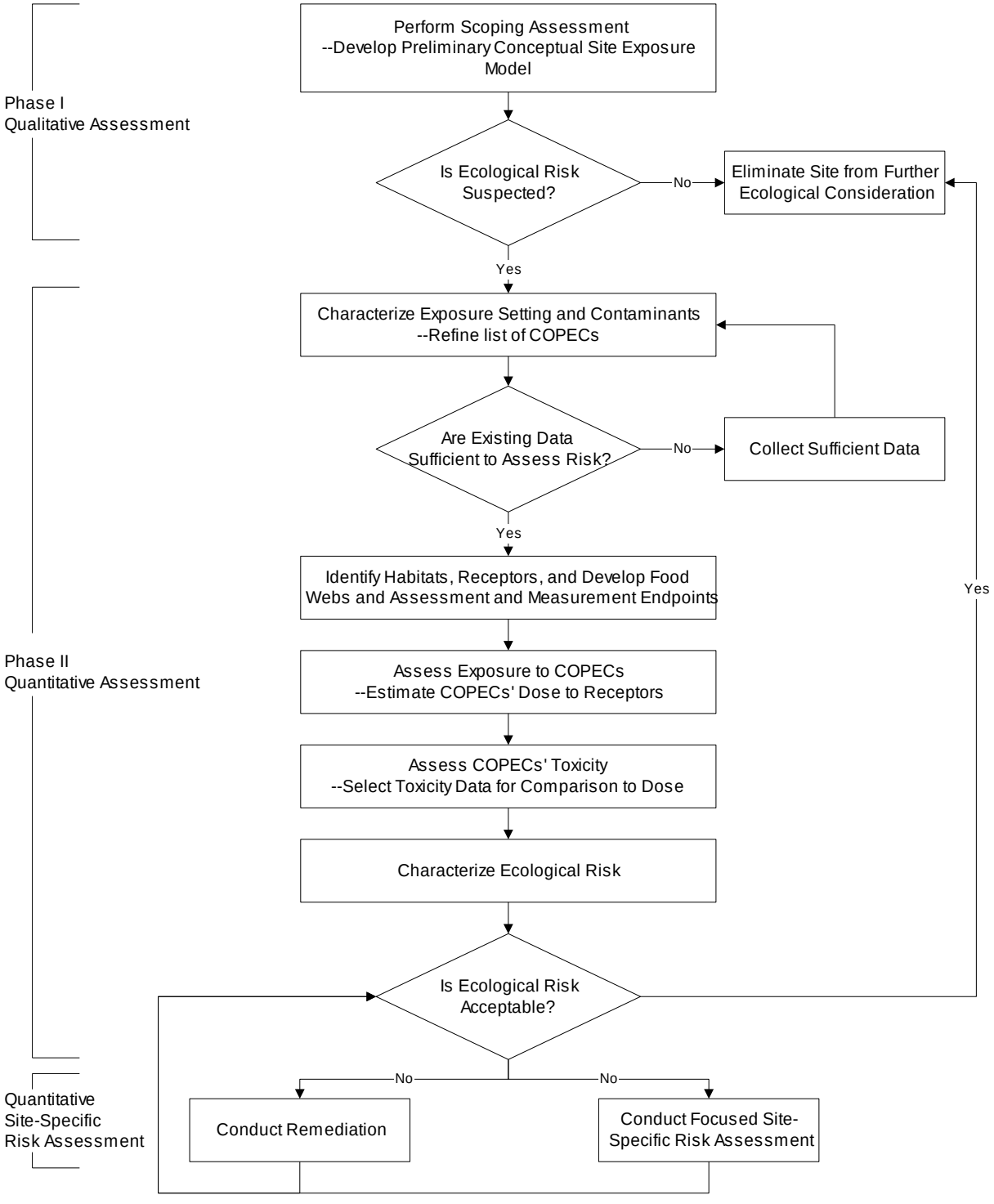
2.4 Developing the Preliminary Conceptual Site Exposure Model

A PCSEM provides a summary of potentially complete exposure pathways, along with potentially exposed receptor types. The PCSEM, in conjunction with the scoping report, is used to determine whether further ecological assessment (i.e., Screening-Level Assessment, Site-Specific Assessment) and/or interim measures are required.

A complete exposure pathway is defined as a pathway having all of the following attributes (US EPA, 1998; NMED, 2014):

- A source and mechanism for hazardous waste/constituent release to the environment;
- An environmental transport medium or mechanism by which a receptor can come into contact with the hazardous waste/constituent;
- A point of receptor contact with the contaminated media or via the food web; and
- An exposure route to the receptor.

If any of the above components are missing from the exposure pathway, it is not a complete pathway for the site. A discussion regarding all possible exposure pathways and the rationale/justification for eliminating any pathways should be included in the PCSEM narrative and in the risk assessment.



Adapted from GAERPC (NMED 2000).

Figure 1. NMED Ecological Risk Assessment Process

The PCSEM is presented as both a narrative discussion and a diagram illustrating potential contaminant migration and exposure pathways to ecological receptors. A sample PCSEM diagram is presented in Figure 2. On the PCSEM diagram, the components of a complete exposure pathway are grouped into three main categories: sources, release mechanisms, and potential receptors. As a contaminant migrates and/or is transformed in the environment, sources and release mechanisms can be defined as primary, secondary, and tertiary.

For example, Figure 2 depicts releases from a landfill that migrate into soils, and reach nearby surface water and sediment via storm water runoff. In this situation, the release from the landfill is considered the primary release, with infiltration as the primary release mechanism. Soil becomes the secondary source, and storm water runoff is the secondary release mechanism to surface water and sediments, the tertiary source.

Subsequent ecological exposures to terrestrial and aquatic receptors will result from this release. The primary exposure routes to ecological receptors are direct contact, ingestion, and possibly inhalation. For example, plant roots will be in direct contact with contaminated sediments, and burrowing mammals will be exposed via dermal contact with soil and incidental ingestion of contaminated soil. In addition, exposures for birds and mammals will occur as they ingest prey items through the food web.

Although completing the Site Assessment Checklist will not provide the user with a readymade PCSEM, a majority of the components of the PCSEM can be found in the information provided by the Site Assessment Checklist. The information gathered for the completion of Section II of the Site Assessment Checklist, can be used to identify sources of releases. The results of Section III, Habitat Evaluation, can be used to both identify secondary and tertiary sources and to identify the types of receptors which may be exposed. The information gathered for completion of Section IV, Exposure Pathway Evaluation, will assist users in tracing the migration pathways of releases in the environment, thus helping to identify release mechanisms and sources.

Once all of the components of the conceptual model have been identified, complete exposure pathways and receptors that have the potential for exposure to site releases can be identified.

2.5 Assembling the Scoping Assessment Summary

After completion of the previously described activities of the scoping assessment, the information should be provided as justification for the screening assessment to support the decision made regarding the first Technical Decision Point (Is Ecological Risk Suspected?). Critical information gained from the Scoping Assessment includes:

- Existing Data Summary,
- Site Visit Summary (and Site Assessment Checklist, if completed),
- Evaluation of Receptors and Pathways,
- Recommendations,

- Attachments (e.g. photographs, field notes, telephone conversation logs with natural resource agencies), and
- References/Data Sources

This information is typically included as part of the site investigation (e.g., RFI) report.

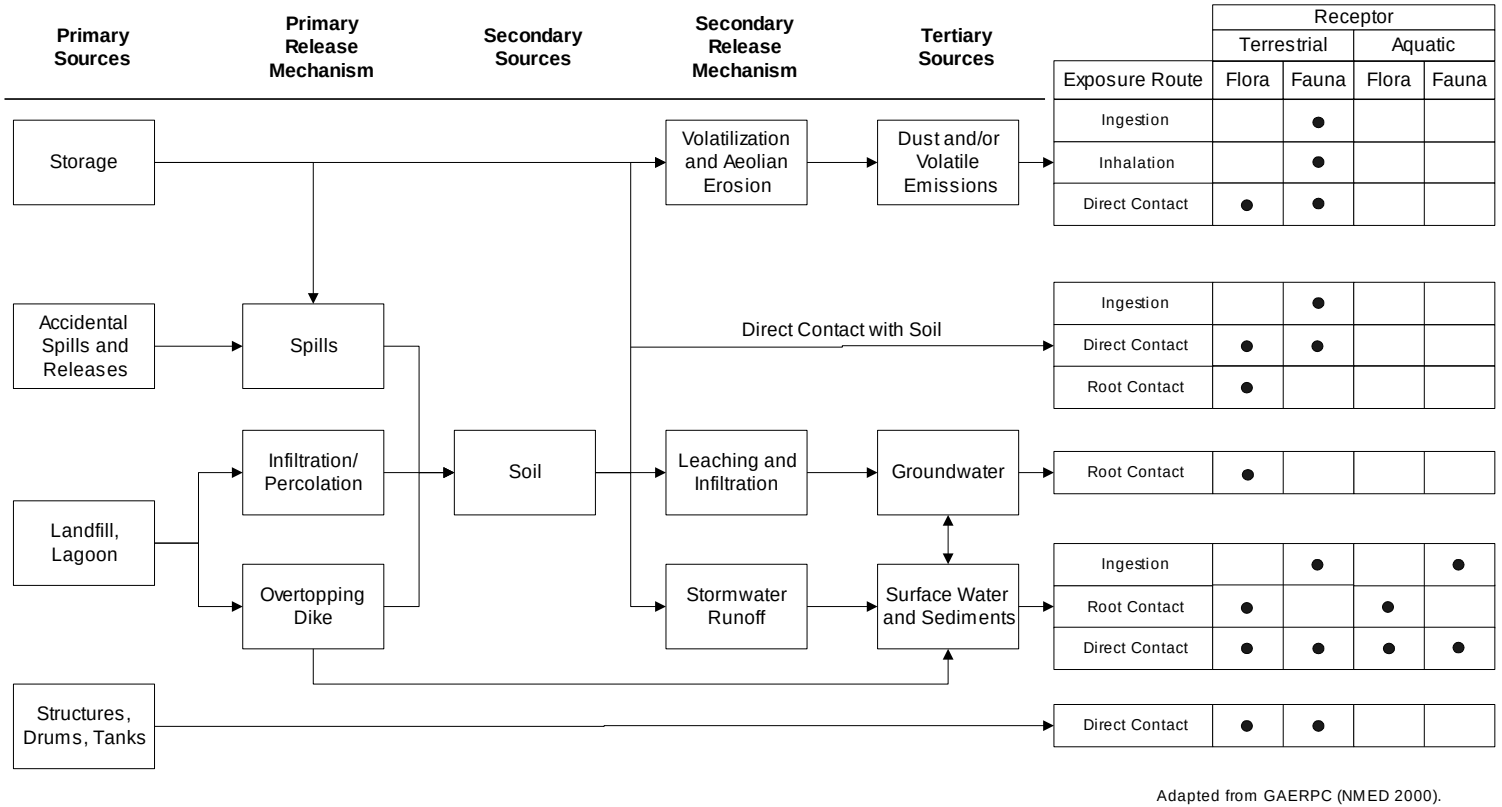


Figure 2. Example Preliminary Conceptual Site Exposure Model Diagram for a Hypothetical Site

2.6 Site Exclusion Criteria

If the assessor believes that the answer to the first Technical Decision Point (Is Ecological Risk Suspected?) is "no" based on the results of the PCSEM and Scoping Assessment summary it should be determined whether the facility meets the NMED Site Exclusion Criteria.

Exclusion criteria are defined as those conditions at an affected property which eliminate the need for a SLERA. The three criteria are as follows:

- Affected property does not include viable ecological habitat.
- Affected property is not utilized by potential (current and/or future) receptors.
- Complete or potentially complete exposure pathways do not exist due to affected property setting or conditions of affected property media.

The Exclusion Criteria Checklist and associated Decision Tree (Attachment B) can be used as a tool to help the user determine if an affected site meets the exclusion criteria. The checklist assists in making a conservative, qualitative determination of whether viable habitats, ecological receptors, and/or complete exposure pathways exist at or in the locality of the site where a release of hazardous waste/constituents has occurred. Thus, meeting the exclusion criteria means that the facility can answer "no" to the first Technical Decision Point.

If the affected property meets the Site Exclusion Criteria, based on the results of the checklist and decision tree, the facility must still submit a Scoping Assessment summary to NMED which documents the site conditions and justification for how the criteria have been met. Upon review and approval of the exclusion by NMED, the facility will not be required to conduct any further evaluation of ecological risk. However, the exclusion is not permanent; a future change in circumstances may result in the affected property no longer meeting the exclusion criteria.

2.7 Technical Decision Point: Is Ecological Risk Suspected?

As discussed in the beginning of this document, the Scoping Assessment is the first phase of the ecological risk assessment process (Figure 1). Following the submission of the information gathered during the Scoping Assessment, NMED will decide upon one of the following two recommendations for the site:

- No further ecological investigation at the site, or
- Continue the risk assessment process.

If the information presented in the Scoping Assessment supports the answer of "no" to the first Technical Decision Point, and the site meets the exclusion criteria, the site will likely be excused from further consideration of ecological risk. However, this is only true if it can be documented that a complete exposure pathway does not exist and will not exist in the future at the site based on current conditions. For those sites where valid pathways for potential exposure exist or are likely to exist in the future, further ecological risk assessment (the first step is the SLERA) will be required.

3.0 TIER 1 SCREENING LEVELS ECOLOGICAL RISK ASSESSMENT (SLERA)

If the PSCEM indicates complete exposure pathways, a SLERA is the next step. The data collected during the scoping assessment is used to define facility-wide conditions and define the steps needed for the SLERA and includes the below items. The SLERA should contain a detailed discussion of each of these items.

- Characterization of the environmental setting, including current and future land uses. Ecological assessments must include the evaluation of present day conditions and land uses but also evaluate future land uses.
- Identification of known or likely chemical stressors (chemicals of potential ecological concern, COPECs). The characterization data from the site (e.g., facility investigation) is evaluated to determine what constituents are present in which media. Selection of COPEC should follow the same methodology as outlined in Volume I of this Soil Screening Guidance (NMED, 2017).
- Identification of the fate and transport pathways that are complete. This includes an understanding of how COPECs may be mobilized from one media to another.
- Identification of the assessment endpoints that should be used to assess impact of the receptors; what is the environmental value to be protected.
- Identification of the complete exposure pathways and exposure routes (as identified in the example in Figure 2). What are the impacted media (soil, surface water, sediment, groundwater, and/or plants) and how might the representative receptors be exposed (direct ingestion, inhalation, and/or direct contact)?
- Species likely to be impacted and selection of representative receptors. From the list of species likely to be present on-site, what species are to be selected to represent specific trophic levels?

3.1 Selection of Representative Species

Sites may include a wide range of terrestrial, semi-aquatic, and aquatic wildlife. A generalized food web is shown in Figure 3. Wildlife receptors for the SLERA should be selected to represent the trophic levels and habitats present or potentially present at the site and include any Federal threatened and endangered species and State sensitive species.

As there are typically numerous species of wildlife and plants present at a given facility or site and in the surrounding areas, only a few key receptors need to be selected for quantitative evaluation in the SLERA, which are representative of the ecological community and varying trophic levels in the food web. Possible receptors that may be evaluated in the SLERAs at each site include the following:

- Plant community,
- Deer mouse,

- Horned lark,
- Kit fox (evaluated at sites greater than 267 acres),
- Pronghorn (evaluated at sites greater than 342 acres), and
- Red-tailed hawk (evaluated at sites greater than 177 acres).

The above key receptors selected as the representative species represent the primary producers as well as the three levels of consumer (primary, secondary, and tertiary) for the most common receptors found at hazardous waste sites in New Mexico. If water bodies are present, and aquatic receptors are viable, NMED should be consulted to discuss appropriate identification of receptor species, pathways, and SLERA methodologies.

3.1.1 Plants

The plant community will be evaluated quantitatively in the SLERAs at all sites. Specific species of plants will not be evaluated separately; rather the plant community will be evaluated as a whole. The plant community provides a necessary food source directly or indirectly through the food web for wildlife receptors.

3.1.2 Deer Mouse

The deer mouse (Peromyscus maniculatus) is a common rodent throughout much of North America and it can thrive in a variety of habitats. The deer mouse was selected as a representative receptor because it is prevalent near most sites in New Mexico, and it represents one of the several species of omnivorous rodents that may be present at sites. Small rodents are also a major food source for larger omnivorous and carnivorous species. The deer mouse receptor will be evaluated at all sites, regardless of size. The deer mouse has a relatively small home range and could therefore be substantially exposed to COPECs at sites if their home range is located within a solid waste management unit (SWMU) or other corrective action site.

Based on a review of literature (OEHHA, 1999) and from the Natural Diversity Information Source (CDW, 2011), a dietary composition consisting of 26% invertebrates and 74% plant matter will be assumed for the deer mouse.

3.1.3 Horned Lark

The horned lark (*Eremophila alpestris*) is a common widespread terrestrial bird. It spends much of its time on the ground and its diet consists mainly of insects and seeds. The horned lark receptor was chosen because it is prevalent in New Mexico and represents one of the many small terrestrial bird species that could be present. Since the horned lark spends most of its time on the ground, it also provides a conservative measure of effect since it has a higher rate of incidental ingestion of soil than other song birds. The horned lark is also a major food source for omnivorous intermediate species, and top avian carnivores. The horned lark will be evaluated based on an omnivorous diet of invertebrates and plant matter. The horned lark receptor will be evaluated at all sites, regardless of size. The horned lark has a relatively small home range and

could therefore be substantially exposed to COPECs at sites if their home range is located within a SWMU or other corrective action unit.

It will be assumed that the horned lark's diet consists of 75% plant matter, and 25% animal matter based on a study conducted by Doctor, *et al*, 2000.

3.1.4 Kit Fox

The kit fox (*Vulpes macrotis*) is native to the western United States and Mexico. Its diet consists of mostly small mammals. Although the kit fox's diet may also consist of plant matter during certain times of the year, the kit fox will be evaluated as a carnivore, with a diet consisting of 100% prey items. It was selected as a key receptor because it is sensitive species and is common in New Mexico, and the surrounding area at most sites in New Mexico provides suitable habitat for the kit fox. The kit fox also is representative of a mammalian carnivore within the food web.

The kit fox will only be evaluated at sites that are larger than 276 acres. A kit fox has a large home range size (2767 acres) (Zoellick & Smith, 1992) and it is assumed that risks are negligible from exposure to COPECs at sites that are less than 10% of the receptors home range. Unless the area use factor (AUF) is at least 10%, food items potentially contaminated with COPECs and incidental soil ingestion at the site would not contribute significantly to the receptor's diet and exposure to COPECs. The kit fox diet will be based on composition of 100% prey.

3.1.5 Red-Tailed Hawk

The red-tailed hawk (*Buteo jamaicensis*) was selected as a top carnivore avian key receptor. The red-tailed hawk is widespread throughout New Mexico and is one of the most common birds of prey. It hunts primarily rodents, rabbits, birds, and reptiles. The red-tailed hawk was chosen as a key receptor since it is a common species through New Mexico. The red-tailed hawk will only be evaluated at sites that are larger than 177 acres. The red-tailed hawk has a large home range size (1770 acres) (US EPA, 1993b), and risks to the red-tailed hawk from exposure to COPECs at sites smaller than 177 acres (10% of the home range) would be negligible. The red-tailed hawk diet will be based on composition of 100% prey.

3.1.6 Pronghorn Antelope

The pronghorn (*Antilocapra Americana*) is a popular big game species that occurs in western Canada, United States, and northern Mexico. Its diet consists mainly of sagebrush and other shrubs, grasses, and forbs. The pronghorn was selected as a key receptor representative of large herbivorous species of wildlife. The pronghorn will only be evaluated at sites that are larger than 342 acres. The pronghorn has a large home range size (3422 acres) (Reynolds, 1984), and risks to the pronghorn from exposure to COPECs at sites smaller than 342 acres (10% of the home range) would be negligible. It is assumed that 100% of the diet is from grazing.

3.2 Exposure Pathways

The scoping survey will provide a summary of potentially complete exposure pathways, along with potentially exposed receptor types. A complete exposure pathway is defined as a pathway having all the following attributes:

- A source and mechanism for hazardous waste/constituent release to the environment,
- An environmental transport medium or mechanism by which a receptor can encounter the hazardous waste/constituent,
- A point of receptor contact with the contaminated media or via the food web, and
- An exposure route to the receptor.

If any of the above components are missing from the exposure pathway, it is not a complete pathway for the site. A discussion regarding all possible exposure pathways and the rationale/justification for eliminating any pathways will be included in the risk assessment.

Affected media that ecological receptors may be exposed to at sites are soil, biota, and surface water or groundwater (through springs). Surface water, sediment, and groundwater should be evaluated based on site-specific conditions.

Wildlife receptors could be exposed to COPECs that have been assimilated into biota. Ingestion of contaminated plant and animal matter, as a necessary component of the receptor's diet, will be evaluated quantitatively in the SLERAs. However, for the Tier 1 SLERA, it will conservatively be assumed that 100% of the wildlife receptors' dietary intake consists of site soil.

For soil, two soil intervals should be evaluated:

- For all non-burrowing receptors and for shallow-rooted plants, the soil exposure interval is typical of surface conditions and is considered to be between zero (0) and one (1) foot below ground surface (ft bgs).
- For all burrowing receptors (and receptors that may use borrows) and deep rooted plants, the soil interval to be evaluated is 0 – 10 ft bgs.

Table 1. Soil Exposure Intervals

Receptor	Exposure Intervals (Soil)
Ecological Receptors (non-burrowing and shallow rooted plants)	0 – 1 ft bgs
Ecological Receptors (burrowing and deep rooted plants)	0 – 10 ft bgs

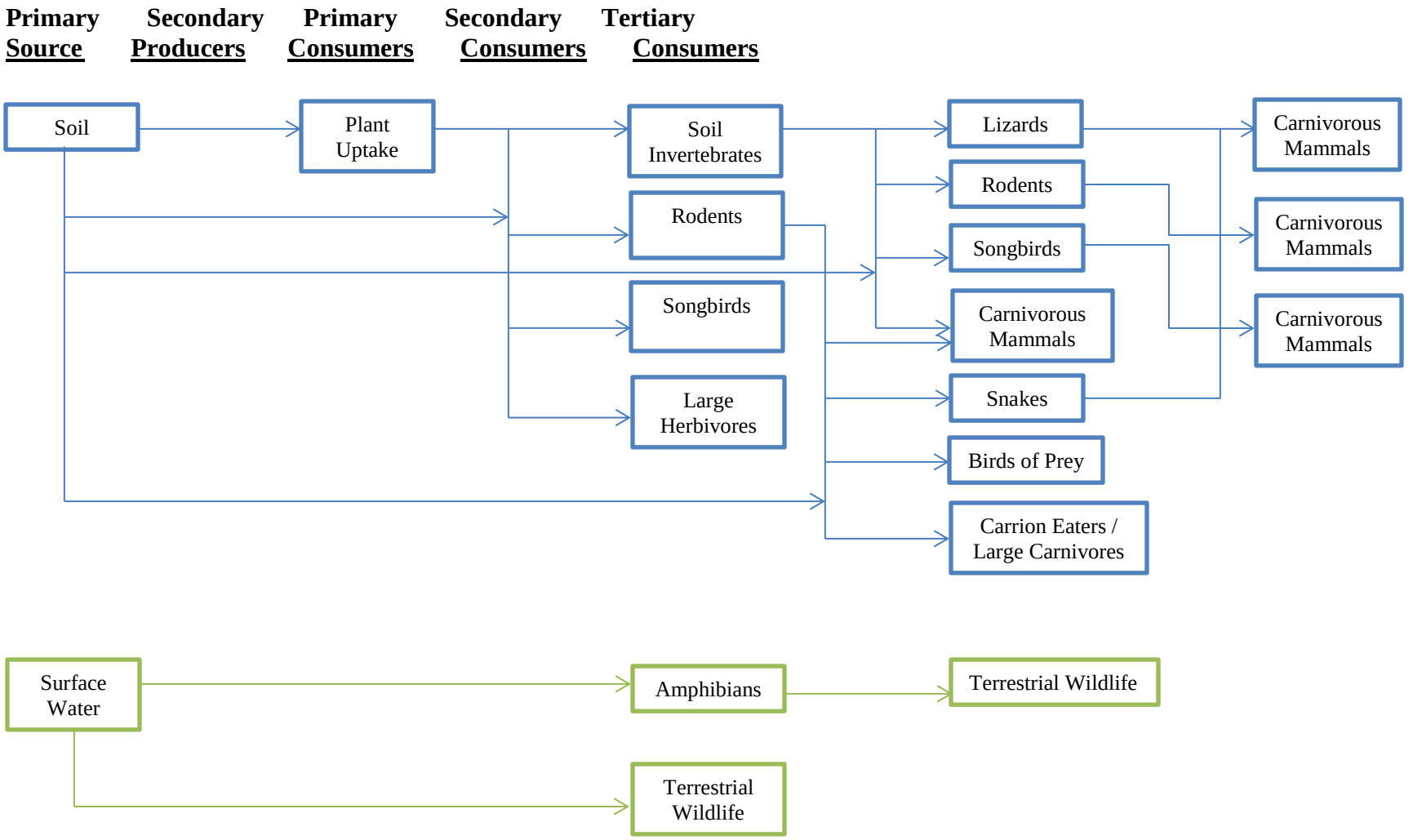


Figure 3. Generic Food Web.

3.3 SLERA Exposure Estimation

For the initial SLERA, conservative assumptions should be applied as follows:

- Maximum detected concentrations for the exposure interval listed in Table 1 will be utilized in calculating exposure doses.
- 100% of the diet is assumed to contain the maximum concentration of each COPEC detected in the site media.
- Minimum reported body weights should be applied.
- Maximum dietary intake rates should be used.
- It will be assumed that 100% of the diet consists of direct ingestion of contaminated soil.
- It is assumed that the bioavailability is 100% at each site.
- Foraging ranges are initial set equal to the size of the site being evaluated. This means that the AUF in the SLERA is set to a value of one.

The equation and exposure assumptions for calculating the Tier 1 exposure doses for the deer mouse are presented in Equation 1.

Equation 1. Calculation of Tier 1 Exposure Dose for COPECs in Soil; Deer Mouse

$$Exposure\ Dose = \frac{(C_s \times (IR * ww{:}dw) \times AUF)}{BW}$$

Parameter	Definition (units)	Value	Reference
Exposure Dose	Estimated receptor-specific contaminant intake (mg/kg of body weight/day)	calculated	--
C_s	Chemical concentration in soil (mg/kg)	Site-specific	Maximum detected concentration (0-10 ft bgs)
IR	Ingestion rate (kg food [ww]/day)	0.007	Maximum reported total dietary intake (US EPA, 1993b)
ww:dw	Wet-weight to dry weight conversion factor for ingested matter	0.22	78-percent moisture
AUF	Area use factor (the ratio of the site exposure area to the receptor foraging range) (unitless)	1	Maximum possible value
BW	Body weight (kg)	0.014	Minimum reported adult body weight (CDW, 2011)

The equation and exposure assumptions for calculating the Tier 1 exposure dose for the horned lark are presented in Equation 2.

Equation 2. Calculation of Tier 1 Exposure Dose for COPECs in Soil; Horned Lark

$$Exposure\ Dose = \frac{(C_s \times (IR * ww{:}dw) \times AUF)}{BW}$$

Parameter	Definition (units)	Value	Reference
Exposure Dose	Estimated receptor-specific contaminant intake (mg/kg of body weight/day)	Calculated	--
C_s	Chemical concentration in soil (mg/kg)	Site-specific	Maximum detected concentration (0-1 ft bgs)
IR	Ingestion rate (kg food [ww]/day)	0.024	Maximum reported total dietary intake; American robin (US EPA, 1993b)
ww:dw	Wet-weight to dry weight conversion factor for ingested matter	0.22	78-percent moisture
AUF	Area use factor (the ratio of the site exposure area to the receptor foraging range) (unitless)	1	Maximum possible value
BW	Body weight (kg)	0.025	Minimum reported adult body weight (Trost, 1972)

The equation and exposure assumptions for calculating the Tier 1 exposure doses for the kit fox are presented in Equation 3.

Equation 3. Calculation of Tier 1 Exposure Dose for COPECs in Soil; Kit Fox

$$Exposure\ Dose = \frac{(C_s \times (IR * ww{:}dw) \times AUF)}{BW}$$

Parameter	Definition (units)	Value	Reference
Exposure Dose	Estimated receptor-specific contaminant intake (mg/kg of body weight/day)	calculated	--
C_s	Chemical concentration in soil (mg/kg)	Site-specific	Maximum detected concentration (0-10 ft bgs)
IR	Ingestion rate (kg food [ww]/day)	0.18	Maximum reported total dietary intake (OEHHA, 2003)
ww:dw	Wet-weight to dry weight conversion factor for ingested matter	0.22	78-percent moisture
AUF	Area use factor (the ratio of the site exposure area to the receptor foraging range) (unitless)	1	Maximum possible value
BW	Body weight (kg)	1.6	Minimum reported adult body weight (OEHHA, 2003)

The equation and exposure assumptions for calculating the Tier 1 exposure doses for the red-tailed hawk are presented in Equation 4.

Equation 4 Calculation of Tier 1 Exposure Dose for COPECs in Soil; Red-tailed Hawk

$$Exposure\ Dose = \frac{(C_s \times (IR * ww{:}dw) \times AUF)}{BW}$$

Parameter	Definition (units)	Value	Reference
Exposure Dose	Estimated receptor-specific contaminant intake (mg/kg of body weight/day)	Calculated	--
C_s	Chemical concentration in soil (mg/kg)	Site-specific	Maximum detected concentration (0-1 ft bgs)
IR	Ingestion rate (kg food [ww]/day)	0.12	Maximum reported total dietary intake (US EPA, 1993b)
ww:dw	Wet-weight to dry weight conversion factor for ingested matter	0.22	78-percent moisture
AUF	Area use factor (the ratio of the site exposure area to the receptor foraging range) (unitless)	1	Maximum possible value
BW	Body weight (kg)	0.96	Minimum reported adult body weight (US EPA, 1993b)

The equation and exposure assumptions for calculating the Tier 1 exposure doses for the pronghorn are presented in Equation 5.

Equation 5. Calculation of Tier 1 Exposure Dose for COPECs in Soil; Pronghorn

$$Exposure\ Dose = \frac{(C_s \times (IR * ww{:}dw) \times AUF)}{BW}$$

Parameter	Definition (units)	Value	Reference
Exposure Dose	Estimated receptor-specific contaminant intake (mg/kg of body weight/day)	calculated	--
C_s	Chemical concentration in soil (mg/kg)	Site-specific	Maximum detected concentration (0-1 ft bgs)
IR	Ingestion rate (kg wet matter/day) Based on equation: $IR=a(BW)^b$ where: a=2.606, b=0.628	0.74	Dry matter intake rate for herbivores (based on Nagy, 2001)
ww:dw	Wet-weight to dry weight conversion factor for ingested matter	0.22	78-percent moisture
AUF	Area use factor (the ratio of the site exposure area to the receptor foraging range) (unitless)	1	Maximum possible value
BW	Body weight (kg)	47	Minimum reported adult body weight (O'Gara, 1978)

Exposure doses will not be calculated for plants. For the Tier 1 exposure assessment, it will be assumed that the exposure concentrations for plants are equal to the maximum detected concentrations of COPECs in soil (as noted in Table 1).

3.4 Effects Assessment

The effects assessment evaluated the potential toxic effects on the receptors being exposed to the COPECs. The effects assessment includes selection of appropriate toxicity reference values (TRVs) for the characterization and evaluation of risk. TRVs are receptor and chemical specific exposure rates at which no adverse effects have been observed, or at which low adverse effects are observed. TRVs that are based on studies with no adverse effects are called no observed adverse effects levels (NOAELs). TRVs that are based on studies with low adverse effects are termed lowest observed adverse effects levels (LOAELs).

For the initial SLERA, the preference for TRVs is based on chronic or long term exposure, when available. The TRVs should be selected from peer-reviewed toxicity studies and from primary literature. Initial risk characterization should be conducted using the lowest appropriate chronic NOAEL for non-lethal or reproductive effects. If a TRV is not available and/or no surrogate data could be identified, the exclusion of potential toxicity associated with the COPEC will be qualitatively addressed in the uncertainty analysis of the risk assessment. Other factors that may be included in this discussion is frequency of detection, depth of detections, and special analysis of the detections. Attachment C, Tables C1 through C6, contains NOAEL- and LOAEL-based TRVs for the key ecological receptors.

3.5 Risk Characterization

Assessment endpoints are critical values to be protected (US EPA, 1997c). The assessment endpoint will be to ensure the survival and reproduction of all ecological receptors to maintain populations. This will be accomplished by determining whether COPECs at each site are present at levels that would adversely affect the population size of ecological receptors by limiting their abilities to reproduce.

For plants, the Tier 1 screening level hazard quotients for plants will be calculated by comparing exposure doses (i.e., maximum detected concentrations of COPECs; 0-1 ft bgs for shallow rooted plans or 0-10 ft bgs for deep rooted plants) to an effect concentration. The equation for screening level hazard quotient (SLHQ) for plants is shown in Equation 6. Attachment C, Table C-6, lists effect concentrations to be used in screening for plants.

Equation 6. Calculation of Screening-Level Hazard Quotients for Plant Receptors

$$SLHQ = \frac{C_s}{Effect\ Concentration}$$

Parameter	Definition (units)
SLHQ	Screening level hazard quotient (unitless)
C_s	Chemical concentration in soil (mg COPEC / kg soil dry weight), (0-1 ft bgs shallow-rooted and 0-10 ft bgs deep rooted plants)
Effect Concentration	Concentration at which adverse effects are not expected (mg/kg); see Attachment C, Table C-6.

Tier 1 SLHQs for wildlife receptors will be calculated by comparing estimated exposure doses derived using Equations 1 through 5 for each of the key receptors determined to have complete habitat and exposure pathways at the site to NOAEL-based TRVs. The derivation of SLHQ for the key receptors (except plants) is shown in Equation 7.

Equation 7 Calculation of Screening-Level Hazard Quotients for Wildlife Receptors

$$SLHQ = \frac{Dose}{TRV}$$

OR

$$SLHQ = \frac{C_s}{ESL}$$

Parameter	Definition (Units)
SLHQ	Screening-level hazard quotient (unitless)
Dose	Estimated receptor-specific contaminant intake, from Equations 1 through 5 (mg/kg of body weight/day)
TRV	NOAEL-based TRV (mg/kg/day), Refer to Attachment C, Tables C1 through C5
C_s	Chemical concentration in soil (mg COPEC / kg soil dry weight)
ESL	Ecological Screening Level (refer to Equation 8 and Attachment C)

Rearranging the terms for the SLHQ in Equation 7, an Ecological Screening Level (ESL) was derived for comparison to chemical concentrations in soil. Equation 8. For the Tier 1 assessment, the maximum detected site concentration is applied as the chemical concentration in soil.

Attachment C, Tables C-1 through C-5, contains the Tier 1 ESLs for the deer mouse, horned lark, kit fox, red-tailed hawk, and pronghorn antelope.

Equation 8 Use of the ESLs to Determine the SLHQ	
$$SLHQ = \frac{C_s}{ESL}$$	
Parameter	**Definition (Units)**
SLHQ	Screening-level hazard quotient (unitless)
C_s	Chemical concentration in soil (mg COPEC / kg soil dry weight)
ESL	Ecological Screening Level (refer to Attachment C, Table C1 through C5))

SLHQs are calculated for each receptor and each COPEC. For each receptor, additive risk must be evaluated. For the initial screening assessment, it is assumed that all COPECs have equal potential risk to the receptor. The overall hazard index (HI) is then calculated for each receptor using Equation 9:

$$HI = SLHQ_x + SLHQ_Y + ... + SLHQ_z \qquad \text{Equation 9}$$

Where:

HI = Hazard Index (unitless)
$SLHQ_x$ = Hazard quotient for each COPEC (unitless)

NMED applies a target risk level for ecological risk assessments of 1.0. If the HI for any receptor is above this target risk level, then there is a potential for adverse effects on ecological receptors and additional evaluation following the Tier 2 SLERA process is required.

As with all risk assessments, the SLERA should include a discussion of the uncertainties. More detailed information may be found in the *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Risk Assessment (NMED, 2014).*

4.0 TIER 2 SLERA

The Tier 2 exposure assessment will consist of calculating refined estimates of exposure doses which will utilize exposure assumptions that are more realistic. The following assumptions will apply to Tier 2 exposure doses:

- Exposure Point Concentration (EPC) – 95 % upper confidence level of the mean (UCLs) will be utilized as the EPC (if sufficient data are available – refer to Volume I of the SSG (NMED, 2017) for determination of EPCs and UCLs).
- AUF – Site-specific value between 0 and 1, based on the ratio of the exposure area (size of SWMU or corrective action site) to the receptor's average home range size, as shown in Equation 1; if a receptor's home range size is less than the exposure area, a value of 1 will be assumed.

$$AUF = \frac{Exposure\ Area\ of\ Site\ (acres)}{Average\ Home\ Range\ (acres)} \qquad \textbf{Equation 10}$$

- Bioavailability – It will be assumed that the bioavailability is 100% at each site.
- Body weight – The average reported adult body weight will be applied.
- Ingestion rate – The average reported ingestion rate will be applied.
- Dietary composition – Receptor-specific percentages of plant, animal, and soil matter will be considered. Concentrations of COPECs in dietary elements (plant and animal matter) will be predicted using bio-uptake and bioaccumulation modeling.
- Wet-weight to dry-weight conversion factor – Because body weight is reported as wet-weight (kg), and soil concentrations are reported as dry-weight (mg/kg), a wet-weight to dry-weight conversion factor will also be applied when calculating exposure doses.

The Tier 2 exposure doses for wildlife receptors will include one, two or all three of the following elements, depending on the receptor being evaluated: 1) ingestion of plant matter; 2) ingestion of animal (or invertebrate) matter; and 3) incidental ingestion of soil. Bio-uptake and bioaccumulation modeling will be utilized to predict the concentrations of COPECs in plants and animal/invertebrate matter that could be ingested by wildlife receptors. Evaluation of surface and/or groundwater should be discussed with NMED.

Plant uptake factors (PUFs) will be used to predict the concentrations of COPECs in plants. The PUFs for inorganic constituents are summarized in Table 2. For organic COPECs, the PUFs are based on the octanol-water partition coefficient (K_{ow}), which will be obtained from US EPA databases or primary literature.

If a PUF is not available, then a value of one (1) will be applied which assumes 100% assimilation. The equation and variables that will be used to predict COPEC concentrations in plants are shown in Equation 11.

Equation 11. Calculation of COPEC Concentrations in Plants

$$C_{plant} = C_{soil} \times PUF$$

Parameter	Definition (Units)	Value
C_{plant}	COPEC concentration in plant (mg/kg dry weight)	Calculated
C_{soil}	Concentration of COPEC in soil (EPC) (mg/kg dry weight)	Site-specific
PUF	Plant-uptake factor (unitless)	For inorganics (see Table 2) For organic constituents (Travis and Arms, 1988): PUF = 1.588 – 0.578 log K_{ow} K_{ow}- obtain from EPA, 2011b or most current

Table 2. Plant Uptake Factors for Inorganics

Analyte	Plant Uptake Factor (PUF)	Analyte	Plant Uptake Factor (PUF)
Aluminum	4.0E-03	Magnesium	1.0E+00
Antimony	2.0E-01	Manganese	2.5E-01
Arsenic	4.0E-02	Mercury	9.0E-01
Barium	1.5E-01	Molybdenum	2.5E-01
Beryllium	1.0E-02	Nickel	6.0E-02
Boron	4.0E+00	Potassium	1.0E+00
Cadmium	5.5E-01	Selenium	2.5E-02
Calcium	3.5E+00	Silver	4.0E-01
Chromium	7.5E-03	Sodium	7.5E-02
Cobalt	2.0E-02	Thallium	4.0E-03
Copper	4.0E-01	Tin	3.0E-02
Iron	4.0E-03	Vanadium	5.5E-03
Lead	4.5E-02	Zinc	1.5E+00
From Baes, *et.al*, 1994			

Concentrations of COPECs in animal matter (invertebrates and prey species) will be predicted by applying bioaccumulation or biomagnification factors (BAFs). The BAFs will be selected from primary literature sources. If BAF data are not available, a default value of 1 will be used, which will conservatively assume 100% assimilation. Methodology for determining BAFs for soil to plants, soil to earthworms, and soil to small mammals may be found in US EPA (2003(b) and 2005). The equation and variables for predicting concentrations in animal matter are shown in Equation 12.

Equation 12. Calculation of COPEC Concentrations in Prey

$$C_{prey} = C_{soil} \times BAF$$

Parameter	Definition (Units)	Value
C_{prey}	COPEC concentration in prey (mg/kg dry weight)	Calculated
C_{soil}	Concentration of COPEC in soil (EPC) (mg/kg dry weight)	Site-specific
BAF	Bioaccumulation/Biomagnification factor	Chemical-specific (see US EPA 2003(b) and 2005)

The equation and exposure assumptions that will be used to calculate the Tier 2 exposure doses for the deer mouse are shown in Equation 13.

Equation 13. Calculation of Tier 2 Exposure Dose for COPECs in Soil; Deer Mouse

$$Exposure\ Dose = \frac{\left[\left(C_{plant} \times \left(IR_{plant} \times ww{:}\,dw\right)\right) + \left(C_{invert} \times \left(IR_{invert} \times ww{:}\,dw\right)\right) + \left(C_{soil} \times IR_{soil} \times ST\right) \times AUF\right]}{BW}$$

Parameter	Definition (Units)	Value	Reference
Exposure dose	Estimated receptor-specific contaminant intake (mg/kg of body weight/day)	Calculated	--
C_{plant}	COPEC concentration in plants (mg final COPEC/kg plant dry weight)	Calculated	See Equation 11
IR_{total}	Receptor-specific average ingestion rate based on total dietary intake (kg wet weight/day)	0.004	US EPA 1993b
IR_{plant}	Receptor-specific plant-matter ingestion rate (kg food wet weight/day)	0.003	Based on an average ingestion rate of 0.004 kg/day (US EPA, 1993b) and a diet of 74% plant matter (OEHHA, 1999)
ww:dw	Wet-weight to dry weight conversion factor for ingested matter	0.22	78-percent moisture
C_{invert}	Invertebrate EPC (mg final COPEC/kg invertebrate dry weight)	Calculated	See Equation 12
IR_{invert}	Receptor-specific animal matter ingestion rate (kg food wet weight/day)	0.001	Based on an average ingestion rate of 0.004 kg/day (US EPA, 1993b) and a diet of 26% invertebrate matter (OEHHA, 1999)
C_{soil}	Surface-soil EPC (mg final COPEC/kg soil dry weight)	Site-specific	95% UCL if available, or maximum (0-10 ft bgs)
IR_{soil}	Receptor-specific incidental soil ingestion rate (kg soil dry weight/day)	0.000018	Based on < 2% (Beyer et. al, 1994); Average ingestion rate of (0.004 kg/day wet weight * 0.22 ww:dw) * 2%.
ST	Bioavailability factor for constituents ingested in soil (assumed to be 1.0 for all constituents)	1.0	Conservative default (assume 100% bioavailability)
AUF	area use factor (maximum value = 1); ratio of area of site to average receptor foraging range (0.3 acres for deer mouse)	Site-specific	US EPA, 1993b
BW	average adult body weight (kg)	0.02	CDW, 2011

The equation and exposure assumptions that will be used to calculate the Tier 2 exposure doses for the horned lark are shown in Equation 14.

Equation 14. Calculation of Tier 2 Exposure Dose for COPECs in Soil; Horned Lark

$$Exposure\ Dose = \frac{\left[\left(C_{plant}\times\left(IR_{plant}\times ww{:}\,dw\right)\right) + \left(C_{invert}\times\left(IR_{invert}\times ww{:}\,dw\right)\right) + \left(C_{soil}\times IR_{soil}\times ST\right)\times AUF\right]}{BW}$$

Parameter	Definition (Units)	Value	Reference
Exposure dose	Estimated receptor-specific contaminant intake (mg/kg of body weight/day)	Calculated	--
C_{plant}	COPEC concentration in plants (mg final COPEC/kg plant dry weight)	Calculated	See Equation 11
IR_{total}	Receptor-specific average ingestion rate based on total dietary intake (kg food wet weight/day)	0.035	US EPA 1993b; based on average ingestion rate for American robin adjusted for horned lark body weight.
IR_{plant}	Receptor-specific plant-matter ingestion rate (kg food wet weight/day)	0.026	Based on average ingestion rate of 0.035 kg/day (US EPA 1993b) and a diet of 75% plant matter (Doctor, *et* al, 2000) and US EPA, 1993b
ww:dw	Wet-weight to dry weight conversion factor for ingested matter	0.22	78-percent moisture
C_{invert}	Invertebrate EPC (mg final COPEC / kg invertebrate dry weight)	Site-specific	See Equation 12
IR_{invert}	Receptor-specific animal matter ingestion rate (kg food wet weight/day)	0.009	Based on average ingestion rate of 0.035 kg/day (US EPA 1993b) and a diet of 25% invertebrates (Doctor, et al, 2000) and US EPA, 1993b
C_{soil}	Surface-soil EPC (mg final COPEC / kg soil dw)	Site-specific	95% UCL if available, or maximum (0-1 ft bgs)
IR_{soil}	Receptor-specific incidental soil ingestion rate (kg/day dry weight)	0.00077	Based on 10% (Baer, *et al*, 1994). Average ingestion rate of (0.035 kg/day (wet weight) * 0.22 ww:dw) * 10%).
ST	Bioavailability factor for constituents ingested in soil (assumed to be 1 for all constituents)	1	Conservative default (assume 100% bioavailability)
AUF	Area use factor (maximum value = 1); ratio of area of site to average receptor foraging range (4 acres for horned lark)	Area of site (acres) / 4 acres	Beason, 1995
BW	Average adult body weight (kg)	0.033	Trost, 1972

The equation and exposure assumptions that will be used to calculate the Tier 2 exposure doses for the kit fox are shown in Equation 15.

Equation 15. Calculation of Tier 2 Exposure Dose for COPECs in Soil; Kit Fox

$$Exposure\ Dose = \frac{\left[\left(C_{prey} \times \left(IR_{prey} \times ww{:}dw\right)\right) + \left(C_{soil} \times IR_{soil} \times ST\right) \times AUF\right]}{BW}$$

Parameter	Definition (Units)	Value	Reference
Exposure dose	Estimated receptor-specific contaminant intake (mg/kg of body weight/day)	Calculated	--
C_{prey}	Prey EPC (mg final COPEC / kg prey dry weight)	Calculated	See Equation 12
IR_{prey}	Receptor-specific animal matter ingestion rate (kg food wet weight/day)	0.13	Based on an average ingestion rate of 0.13 kg/day (OEHHA, 2003) and a diet of 100% animal matter
ww:dw	Wet-weight to dry weight conversion factor for ingested matter	0.22	78-percent moisture
C_{soil}	Surface and subsurface-soil (0-10 ft bgs) EPC (mg final COPEC / kg soil dw)	Site-specific	95% UCL if available, or maximum (0-10 ft bgs)
IR_{soil}	Receptor-specific incidental soil ingestion rate (kg soil dry weight/day)	0.0008	Based on 2.8% (Beyer et.al., 1994). Average ingestion rate of (0.13 kg/day (wet weight) *0.22 ww:dw) * 2.8%).
ST	Bioavailability factor for constituents ingested in soil (assumed to be 1for all constituents)	1	Conservative default (assume 100% bioavailability)
AUF	Area use factor (maximum value = 1); ratio of area of site to average receptor foraging range (1713 acres for kit fox)	Site-specific	--
BW	Average adult body weight (kg)	2.0	OEHHA, 2003

The equation and exposure assumptions that will be used to calculate the Tier 2 exposure doses for the red-tailed hawk are shown in Equation 16.

Equation 16. Calculation of Tier 2 Exposure Dose for COPECs in Soil; Red-Tailed Hawk

$$Exposure\ Dose = \frac{\left[\left(C_{prey} \times \left(IR_{prey} \times ww{:}dw\right)\right) + \left(C_{soil} \times IR_{soil} \times ST\right) \times AUF\right]}{BW}$$

Parameter	Definition (Units)	Value	Reference

Exposure dose	Estimated receptor-specific contaminant intake (mg/kg of body weight/day)	Calculated	--
C_{prey}	Prey EPC (mg final COPEC / kg prey dry weight)	Calculated	See Equation 12
IR_{prey}	receptor-specific animal matter ingestion rate (kg food wet weight/day)	0.1	Based on an average ingestion rate of 0.1 kg/day (US EPA 1993b) and a diet of 100% animal matter
ww:dw	Wet-weight to dry weight conversion factor for ingested matter	0.22	78-percent moisture
C_{soil}	surface-soil EPC (mg final COPEC / kg soil dw)	Site-specific	95% UCL if available, or maximum (0-1 ft bgs)
IR_{soil}	receptor-specific incidental soil ingestion rate (kg soil dry weight/day)	0.0004	Based on < 2% (Beyer et. al., 1994). Average ingestion rate of (0.12 kg/day (wet weight) *0.22) * 2%).
ST	bioavailability factor for constituents ingested in soil (assumed to be 1 for all constituents)	1	Conservative default (assume 100% bioavailability)
AUF	area use factor (maximum value = 1); ratio of area of site to average receptor foraging range (1770 acres for red-tailed hawk)	Site-specific	--
BW	average adult body weight (kg)	1.1	US EPA, 1993b

The equation and exposure assumptions that will be used to calculate the Tier 2 exposure doses for the pronghorn are shown in Equation 17.

Equation 17. Calculation of Tier 2 Exposure Dose for COPECs in Soil; Pronghorn

$$Exposure\ Dose = \frac{\left[\left(C_{plant} \times \left(IR_{plant} \times ww{:}\,dw\right)\right) + \left(C_{soil} \times IR_{soil} \times ST\right) \times AUF\right]}{BW}$$

Parameter	Definition (Units)	Value	Reference
Exposure dose	Estimated receptor-specific contaminant intake (mg/kg of body weight/day)	Calculated	--
C_{plant}	COPEC concentration in plants (mg final COPEC/kg plant dry weight)	Calculated	See Equation 11
IR_{plant}	receptor-specific plant-matter ingestion rate (kg food wet weight/day)	1.4	Based on an average ingestion rate of 1.4 kg/day (US FWS, 2005) and a diet of 100% plant matter
ww:dw	Wet-weight to dry weight conversion factor for ingested matter	0.22	78-percent moisture
C_{soil}	surface-soil EPC (mg final COPEC / kg soil dw)		95% UCL if available, or maximum (0-1 ft bgs)
IR_{soil}	receptor-specific incidental soil ingestion rate (kg soil dry weight/day)	0.006	Based on < 2% (Beyer et. al., 1994). Average ingestion rate of (1.4 kg/day (wet weight) * 0.22 ww:dw) * 2%).
ST	bioavailability factor for constituents ingested in soil (assumed to be 1.0 for all constituents)	1	Conservative default (assume 100% bioavailability)
AUF	area use factor (maximum value = 1); ratio of area of site to average receptor foraging range (3422 acres for pronghorn)	Site-specific	Zoellick & Smith, 1992
BW	Average adult body weight (kg)	50	O'Gara, 1978

4.1.1 Toxicity Assessment – Tier 2

The Tier 2 TRVs will be based on LOAELs. The LOAEL will be used as it is more representative of population risks. Attachment C, Tables C1 through C6 lists Tier 2 TRVs for select constituents for each of the key ecological receptors.

4.1.2 Risk Characterization – Tier 2

Risk characterization for Tier 2 will be conducted by calculating HQs for plant and wildlife receptors using a similar method as in the Tier 1 SLERA. The equation and assumptions for calculating the Tier 2 HQs for wildlife receptors are shown in Equation 18.

Equation 18. Calculation of Tier 2 Hazard Quotients for Wildlife Receptors	
$$HQ = \frac{Dose}{TRV}$$	
Parameter	**Definition (Units)**
HQ	Hazard quotient (unitless)
Dose	Estimated receptor-specific contaminant intake (mg/kg of body weight/day)
TRV	Toxicity reference value (mg/kg/day) based on lowest observed adverse effects level (LOAEL), Refer to Attachment C

For plants, a qualitative discussion of the potential for adverse risk will be provided in the assessment. Comparison of TRVs to soil concentrations based on the 95% UCL may be provided.

Summation of HQs will be added for COPECs that have a similar receptor-specific mode of toxicity. If the Tier 2 HI is less than one, adverse ecological effects are not expected and no further action will be taken.

For sites that have an HI equal to or greater than one, the site may require: 1) additional evaluation under a weight-of-evidence analysis; 2) a Tier 3 risk assessment; or 3) a corrective measures study or other remedial action.

Per US EPA (1997c), Tier 2 ecological risk characterization should include a discussion of the uncertainties since many assumptions may or may not accurately reflect site conditions. Therefore, a discussion of the uncertainties associated with the Tier 2 SLERA will be included in the report.

5.0 TIER 3: PHASE II - QUANTITATIVE ASSESSMENT

If the SLERA does not show that levels of contamination in the impacted media are below the target level of 1.0, additional quantitative analyses (e.g., biota studies to evaluate impacts at the site) or even corrective actions (e.g., removals) may be warranted. NMED should be consulted before proceeding with additional analyses and/or corrective actions and a cost-benefit analysis that weighs corrective actions (removals) versus additional investigations should be performed. If the SLERA, consultation with NMED, and the cost-benefit analysis support further evaluation of the contaminated site, site-specific data that supports formulation of a problem statement for a Tier 3 site-specific ecological risk assessment should be conducted (Section 5.2).

5.1 Performing a Tier 3 Site Specific Ecological Risk Assessment

After problem formulation is completed and an integrated conceptual exposure model is developed and discussed with NMED, a Work Plan should be developed and submitted to NMED for approval (Section 5.3).Site specific data should be collected and used, wherever practicable, to determine whether or not site releases present unacceptable risks and to develop

quantitative cleanup levels that are protective. As in all risk assessments, the scope of the Tier 3 site-specific risk assessment should be tailored to the nature and complexity of the issues present at the site and all response alternatives being considered, including their costs and implementability.

5.2 Problem Formulation for Tier 3

Similar to a Tier 1 or Tier 2 screening-level ecological risk assessment, a Tier 3 assessment begins with a problem formulation step. By combining information on: (1) the site COPECs; (2) the ecotoxicity of the COPECs; (3) the ecological setting; (4) environmental fate and transport; and (5) complete exposure pathways, those aspects of the site ecosystem potentially at risk as well as the responses to that risk are identified. Based on that information, the risk assessment team and NMED agree on assessment endpoints and specific risk questions or testable hypotheses that, together with an integrated conceptual site model (CSM), form the basis for the site investigation.

Problem Formulation for a Tier 3 assessment includes the following elements:

- Refinement of the COPECs by examining the assumptions used in the SLERA.
- Further characterization of the ecological effects associated with the contaminants.
- Reviewing and refining information on contaminant fate and transport, complete exposure pathways, and ecosystems potentially at risk.
- Selection of site-specific assessment endpoints.
- Development of an integrated CSM and associated risk questions.

If the problem formulation step indicates additional sampling is required for the Tier 3 assessment, a separate sampling and analysis plan (SAP) may also be required. In addition to documenting the approaches, procedures, and expectations for the Tier 3 site-specific ecological risk assessment, the Work Plan should also summarize all agreements between the facility and NMED regarding the contaminants of concern, assessment endpoints, exposure pathways, and risk questions.

5.2.1 Refining Contaminants of Concern

Because of the conservative assumptions used during the SLERA, some of the COPECs retained for the Tier 3 assessment might pose negligible risk. At this stage of the ecological risk assessment process, the risk assessment team should review the assumptions used in the SLERA (e.g., bioavailability assumed to be 100 percent) against COPEC-specific values reported in the literature and consider how the hazard quotients or indices would change if more realistic, yet conservative, assumptions were applied.

New information may become available that indicates the initial assumptions that screened some contaminants out of the SLERA are no longer valid (e.g., site contaminant levels are higher than originally reported). In this case, contaminants can be placed back on the list of COPECs to be investigated.

After consultation with NMED, one or more of the following supplemental components (background concentrations, frequency and magnitude of detection, dietary considerations) may be included in the Problem Formulation step for the Tier 3 assessment. These components need not be implemented in the order presented herein, nor do all the components need to be implemented. However, any COPEC identified for potential exclusion from the Tier 3 assessment through application of any supplemental component must also be evaluated for its potential to bioaccumulate, biomagnify, and bioconcentrate.

Those components included in the assessment should be identified and discussed in the Work Plan. In addition, the Tier 3 ecological risk assessment report should fully address the issues associated with each supplemental component included in the Tier 3 assessment and describe the rationale underlying its selection for inclusion in the assessment.

5.2.1.1 Frequency and Magnitude of Detection

The SAP needs to provide for characterization of the full range of variability and distribution in the data while meeting the project criteria for completeness, comparability, representativeness, precision, and accuracy. Given data of adequate quality, reduction of COPECs through application of this component may be determined acceptable following consultation with NMED. A frequency of detection (FOD) evaluation should re-examine the original results giving consideration to:

- The information and data considered in the evaluation performed for the SLERA;
- The results of the SLERA; and
- The information and data gathered in performing the problem formulation activities associated with the Tier 3 site-specific ecological risk assessment.

The rationale, criteria, and methodology to be employed should be discussed with NMED. For a Tier 3 assessment, these discussions should be expanded to address additional issues including: the influence of random and/or biased sampling on the frequency and magnitude of detected values within the distribution of data: the spatial and temporal pattern of contaminants identified as low frequency and/or low magnitude; comparison of risk-based detection limits with toxicity benchmarks; and the relationship of detected values to toxicity benchmarks. The agreed upon approach should be documented in the Work Plan.

5.2.1.2 Dietary Considerations

Some site-related chemicals such as calcium, iron, magnesium, sodium, and potassium can function as nutrients in organisms serving as physiological electrolytes. When present at concentrations that allow them to function in this manner, they typically pose little ecological risk. However, some nutrients (e.g., selenium, copper, molybdenum, and boron) can transition from essential to toxic at slightly higher concentrations. As part of the Tier 3 assessment, the suite of nutrients relevant to the range of ecological receptors (wildlife versus plants) at the site should be identified. The potential for toxic effects resulting from site concentrations relative to the toxicological benchmarks for nutrients should be evaluated. In addition, the assessment should determine whether exposure to site contamination could result in a nutrient deficiency for

organisms of concern. As part of the analysis, the nutrient deficiency level and the toxicity benchmark should be compared to determine if they are similar in magnitude.

5.2.1.3 Bioaccumulation, Bioconcentration and Biomagnification

For those COPECs identified by applying any of the supplemental components discussed above, it is essential to evaluate their potential to bioaccumulate, bioconcentrate, and/or biomagnify prior to eliminating them from further consideration in the Tier 3 assessment. Compounds with a high potential to accumulate and persist in the food chain should be carried through the risk assessment process.

Additionally, the Tier 3 assessment should address the likelihood that contaminants identified for removal from the list of COPECs could exert adverse effects on higher trophic level organisms. A determination that bioaccumulation and biomagnification have been satisfactorily addressed through methods developed in consultation with the NMED and documented in the Tier 3 assessment Work Plan (e.g., modeling, site-related tissue measurements) should be included in the site-specific risk assessment report.

5.2.2 Further Characterization of Ecological Effects

The literature searches conducted as part of the SLERA should be expanded to obtain the information needed for the more detailed problem formulation phase of the Tier 3 site-specific ecological risk assessment. The literature search should identify NOAELs, LOAELs, exposure-response functions, and the mechanisms of toxic responses for those contaminants that were not addressed in the SLERA. Appendix C of USEPA's 1997 *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (US EPA 1997a) presents additional details on the factors that are important in conducting a literature search. For all chemicals on the refined list of COPECs, it is important to obtain and review the primary literature to ensure potential data gaps are addressed and that the most recently available information is used is Tier 3 risk assessment.

5.2.3 Reviewing and Refining Information on Contaminant Fate and Transport, Complete Exposure Pathways, and Ecosystems Potentially at Risk

The exposure pathways and the ecosystems associated with the assessment endpoints that were retained in the SLERA are evaluated in more detail. Additional information should be compiled on:

- The environmental fate and transport of the COPECs;
- The ecological setting and general flora and fauna of the site (including habitat, potential receptors, etc.); and
- The magnitude and extent of contamination, including its spatial and temporal variability relative to the assessment endpoints.

It is frequently possible to reduce the number of exposure pathways that require evaluation to one or a few "critical exposure pathways" which (1) reflect maximum exposures of receptors

within the ecosystem, or (2) constitute exposure pathways to ecological receptors sensitive to specific COPECs. If multiple critical exposure pathways exist at a site, each should be evaluated as part of the Tier 3 assessment.

5.2.3.1 Contaminant Fate and Transport

Information on how the COPECs will or could be transported or transformed in the environment by physical, chemical, and biological processes should be used to identify the exposure pathways that could produce significant ecological impacts. Physically, COPECs move through the environment by volatilization, erosion, deposition (contaminant sinks), weathering of parent material with subsequent transport, and/or water transport. Chemically, COPECs can undergo several processes in the environment such as degradation, complexation, ionization, precipitation, and/or adsorption. Several biological processes also affect COPEC fate and transport in the environment including bioaccumulation, biodegradation, biological transformation, food chain transfers, and/or excretion. Degradation product(s) and biological transformation products may be more or less toxic than the parent compound.

The above information is used to evaluate how COPECs will partition in the environment and determine the bioavailability of site contaminants. Note that at this point in the process, it may be possible for the risk assessment team and NMED to use this information to replace some of the conservative assumptions employed in the SLERA and eliminate some COPECs from further evaluation. Such negotiations should be summarized in the Work Plan and must be documented in the Tier 3 site-specific ecological risk assessment report.

5.2.3.2 Complete Exposure Pathways

The potentially complete exposure pathways identified in the SLERA must be evaluated in more detail in the Tier 3 assessment on the basis of the refined contaminant fate and transport evaluation and the refined evaluation of potential ecological receptors.

Some of the potentially complete exposure pathways identified in the SLERA may be ruled out from further consideration at this time. Conversely, additional exposure pathways might be identified particularly those originating from secondary sources of contamination. Any data gaps that result in questions about whether an exposure pathway is complete should be identified, and the type of data needed to answer those questions should be described to assist in developing the Work Plan and SAP. During the re-examination of the exposure pathways, the potential for food-chain exposures deserves particular attention as some COPECs are effectively transferred through food chains while others are not.

5.2.3.3 Ecosystems Potentially at Risk

The ecological setting information collected during the SLERA should provide answers to several questions including:

- What habitats are present?
- What types of water bodies are present, if any?
- Do any other habitats exist on or adjacent to the site (Table 3)?

If the questions above cannot be effectively answered using the information from the SLERA, an additional site visit should be considered to supplement the one conducted during the Scoping Assessment.

Available information on the ecological effects of contaminants as well as observations made during the initial and subsequent site visits can help focus the Tier 3 assessment on specific ecological resources that should be evaluated more thoroughly. For example, some groups of organisms can be more sensitive than others to a particular COPEC; alternatively, an already-stressed population (e.g., due to habitat degradation) could be particularly sensitive to any added stressor.

5.2.4 Selection of Site-Specific Assessment Endpoints

The selection of assessment endpoints includes discussion between the risk assessment team and NMED concerning management policy goals and ecological values. Input should be sought from all stakeholders associated with a site when identifying assessment endpoints. Stakeholder input at this stage helps ensure that NMED can readily defend the assessment endpoints when making decisions for the site.

If a Tier 2 screening assessment has been performed for the site, the selection of assessment endpoints should be re-examined. The endpoints selected for the Tier 3 assessment should reflect:

- Contaminants and concentrations at the site;
- Mechanisms of toxicity of the contaminants to different groups of organisms;
- Ecologically relevant receptor groups potentially sensitive or highly exposed to site contaminants and attributes of their natural history; and
- Potentially complete exposure pathways.

In addition, the risk assessment team should determine if any of the COPECs can adversely affect organisms in direct contact with contaminated media (e.g., direct exposure to water, sediment, soil) or if the contaminants accumulate in food chains, resulting in adverse effects in organisms that are not directly exposed or are minimally exposed to the original contaminated media (i.e., indirect exposure). Also, the risk assessment team must decide if the Tier 3 assessment should focus on toxicity resulting from direct or indirect exposures, or if both should be evaluated.

In specifying assessment endpoints, a broad specification (e.g., protecting aquatic communities) is generally of less value in problem formulation than a focused specification (e.g., maintaining aquatic community composition and structure downstream of a site similar to that upstream of the site). Focused assessment endpoints define the ecological value in sufficient detail to identify the measures needed to answer specific questions about the site or to test specific hypotheses.

Once assessment endpoints have been selected, testable hypotheses should be developed to determine whether or not a potential threat to the assessment endpoints exists. Measurement endpoints can also be developed or if developed as part of a Tier 2 screening assessment, refined based on the activities associated with the problem formulation step of the Tier 3 assessment. Note that testable hypotheses and measurement endpoints cannot be finalized without agreement on the assessment endpoints among NMED, the risk assessment team, and other stakeholders.

5.2.5 Development of a Conceptual Site Model and Associated Risk Questions

5.2.5.1 Conceptual Site Model

Based on the information obtained from the SLERA, knowledge of the contaminants present, the refined PSCEM, including the exposure pathway model, and the assessment endpoints, an integrated conceptual site model (CSM) should be developed. The integrated CSM should include a contaminant fate-and-transport diagram that traces the movement of COPECs from sources through the ecosystem to receptors associated with the assessment endpoints.

Exposure pathways that do not lead to a species or group of species associated with the proposed assessment endpoint indicate that: (1) there is an incomplete exposure pathway to the receptor(s) associated with the proposed assessment endpoint; or (2) there are missing components or data necessary to demonstrate a complete exposure pathway. If case (1) is true, the proposed assessment endpoint should be reevaluated to determine if it is an appropriate endpoint for the site. If case (2) is true, then additional field data may be needed to reevaluate contaminant fate and transport at the site.

Assessment endpoints differ from site to site, and can represent one or more levels of biological organization. At any particular site, the appropriate assessment endpoints might involve local populations of a particular species, community-level integrity, and/or habitat preservation. The integrated CSM must encompass the level of biological organization appropriate for the assessment endpoints for the site.

5.2.5.2 Risk Questions

Ecological risk questions are inquiries into the relationship between an assessment endpoint and its expected response when exposed to site contamination. Risk questions should be based on the assessment endpoints selected for the site and lead to answers that establish a foundation for the study design and evaluation of the results of the site investigation in the analysis and risk characterization phases of the risk assessment process. The most basic question applicable to virtually every site asks whether site-related contaminants are causing or have the potential to cause adverse effects on the assessment endpoint(s). To ensure the Tier 3 assessment is useful in a feasibility study, it is helpful if the specific contaminant(s) posing the most significant threat(s) can be identified. Thus, the question is refined to ask "does (or could) chemical X cause adverse effects on the assessment endpoint?" In general, four lines of evidence are used to answer this question:

- Comparison of estimated or measured exposure levels for chemical X with levels that are known from the literature to be toxic to receptors associated with the assessment endpoints;
- Comparison of laboratory bioassays of media from the site and bioassays of media from a reference site;
- Comparison of in situ toxicity tests at the site with in situ toxicity tests in a reference body of water; and
- Comparison of observed effects in the receptors associated with the site with similar receptors at a reference site.

5.2.6 Finalization of the CSM

The problem formulation step for the Tier 3 assessment is considered complete once the risk assessment team and NMED reach agreement on four items: the ecological contaminants of concern, the assessment endpoints, the exposure pathways, and the risk questions. These items should be presented and summarized in the integrated CSM for the site and the CSM should be presented and discussed in the Work Plan and SAP (if a separate SAP is developed) for the Tier 3 site-specific assessment.

5.3 Develop a Work Plan and SAP for Tier 3

Based on the information assembled during problem formulation, the risk assessment team and NMED agree on assessment endpoints, risk questions and/or testable hypotheses that, together with the rest of the integrated CSM, form the basis for the site investigation. At this stage, site-specific information on exposure pathways and/or the presence of specific species is likely to be incomplete. By using the integrated CSM, measurement endpoints can be selected/verified and a plan for filling information gaps can be developed and written into the Work Plan and SAP.

Field verification of the SAP is important to ensure that the data quality objectives (DQOs) for the site investigation will be met. This step verifies that the selected assessment endpoints, testable hypotheses, exposure pathway model, measurement endpoints, and study design are appropriate and implementable at the site. By verifying the field sampling plan prior to conducting the full site investigation, well-considered alterations can be made to the study design and/or its implementation if necessary. If changing conditions identified during field verification force changes to the Work Plan and/or SAP (e.g., selection of a different reference site), the changes should be agreed to and documented by the risk assessment team in consultation with NMED.

Site investigation activities and sampling and analysis procedures should be clearly documented in the Work Plan and/or SAP. However, the Work Plan and SAP should allow for instances where unexpected conditions arise in the field that indicate a need to change the study design. The Work Plan and SAP should indicate that should the need arise, the ecological risk assessment team will reevaluate the feasibility or adequacy of the sampling design and any resulting changes to the Work Plan or SAP will be agreed upon by both the risk assessment team and NMED and will be documented in the Tier 3 site-specific ecological risk assessment report.

When possible, any field sampling efforts for the ecological risk assessment should overlap with other site data collection efforts to reduce sampling costs and to prevent redundant sampling. The Work Plan and/or the SAP should specify the methods by which the collected data will be analyzed. Both plans should address all food chain exposure model parameters, data reduction techniques, data interpretation methods, and statistical analyses that will be used. Once completed, the documents should be submitted to NMED. At the successful conclusion of the review process, NMED will issue approvals or approvals with modifications for the Work Plan and SAP and the site investigation, data evaluation, and risk characterization can proceed.

♦ Recommended Information for Tier 3 site-specific Ecological Risk Assessment Work Plan and/or Sampling and Analysis Plan

At a minimum, the Tier 3 site-specific ecological Work Plan and accompanying SAP (if needed) should include:

- A brief and concise summary of the information contained in the SLERA Report.
- The results of the problem formulation step for the Tier 3 site-specific ecological risk assessment including:
- Summary of discussion and agreements with NMED regarding the use of FOD in the assessment.
- Refined list of COPECs.
- Further characterization of the ecological effects associated with site contaminants.
- Review and refinement of information on contaminant fate and transport, complete exposure pathways, and ecosystems potentially at risk at the site.
- Review and refinement of the selection of site-specific assessment endpoints.
- Development of the integrated CSM and associated risk questions.
- Identification and discussion of the Supplemental Components (i.e., background concentrations, frequency and magnitude of detection, dietary considerations, and any additional considerations used in refining the list of COPECs.
- Presentation and discussion of the integrated CSM.
- Detailed presentation of all site investigation activities and sampling and analysis procedures including quality assurance/quality control requirements.
- Presentation and discussion of all assessment endpoints, risk questions, and testable hypotheses.
- The SAP should specify the relationship between measurement and assessment endpoints, the necessary number, volume, and types of samples to be collected, and the sampling techniques to be used.
- The SAP should specify the data reduction and interpretation techniques and the DQOs for the site investigation.
- Contingency plan(s) that anticipate situations that may arise during the site investigation that require modification of the approaches documented in the Work Plan and/or SAP.
- Detailed presentation of procedures for analyzing site-specific data collected during the site investigation.
- Identification and discussion of the methodology to be employed in the analysis of exposure response.
- Identification and discussion of statistical techniques to be used in the Tier 3 assessment
- Quantified exposure for each measurement receptor for each pathway.
- Technical Decision Point summarizing agreement between the risk assessment team and NMED on the list of COPECs, assessment endpoints, exposure pathways, and risk questions.

5.4 Analysis of Ecological Exposures and Effects

Analysis of exposure and effects is performed interactively, with one analysis informing the other. These analyses are based on the information collected during the SLERA, problem formulation activities conducted in preparation for the Tier 3 assessment, and additional information collected in developing the Work Plan and SAP. Both analyses are performed in accordance with the data interpretation and analysis methods outlined in the Work Plan and SAP.

In the analysis phase, the site-specific data obtained during the site investigation replace many of the assumptions made for the SLERA. For the exposure and ecological effects characterizations, the uncertainties associated with the field measurements and with the assumptions made where site-specific data are not available must be documented in the Tier 3 site-specific ecological risk assessment report.

5.4.1 Characterizing Exposures

In the exposure analysis, both the ecological stressor and the ecosystem must be characterized on similar temporal and spatial scales. The result of the analysis is an exposure profile that quantifies the magnitude and spatial and temporal patterns of exposure as they relate to the assessment endpoints and risk questions developed during problem formulation. This exposure profile along with a description of the associated uncertainties and assumptions serves as input to the risk characterization.

Stressor characterization involves determining the stressor's distribution and pattern of change. The analytic approach for characterizing ecological exposures should follow the methodology specified in the Work Plan and SAP. For chemical stressors, a combination of fate-and-transport modeling and sampling data from the site are typically used to predict the current and likely future nature and extent of contamination at a site. Any site-specific information that can be used to replace previous assumptions based on literature searches or information from other sites should be incorporated into the description of ecological conditions at the site. This information and all remaining assumptions and uncertainties associated with the characterization of exposures at the site should be documented in the Tier 3 site-specific ecological risk assessment report.

Specifically, exposure to COPECs released from facility contaminant sources is evaluated through consideration of the exposure pathways included in the integrated CSM. All exposure pathways identified as potentially complete should be evaluated in the exposure assessment. The summation of this potential exposure across all pathways for a measurement receptor defines the exposure of that measurement receptor to a COPEC. Exposure assessments are conducted separately for each community and each measurement receptor.

5.4.2 Characterizing Ecological Effects

Following the methods for analyzing site-specific data specified in the Work Plan and SAP, the assembled information on ecological effects is integrated with any evidence of existing impacts gathered during the site investigation (e.g., toxicity testing).

5.4.2.1 Exposure-response Analysis

In this phase of the analysis, measurement endpoints are related to the assessment endpoints using the logical structure provided by the integrated CSM. Any extrapolations required to relate measurement to assessment endpoints (e.g., between species, between response levels, from laboratory to field) should be explained. Finally, an exposure-response relationship is described to the extent possible (e.g., by a regression equation), including the confidence limits (quantitative or qualitative) associated with the relationship. Statistical techniques such as those available in US EPA's ProUCL software (US EPA, 2013a) and other methods used to identify and/or describe the relationship between exposure and response from the field data should follow the analysis procedure specified in the Work Plan and SAP.

When exposure-response data are not available or cannot be developed, a threshold for adverse effects can be developed instead, as in the SLERA. For the Tier 3 assessment: however, site-specific information should be used instead of the conservative assumptions used in the SLERA. If a site will be analyzed using this approach, the methodology should be described in the Work Plan and, as necessary, the SAP (see Sections 3.2 and 4.1).

5.4.2.2 Evidence of Causality

Demonstrating a correlation between the contaminant gradient at the site and ecological impacts is an important component of establishing causality. Thus, it is important to evaluate the strength of the causal association between the site contaminants and their impact on the measurement and assessment endpoints. However, other lines of evidence should be presented in support or in the absence of such a demonstration. Note that by itself, an exposure-response correlation at a site is not sufficient to demonstrate causality. The correlation must be supported by one or more lines of evidence as well as an analysis of potential confounding factors at the site. Criteria for evaluating causal associations are outlined in the US EPA's *Framework for Ecological Risk Assessment* (US EPA, 1992d).

5.5 Risk Characterization

The risk characterization section of the Tier 3 site-specific ecological risk assessment report should include a qualitative and quantitative presentation of the risk results and associated uncertainties.

5.5.1 Risk Estimation

For population measurement receptors, HQs and HIs should reflect the actual diet of the receptor; the exposure and risk to multiple contaminants are additive (i.e., two or more contaminants may affect the same target organs or organ systems and/or act by similar mechanisms). Therefore, HQs and HIs calculated using TRVs based on different effects (e.g., survivorship vs. reproductive ability), toxicity endpoints (e.g., NOAEL, LOAEL), and/or exposure durations (e.g., acute, chronic) should not be summed to derive HIs. In these cases, risk assessment efforts should be focused on the highest contributing COPEC or class of

COPECs which can reasonably be summed across effects, toxicity endpoints, and exposure durations (US EPA, 1999a).

Documentation of the risk estimates should describe how inferences are made from the measurement endpoints to the assessment endpoints established during problem formulation. For ecological risk assessments that rely upon multiple lines of evidence, a strength-of-evidence approach is used to integrate different types of data to support the conclusions of the assessment. The lines of evidence might include toxicity test results, assessments of existing impacts at a site, or risk calculations comparing exposures estimated for the site with toxicity values from the literature. Balancing and interpreting these different types of data can be a major task and require professional judgment. As already noted the strength of evidence provided by different types of tests and the precedence that one type of study might have over another should have been established in the Work Plan. Taking this approach will ensure that data interpretation is objective and not biased to support a preconceived result. Additional strength-of-evidence considerations at this stage include the degree to which DQOs were met and whether confounding factors became evident during the site investigation and analysis phase of the risk assessment process.

For some biological tests (e.g., toxicity tests, benthic macroinvertebrate studies), all or some of the data interpretation process should be outlined in existing documents, such as in toxicity testing manuals. In most cases; however, the Work Plan or SAP (if available) must describe how the resulting data will be interpreted for a site. The data interpretation methods also should be presented in the risk characterization documentation. For example, if the triad approach was used to evaluate contaminated sediments, the risk estimation section should describe how the three types of studies (i.e., toxicity test, benthic invertebrate survey, and sediment chemistry) are integrated to draw conclusions about risk.

Where exposure-response functions are not available or developed, the quotient method of comparing an estimated exposure concentration to a threshold for response can be used, as used in the SLERA. If possible, presentation of full exposure-response functions is preferred as these functions provide NMED with more information on which to base site decisions. This guidance has recommended the use of on-site contamination gradients to demonstrate on-site exposure-response functions. Where such data have been collected, they should be presented along with the risk estimates in the Tier 3 site specific ecological risk assessment report. HQs and HI s (for contaminants with the same mechanism of toxicity), the results of in situ toxicity testing, or community survey data can be mapped along with analytic chemistry data to provide a clear picture of the relationship between areas of contamination and observed or expected ecological effects.

In addition to developing point estimates of exposure concentrations (as provided by the hazard quotient approach), it may be possible to develop a distribution of exposure levels based on the potential variability in various exposure parameters. Probabilities of exceeding a threshold for adverse effects can then be estimated. As previously stated, the risk assessment team and NMED should agree on the specific analyses to be used in characterizing risks and documented the procedures for the analyses in the Work Plan.

5.5.2 Risk Description

Risk descriptions for Tier 3 assessments should document the environmental contamination levels that bound the threshold for adverse ecological effects for each assessment endpoint. The lower bound of the threshold should be based on consistent conservative assumptions and NOAEL toxicity values while the upper bound should be based on observed impacts or predictions that ecological impacts could occur. This upper bound should be developed using consistent assumptions, site-specific data, LOAEL toxicity values, or an impact evaluation.

The approach for estimating environmental contaminant concentrations that represent thresholds for adverse ecological effects should be specified in the study design and documented in the Work Plan. When higher trophic-level organisms are associated with assessment endpoints, the study design should describe how monitoring data and contaminant-transfer models will be used to back-calculate an environmental concentration representing a threshold for effect. If the site investigation identifies a gradient of ecological effects along a contamination gradient, the risk assessment team should identify and document the levels of contamination below which no further improvements in the assessment endpoints are discernable or expected. If departures from the original analysis plan are necessary based on information obtained during the site investigation or data analysis phase, the reasons for the change should be discussed with NMED and the results of those discussions documented in the Tier 3 risk assessment report.

5.5.3 Additional Risk Information

In addition to developing numerical estimates of existing impacts, risks, and thresholds for ecological effects, the risk assessment team should establish the context of the estimates by describing their extent, magnitude, and potential ecological significance. Additional ecological risk descriptors are listed below:

- The location and areal extent of existing contamination above a threshold for adverse effects;
- The degree to which the threshold for contamination is exceeded or is likely to be exceeded in the future, particularly if exposure-response functions are available; and
- The expected half-life (qualitative or quantitative) of contaminants in the environment (e.g., sediments, food chain) and the potential for natural recovery once the sources of contamination are removed.

5.6 Uncertainty Analysis

There are several sources of uncertainties associated with ecological risk estimates. One is the initial selection of substances of concern based on the sampling data and available toxicity information. Other sources of uncertainty include estimates of toxicity to ecological receptors at the site based on limited data from the laboratory (usually on other species), from other ecosystems, or from the site over a limited period. Additional uncertainties result from the exposure assessment, because of the uncertainty in chemical monitoring data and models used to estimate exposure concentrations or doses. Further uncertainties are included in risk estimates when simultaneous exposures to multiple substances occur.

Within the analysis each source of uncertainty should be identified and its impact on the risk estimates and risk characterization discussed. Uncertainty should be distinguished from variability. Variability arises from true heterogeneity or variation in environmental characteristics and receptors. Uncertainty, on the other hand, represents lack of knowledge about certain factors, which can sometimes be reduced through additional study.

In general, there are two approaches to tracking uncertainties through a risk assessment:

- Using various point estimates of exposure and response to develop one or more point estimates of risk; and
- Conducting a distributional analysis to predict a distribution of risks based on a distribution of exposure levels and exposure-response information. Whether one or the other or both approaches are taken should have been agreed to by the risk assessment team and NMED and documented in the Work Plan.

5.7 Recommended Content of the Tier 3 Ecological Risk Assessment Report

In addition to the information delineated below, the report should include any other information about the site which the risk assessors considerrelevant to evaluating the ecological risk at the site. For purposes of clarity, it is recommended that this additional information be included in an appendix to the Tier 3 Report and merely referenced in the main body of the report text.

The results of the Tier 3 COPECs selection process should be presented in a tabular format showing the final list of COPECs from the SLERA, the refined list of COPECs developed during Tier 3 problem formulation and technically defensible justification for each COPEC eliminated from or added to the refined list of site contaminants.

The following items should also be included in the Tier 3 Ecological Risk Assessment Report:

- A brief and concise but comprehensive summary of the information contained in the SLERA Report;
- The list of refined COPECs addressed in the Tier 3 assessment;
- A comprehensive summary of the results of all Tier 3 problem formulation activities;
- A description of all deviations from the Work Plan and SAP, including the circumstances that led to the deviations and the agreements with NMED on how to address those circumstances;
- A description of all in-field modifications to the approaches outlined in the Work Plan and/or SAP, including the circumstances that led to the need for in-field modifications and the agreements with NMED regarding the appropriate modifications for addressing those circumstances;
- Identification and discussion of the assumptions and uncertainties associated with the analysis of ecological exposures and ecological effects;
- A demonstration of the correlation between the contaminant gradients at the site and the ecological effects of the contaminant gradients, including any supporting lines of evidence needed to establish causality;
- Presentation and discussion of qualitative and quantitative risk results and the uncertainties reflected in the results;
- Number, type and size of habitats present in the assessment area;

- Sources of information used to determine habitats;
- Plant and animal species typical of those habitats;
- All food webs developed for habitats occurring in the assessment area including:
    - Media for which web is constructed,
    - Division into trophic levels,
    - Class-specific guild designations for each trophic level, and
    - Major dietary interactions.
- Assessment endpoints selected for guilds and communities (and rationale);
- Measurement endpoints associated with identified assessment endpoints;
- Measures of effect selected for guilds and communities (and rationale);
- Integrated conceptual site exposure model;
- Estimated COPEC concentration in each component of each trophic level;
- Quantified exposure for each measurement receptor for each pathway;
- Summary of toxicity values used in the Tier 3 assessment;
- Results of HQ and HI calculations for each receptor if this approach is used in the Tier 3 assessment;
- Evaluation of nature/magnitude of risk at each site; and
- Qualitative analysis of impact of all identified uncertainties on the ecological risk assessment process.

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ATTACHMENT A
SCREENING-LEVEL ECOLOGICAL RISK ASSESSMENT
SCOPING ASSESSMENT
SITE ASSESSMENT CHECKLIST

INTRODUCTION

This checklist has been developed as a tool for gathering information about the facility property and surrounding areas, as part of the scoping assessment. Specifically, the checklist assists in the compilation of information on the physical and biological aspects of the site including the site environmental setting, usage of the site, releases at the site, contaminant fate and transport mechanisms, and the area's habitats, receptors, and exposure pathways. The completed checklist can then be used to construct the preliminary conceptual site exposure model (PCSEM) for the site. In addition, the checklist and PCSEM will serve as the basis for the scoping assessment. Section III of this document provides further information on using the completed checklist to develop the PCSEM.

In general, the checklist is designed for applicability to all sites; however, there may be unusual circumstances which require professional judgment to determine the need for further ecological evaluation (*e.g.*, cave-dwelling receptors). In addition, some of the questions in the checklist may not be relevant to all sites. Some facilities may have large amounts of data available regarding contaminant concentrations and hydrogeologic conditions at the site, while other may have only limited data. In either case, the questions on the checklist should be addressed as completely as possible with the information available.

Habitats and receptors, which may be present at the site, can be identified by direct or indirect[1] observations and by contacting local and regional natural resource agencies. Habitat types may be determined by reviewing LULC, which are available via the Internet at http://www.nationalatlas.gov/mapit.html. With regard to receptors, it should be noted that receptors are often present at a site even when they are not observed. Therefore, for the purposes of this checklist, it should be assumed that receptors are present if viable habitat is present. The presence of receptors should be confirmed by contacting one or several of the organizations listed below.

Sources of general information available for the identification of ecological receptors and habitats include:

- U.S. Fish and Wildlife Service (http://www.fws.gov)
- Biota Information System of New Mexico (BISON-M) maintained by the New Mexico Department of Game and Fish (NMGF) (http://151.199.74.229/states/nm.htm)
- U.S. Forest Service (USFS) (http://www.fs.fed.us/)
- New Mexico Forestry Division (NMFD) of the Energy, Minerals and Natural Resources Department (http://www.emnrd.state.nm.us/forestry/index.htm)
- U.S. Bureau of Land Management (USBLM) (http://www.blm.gov/nhp/index.htm) or (http://www.nm.blm.gov/www/new_home_2.html)
- United States Geological Service (USGS) (http://www.usgs.gov)

1 Examples of indirect observations that indicate the presence of receptors include: tracks, feathers, burrows, scat

- National Wetland Inventory Maps (http://wetlands.fws.gov)
- National Audubon Society (http://www.audobon.com)
- National Biological Information Infrastructure (http://biology.usgs.gov)
- Sierra Club (http://www.sierraclub.org)
- National Geographic Society (http://www.nationalgeographic.com)
- New Mexico Natural Heritage Program (http://nmnhp.unm.edu/)
- State and National Parks System
- Local universities
- Tribal organizations

INSTRUCTIONS FOR COMPLETING THE CHECKLIST

The checklist consists of four sections: Site Location, Site Characterization, Habitat Evaluation, and Exposure Pathway Evaluation. Answers to the checklist should reflect existing conditions and should not consider future remedial actions at the site. Completion of the checklist should provide sufficient information for the preparation of a PCSEM and scoping report and allow for the identification of any data gaps.

Section I - Site Location, provides general site information, which identifies the facility being evaluated, and gives specific location information. Site maps and diagrams, which should be attached to the completed checklist, are an important part of this section. The following elements should be clearly illustrated: 1) the location and boundaries of the site relative to the surrounding area, 2) any buildings, structures or important features of the facility or site, and 3) all ecological areas or habitats identified during completion of the checklist. It is possible that several maps will be needed to illustrate the required elements clearly and adequately. Although topographical information should be illustrated on at least one map, it is not required for every map. Simplified diagrams (preferably to scale) of the site and surrounding areas will usually suffice.

Section II - Site Characterization, is intended to provide additional temporal and contextual information about the site, which may have an impact on determining whether a certain area should be characterized as ecologically viable habitat or contains receptors. Answers to the questions in Section II will help the reviewer develop a broader and more complete evaluation of the ecological aspects of a site.

Section III - Habitat Evaluation, provides information regarding the physical and biological characteristics of the different habitat types present at or in the locality of the site. Aquatic features such as lakes, ponds, streams, arroyos and ephemeral waters can be identified by reviewing aerial photographs, LULC and topographic maps and during site reconnaissance visits. In New Mexico, there are several well-defined terrestrial communities, which occur naturally. Typical communities include wetlands, forest (e.g., mixed conifer, ponderosa pine and pinyon juniper), scrub/shrub, grassland, and desert. Specific types of vegetation characterize each of these communities and can be used to identify them. Field guides are often useful for identifying vegetation types. A number of sites may be in areas that have been disturbed by human activities and may no longer match any of the naturally occurring communities typical of the southwest. Particularly at heavily used areas at facilities, the two most common of these areas are usually

described as "weed fields" and "lawn grass". Vegetation at "weed fields" should be examined to determine whether the weeds consist primarily of species native to the southwest or introduced species such as Kochia. Fields of native weeds and lawn grass are best evaluated using the short grass prairie habitat guides.

The applicable portions of Section III of the checklist should be completed for each individual habitat identified. For example, the questions in Section III.A of the checklist should be answered for each wetland area identified at or in the locality of the site and the individual areas must be identified on a map or maps.

Section IV- Exposure Pathway Evaluation is used to determine if contaminants at the site have the potential to impact habitat identified in Section III. An exposure pathway is the course a chemical or physical agent takes from a source to an exposed organism. Each exposure pathway includes a source (or release from a source), an environmental transport mechanism, an exposure point, and an exposure route. A complete exposure pathway is one in which each of these components, as well as a receptor to be exposed, is present. Essentially, this section addresses the fate and transport of contaminants that are known or suspected to have been released at the site. In most cases, without a complete exposure pathway between contaminants and receptors, additional ecological evaluation is not warranted.

Potential transport pathways addressed in this checklist include migration of contaminants via air dispersion, leaching into groundwater, soil erosion/runoff, groundwater discharge to surface water, and irradiation. Due to New Mexico's semi-arid climate, vegetation is generally sparse. The sparse vegetation, combined with the intense nature of summer storms in New Mexico, results in soil erosion that occurs sporadically over a very brief time frame. Soil erosion may be of particular concern for sites located in steeply sloped areas. Several questions within Section IV of this checklist have been developed to aid in the identification of those sites where soil erosion/runoff would be an important transport mechanism.

USING THE CHECKLIST TO DEVELOP THE PRELIMINARY CONCEPTUAL SITE EXPOSURE MODEL

The completed Site Assessment Checklist can be used to construct the PCSEM. An example PCSEM diagram is presented in Figure 1. The CSM illustrates actual and potential contaminant migration and exposure pathways to associated receptors. The components of a complete exposure pathway are simplified and grouped into three main categories: sources, release mechanisms, and potential receptors. As a contaminant migrates and/or is transformed in the environment, sources and release mechanisms may expand into primary, secondary, and tertiary levels. For example, Figure 1 illustrates releases from inactive lagoons (primary sources) through spills (primary release mechanism), which migrate to surface and subsurface soils (secondary sources), which are then leached (secondary release mechanism) to groundwater (tertiary source). Similarly, exposures of various trophic levels to the contaminant(s) and consequent exposures via the food chain may lead to multiple groups of receptors. For example, Figure 1 illustrates groups of both aquatic and terrestrial receptors which may be exposed and subsequently serve as tertiary release mechanisms to receptors which prey on them.

Although completing the checklist will not provide the user with a readymade PCSEM, a majority of the components of the PCSEM can be found in the answers to the checklist. It is

 then up to the user to put the pieces together into a comprehensive whole. The answers from Section II of the checklist, Site Characterization, can be used to identify sources of releases. The answers to Section IV, Exposure Pathway Evaluation, will assist users in tracing the migration pathways of releases in the environment, thus helping to identify release mechanisms and sources. The results of Section III, Habitat Evaluation, can be used to both identify secondary and tertiary sources and to identify the types of receptors which may be exposed. Appendix B of the NMED's *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Assessment* also contains sample food webs which may be used to develop the PCSEM.

Once all of the components have been identified, one can begin tracing the steps between the primary releases and the potential receptors. For each potential receptor, the user should consider all possible exposure points (e.g., prey items, direct contact with contaminated soil or water, etc.) then begin eliminating pathways, which are not expected to result in exposure to the contaminant at the site. Gradually, the links between the releases and receptors can be filled in, resulting in potential complete exposure pathways.

For further guidance on constructing a PCSEM, consult the NMED's *Guidance for Assessing Ecological Risks Posed by Chemicals: Screening-Level Ecological Assessment* (2000), and EPA's Office of Solid Waste and Emergency *Response's Soil Screening Guidance: User's Guide* (1996).

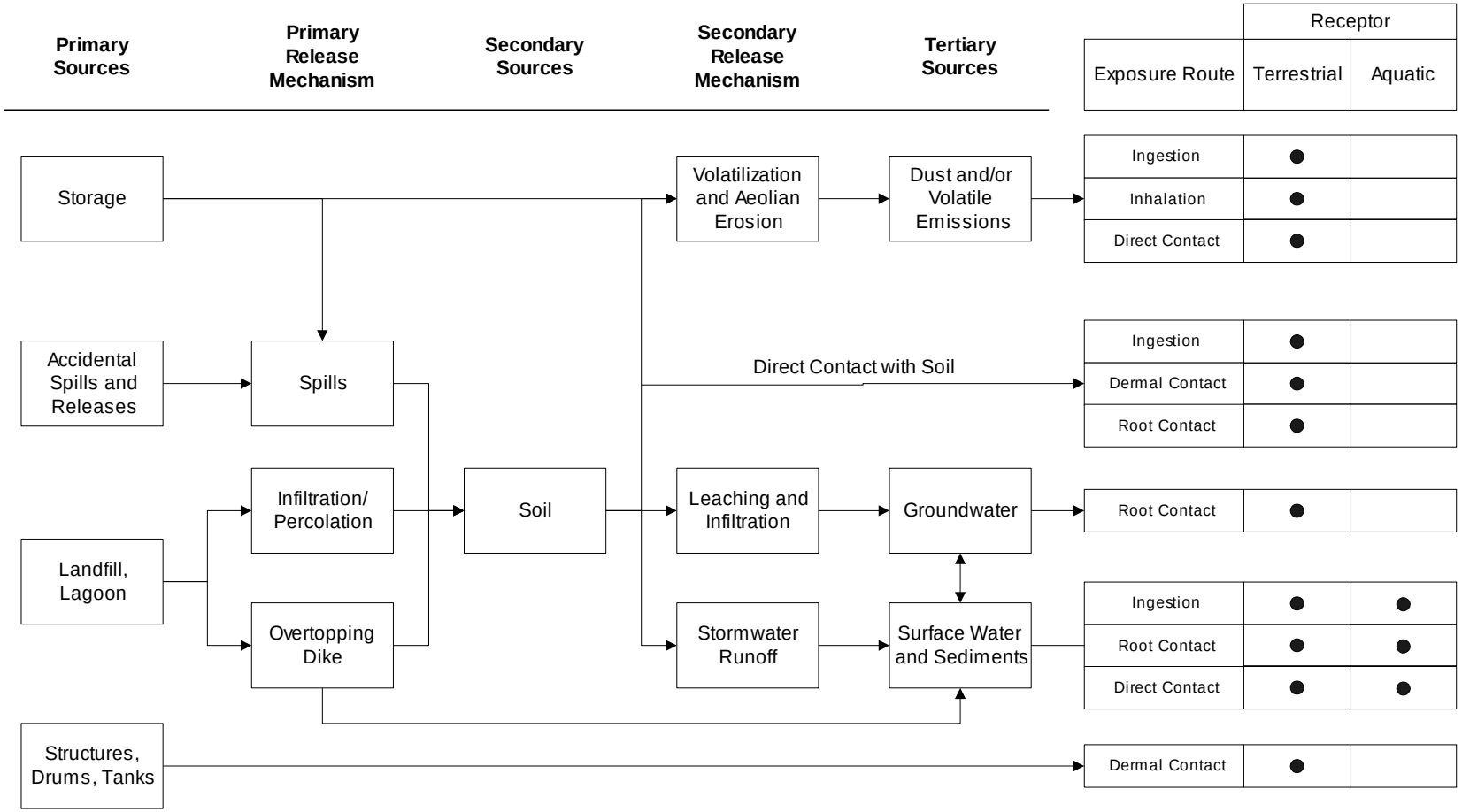


Figure 1. Example Preliminary Conceptual Site Exposure Model Diagram

NEW MEXICO ENVIRONMENT DEPARTMENT
SITE ASSESSMENT CHECKLIST

I. SITE LOCATION

1. Site
   Name:_____
   US EPA I.D.
   Number:_____
   Location:_____
   County:_____
   City:_____State:_____

2. Latitude:_____ Longitude:_____

3. Attach site maps, including a topographical map, a diagram which illustrates the layout of the facility (e.g., site boundaries, structures, etc.), and maps showing all habitat areas identified in Section III of the checklist. Also, include maps which illustrate known release areas, sampling locations, and any other important features, if available.

II. SITE CHARACTERIZATION

1. Indicate the approximate area of the site (i.e., acres or sq. ft)
   _____

2. Provide an approximate breakdown of the land uses on the site:

_____% Heavy Industrial	_____% Light Industrial	_____% Urban
_____% Residential	_____% Rural	_____% Agricultural[b]
_____% Recreational[a]	_____% Undisturbed	_____% Other[c]

[a]For recreational areas, please describe the usage of the area (e.g., park, playing field, etc.):
_____

[b]For agricultural areas, please list the crops and/or livestock which are present:
_____

[c]For areas designated as "other", please describe the usage of the area:
_____

3. Provide an approximate breakdown of the land uses in the area surrounding the site. Indicate the radius (in miles) of the area described: _____

_____% Heavy Industrial	_____% Light Industrial	_____% Urban
_____% Residential	_____% Rural	_____% Agricultural[b]
_____% Recreational[a]	_____% Undisturbed	_____% Other [c]

[a]For recreational areas, please describe the usage of the area (e.g., park, playing field, golf course, etc.):
_____

[b]For agricultural areas, please list the crops and/or livestock which are present:
_____

[c]For areas designated as "other", please describe the usage of the area:
_____
_____

4. Describe reasonable and likely future land and/or water use(s) at the site.
_____
_____
_____
_____
_____
_____

5. Describe the historical uses of the site. Include information on chemical releases that may have occurred as a result of previous land uses. For each chemical release, provide information on the form of the chemical released (i.e., solid, liquid, vapor) and the known or suspected causes or mechanism of the release (i.e., spills, leaks, material disposal, dumping, explosion, etc.).
_____
_____
_____
_____
_____

6. If any movement of soil has taken place at the site, describe the degree of the disturbance. Indicate the likely source of any disturbances (e.g., erosion, agricultural, mining, industrial activities, removals, etc.) and estimate when these events occurred.
_____
_____
_____

7. Describe the current uses of the site. Include information on recent (previous 5 years) disturbances or chemical releases that have occurred. For each chemical release, provide information on the form of the chemical released and the causes or mechanism of the release.

_____
_____
_____
_____
_____

8. Identify the location or suspected location of chemical releases at the site. Provide an estimate of the distance between these locations and the areas identified in Section III.

_____
_____
_____
_____
_____

9. Identify the suspected contaminants of concern (COCs) at the site. If known, include the maximum contaminant levels. Please indicate the source of data cited (e.g., RFI, confirmatory sampling, etc.).

_____
_____
_____
_____
_____
_____

10. Identify the media (e.g., soil (surface or subsurface), surface water, air, groundwater) which are known or suspected to contain COCs._____
_____

11. Indicate the approximate depth to groundwater (in feet below ground surface [(bgs)].

_____

12. Indicate the direction of groundwater flow (e.g., north, southeast, etc.)

_____

III. HABITAT EVALUATION

III.A Wetland Habitats

Are any wetland[2] areas such as marshes or swamps on or adjacent to the site?

☐ Yes ☐ No

If yes, indicate the wetland area on the attached site map and answer the following questions regarding the wetland area. If more than one wetland area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual wetland area. Distinguish between wetland areas by using names or other designations (such as location), and clearly identify each area on the site map. Also, obtain and attach a National Wetlands Inventory Map (or maps) to illustrate each wetland area.

Identify the sources of the observations and information (e.g., National Wetland Inventory, Federal or State Agency, USGS topographic maps) used to make the determination that wetland areas are or are not present.

_____
_____
_____
_____

If no wetland areas are present, proceed to Section III.B.

Wetland Area Questions

☐ Onsite ☐ Offsite

Name or
Designation:_____

1. Indicate the approximate area of the wetland (acres or ft^2)_____

2. Identify the type(s) of vegetation present in the wetland.

- ❑ Submergent (i.e., underwater) vegetation
- ❑ Emergent (i.e., rooted in the water, but rising above it) vegetation
- ❑ Floating vegetation
- ❑ Scrub/shrub
- ❑ Wooded

2Wetlands are defined in 40 CFR §232.2 as " Areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Examples of typical wetlands plants include: cattails, cordgrass, willows and cypress trees. National wetland inventory maps may be available at http:\\nwi.fws.gov. Additional information on wetland delineation criteria is also available from the Army Corps of Engineers.

- ❑ Other (Please describe):_____

3. Estimate the vegetation density of the wetland area.

   - ❑ Dense (i.e., greater than 75% vegetation)
   - ❑ Moderate (i.e., 25% to 75% vegetation)
   - ❑ Sparse (i.e., less than 25% vegetation)

4. Is standing water present? ☐ Yes ☐ No

   If yes, is the water primarily: ☐ Fresh or ☐ Brackish
   Indicate the approximate area of the standing water (ft^2):
   _____
   Indicate the approximate depth of the standing water, if known (ft. or in.)_____

5. If known, indicate the source of the water in the wetland.

   - ❑ Stream/River/Creek/Lake/Pond
   - ❑ Flooding
   - ❑ Groundwater
   - ❑ Surface runoff

6. Is there a discharge from the facility to the wetland? ☐ Yes ☐ No
   If yes, please describe:_____
   _____
   _____
   _____
   _____
   _

Wetland Area Questions (Continued)

7. Is there a discharge from the wetland? ☐ Yes ☐ No
If yes, indicate the type of aquatic feature the wetland discharges into:

- ❑ Surface stream/River (Name:_____)
- ❑ Lake/Pond (Name:_____)
- ❑ Groundwater
- ❑ Not sure

8. Does the area show evidence of flooding? ☐ Yes ☐ No
If yes, indicate which of the following are present (mark all that apply):

- ❑ Standing water
- ❑ Water-saturated soils
- ❑ Water marks
- ❑ Buttressing
- ❑ Debris lines
- ❑ Mud cracks
- ❑ Other (Please describe):_____

9. Animals observed in the wetland area or suspected to be present based on indirect evidence or file material:

- ❑ Birds
- ❑ Fish
- ❑ Mammals
- ❑ Reptiles (e.g., snakes, turtles)
- ❑ Amphibians (e.g., frogs, salamanders)
- ❑ Sediment-dwelling invertebrates (e.g., mussels, crayfish, insect nymphs)

Specify species, if known:
_____
_____
_____
_____

III.B Aquatic Habitats
III.B.1 Non-Flowing Aquatic Features

Are any non-flowing aquatic features (such as ponds or lakes) located at or adjacent to the site?

☐ Yes ☐ No

If yes, indicate the aquatic feature on the attached site map and answer the following questions regarding the non-flowing aquatic features. If more than one non-flowing aquatic feature is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual aquatic feature. Distinguish between aquatic features by using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.B.2.

Non-Flowing Aquatic Feature Questions

☐ Onsite ☐ Offsite

Name or Designation:_____

1. Indicate the type of aquatic feature present:

   - ❑ Natural (e.g., pond or lake)
   - ❑ Man-made (e.g., impoundment, lagoon, canal, etc.)

2. Estimate the approximate size of the water body (in acres or sq. ft.)_____

3. If known, indicate the depth of the water body (in ft. or in.)._____

Non-Flowing Aquatic Feature Questions (Continued)

4. Indicate the general composition of the bottom substrate. Mark all sources that apply from the following list.

☐ Bedrock	☐ Sand	☐ Concrete
☐ Boulder (>10 in.)	☐ Silt	☐ Debris
☐ Cobble (2.5 - 10 in.)	☐ Clay	☐ Detritus
☐ Gravel (0.1 - 2.5 in.)	☐ Muck (fine/black)	

☐ Other (please specify):_____

5. Indicate the source(s) of the water in the aquatic feature. Mark all sources that apply from the following list.

- ❑ River/Stream/Creek
- ❑ Groundwater
- ❑ Industrial Discharge
- ❑ Surface Runoff
- ❑ Other (please specify):_____

6. Is there a discharge from the facility to the aquatic feature? ☐ Yes ☐ No

If yes, describe the origin of each discharge and its migration path:

_____
_____
_____
_____

7. Does the aquatic feature discharge to the surrounding environment? ☐ Yes ☐ No

If yes, indicate the features from the following list into which the aquatic feature discharges, and indicate whether the discharge occurs onsite or offsite:

- ❑ River/Stream/Creek ☐ onsite ☐ offsite
- ❑ Groundwater ☐ onsite ☐ offsite
- ❑ Wetland ☐ onsite ☐ offsite
- ❑ Impoundment ☐ onsite ☐ offsite
- ❑ Other (please describe)_____

Non-Flowing Aquatic Feature Questions (Continued)

8. Animals observed in the vicinity of the aquatic feature or suspected to be present based on indirect evidence or file material:

- ❑ Birds
- ❑ Fish
- ❑ Mammals
- ❑ Reptiles (e.g., snakes, turtles)
- ❑ Amphibians (e.g., frogs, salamanders)
- ❑ Sediment-dwelling invertebrates (e.g., mussels, crayfish, insect nymphs)

Specify species, if known:

_____
_____
_____
_____

III.B.2 Flowing Aquatic Features

Are any flowing aquatic features (such as streams or rivers) located at or adjacent to the site?

☐ Yes ☐ No

If yes, indicate the aquatic feature on the attached site map and answer the following questions regarding the flowing aquatic features. If more than one flowing aquatic feature is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual aquatic feature. Distinguish between aquatic features by using names or other designations, and clearly identify each area on the site map

If no, proceed to Section III.C.

Flowing Aquatic Feature Questions

☐ Onsite ☐ Offsite

Name or Designation:_____

1. Indicate the type of flowing aquatic feature present.

   - ❑ River
   - ❑ Stream
   - ❑ Creek
   - ❑ Brook
   - ❑ Dry wash
   - ❑ Arroyo
   - ❑ Intermittent stream
   - ❑ Artificially created (ditch, etc.)
   - ❑ Other (specify)
   - ❑

2. Indicate the general composition of the bottom substrate.

   ☐ Bedrock ☐ Sand ☐ Concrete
   ☐ Boulder (>10 in.) ☐ Silt ☐ Debris
   ☐ Cobble (2.5 - 10 in.) ☐ Clay ☐ Detritus
   ☐ Gravel (0.1 - 2.5 in.) ☐ Muck (fine/black)
   ☐ Other (please specify):_____

3. Describe the condition of the bank (e.g., height, slope, extent of vegetative cover) of the aquatic feature.

   _____
   _____
   _____
   _____

4. Is there a discharge from the facility to the aquatic feature? ☐ Yes ☐ No
   If yes, describe the origin of each discharge and its migration path:

   _____
   _____
   _____
   _____

5. Indicate the discharge point of the water body. Specify name, if known.

   _____
   _____
   _____

Flowing Aquatic Feature Questions (Continued)

6. If the flowing aquatic feature is a dry wash or arroyo, answer the following questions.
   - ❑Check here if feature is not a dry wash or arroyo

   If known, specify the average number of days in a year in which flowing water is present in the feature: _____

   Is standing water or mud present? Check all that apply.
   - ❑Standing water
   - ❑Mud
   - ❑Neither standing water or mud

   Does the area show evidence of recent flow (e.g., flood debris clinging to vegetation)?
   - ❑Yes
   - ❑No
   - ❑Not sure
7. Animals observed in the vicinity of the aquatic feature or suspected to be present based on indirect evidence or file material:

   - ❑ Birds
   - ❑ Fish
   - ❑ Mammals
   - ❑ Reptiles (e.g., snakes, turtles)
   - ❑ Amphibians (e.g., frogs, salamanders)
   - ❑ Sediment-dwelling invertebrates (e.g., mussels, crayfish, insect nymphs)

   Specify species, if known:
   _____
   _____
   _____
   _____

III.C Terrestrial Habitats
III.C.1 Wooded

Are any wooded areas on or adjacent to the site? ☐ Yes ☐ No

If yes, indicate the wooded area on the attached site map and answer the following questions. If more than one wooded area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual wooded area. Distinguish between wooded areas by using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.C.2.

Wooded Area Questions

☐ On-site ☐ Off-site

Name or Designation:_____

1. Estimate the approximate size of the wooded area (in acres or sq. ft.)_____

2. Indicate the dominant type of vegetation in the wooded area.

   - ❑ Evergreen
   - ❑ Deciduous
   - ❑ Mixed

   Dominant plant species, if known:_____

3. Estimate the vegetation density of the wooded area.

   ❑Dense (i.e., greater than 75% vegetation)
   ❑Moderate (i.e., 25% to 75% vegetation)
   ❑Sparse (i.e., less than 25% vegetation)

4. Indicate the predominant size of the trees at the site. Use diameter at chest height.

   - ❑ 0-6 inches
   - ❑ 6-12 inches
   - ❑ >12 inches
   - ❑ No single size range is predominant

5. Animals observed in the wooded area or suspected to be present based on indirect evidence or file material:

   - ❑ Birds
   - ❑ Mammals
   - ❑ Reptiles (e.g., snakes, lizards)
   - ❑ Amphibians (e.g., toads, salamanders)

   Specify species, if known:
   _____
   _____
   _____
   _____

III.C.2 Shrub/Scrub

Are any shrub/scrub areas on or adjacent to the site? ☐ Yes ☐ No

If yes, indicate the shrub/scrub area on the attached site map and answer the following questions. If more than one shrub/scrub area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual shrub/scrub area. Distinguish between shrub/scrub areas, using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.C.3.

Shrub/Scrub Area Questions

☐ Onsite ☐ Offsite

Name or Designation:_____

1. Estimate the approximate size of the shrub/scrub area (in acres or sq. ft.)._____

2. Indicate the dominant type of shrub/scrub vegetation present, if known.
_____
_____
_____
_____

3. Estimate the vegetation density of the shrub/scrub area.

   - ❑ Dense (i.e., greater than 75% vegetation)
   - ❑ Moderate (i.e., 25% to 75% vegetation)
   - ❑ Sparse (i.e., less than 25% vegetation)

4. Indicate the approximate average height of the scrub/shrub vegetation.

   - ❑ 0-2 feet
   - ❑ 2-5 feet
   - ❑ >5 feet

5. Animals observed in the shrub/scrub area or suspected to be present based on indirect evidence or file material:
   ❑Birds
   ❑Mammals
   ❑Reptiles (e.g., snakes, lizards)
   ❑Amphibians (e.g., toads, salamanders)

   Specify species, if known:
   _____
   _____
   _____
   _____

III.C.3 Grassland

Are any grassland areas on or adjacent to the site? ☐ Yes ☐ No

If yes, indicate the grassland area on the attached site map and answer the following questions. If more than one grassland area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual grassland area. Distinguish between grassland areas by using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.C.4.

Grassland Area Questions

☐ Onsite ☐ Offsite

Name or Designation:_____

1. Estimate the approximate size of the grassland area (in acres or sq. ft.)._____

2. Indicate the dominant plant type, if known.
_____
_____
_____
_____

3. Estimate the vegetation density of the grassland area.

   - ❑ Dense (i.e., greater than 75% vegetation)
   - ❑ Moderate (i.e., 25% to 75% vegetation)
   - ❑ Sparse (i.e., less than 25% vegetation)

4. Indicate the approximate average height of the dominant plant type (in ft. or in.)_

5. Animals observed in the grassland area or suspected to be present based on indirect evidence or file material:

   ❑Birds
   ❑Mammals
   ❑Reptiles (e.g., snakes, lizards)
   ❑Amphibians (e.g., toads, salamanders)

   Specify species, if known:

III.C.4 Desert

Are any desert areas on or adjacent to the site? ☐ Yes ☐ No

If yes, indicate the desert area on the attached site map and answer the following questions. If more than one desert area is present on or adjacent to the site, make additional copies of the following questions and fill out for each individual desert area. Distinguish between desert areas by using names or other designations, and clearly identify each area on the site map.

If no, proceed to Section III.C.5.

Desert Area Questions

☐ Onsite ☐ Offsite

Name or Designation:_____

1. Estimate the approximate size of the desert area (in acres or sq. ft.)._____

2. Describe the desert area (e.g., presence or absence of vegetation, vegetation types, presence/size of rocks, sand, etc.)

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

3. Animals observed in the desert area or suspected to be present based on indirect evidence or file material:

❑Birds
❑Mammals
❑Reptiles (e.g., snakes, lizards)
❑Amphibians (e.g., toads, salamanders)

Specify species, if known:

_____

III.C.5 Other

1. Are there any other terrestrial communities or habitats on or adjacent to the site which were not previously described?

☐ Yes ☐ No

If yes, indicate the "other" area(s) on the attached site map and describe the area(s) below. Distinguish between onsite and offsite areas. If no, proceed to Section III.D.

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

III.D Sensitive Environments and Receptors

1. Do any other potentially sensitive environmental areas[3] exist adjacent to or within 0.5 miles of the site? If yes, list these areas and provide the source(s) of information used to identify sensitive areas. *Do not answer "no" without confirmation from the U.S. Fish and Wildlife Service and appropriate State of New Mexico division.*

_____
_____
_____
_____
_____
_____
_____
_____

3 Areas that provide unique and often protected habitat for wildlife species. These areas are typically used during critical life stages such as breeding, hatching, rearing of young and overwintering. Refer to **Table 1** at the end of this document for examples of sensitive environments.

2. Are any areas on or near (i.e., within 0.5 miles) the site which are owned or used by local tribes? If yes, describe. *Contact the Tribal Liaison in the Office of the Secretary (505)827-2855 to obtain this information.*

4. Does the site serve or potentially serve as a habitat, foraging area, or refuge by rare, threatened, endangered, candidate and/or proposed species (plants or animals), or any otherwise protected species? If yes, identify species. *This information should be obtained from the U.S. Fish and Wildlife Service and appropriate State of New Mexico division.*

5. Is the site potentially used as a breeding, roosting or feeding area by migratory bird species? If yes, identify which species.

6. Is the site used by any ecologically[4], recreationally, or commercially important species? If yes, explain.

4 Ecologically important species include populations of species which provide a critical (i.e., not replaceable) food resource for higher organisms and whose function as such would not be replaced by more tolerant species; or perform a critical ecological function (such as organic matter decomposition) and whose functions will not be replaced by other species. Ecologically important species include pest and opportunistic species that populate an area if they serve as a food source for other species, but do not include domesticated animals (e.g., pets and livestock) or plants/animals whose existence is maintained by continuous human interventions (e.g., fish hatcheries, agricultural crops, etc.,)

_____
_____
_____
_____
_____

IV. EXPOSURE PATHWAY EVALUATION

1. Do existing data provide sufficient information on the nature, rate, and extent of contamination at the site?

   - ❑ Yes
   - ❑ No
   - ❑ Uncertain

   Please provide an explanation for your answer:_____

_____
_____
_____
_____

2. Do existing data provide sufficient information on the nature, rate, and extent of contamination in offsite affected areas?

   - ❑ Yes
   - ❑ No
   - ❑ Uncertain
   - ❑ No offsite contamination

   Please provide an explanation for your answer:_____

_____
_____
_____
_____

3. Do existing data address potential migration pathways of contaminants at the site?

   - ❑ Yes
   - ❑ No
   - ❑ Uncertain

   Please provide an explanation for your answer:_____
   _

4. Do existing data address potential migration pathways of contaminants in offsite affected areas?

   - ❑ Yes
   - ❑ No
   - ❑ Uncertain
   - ❑ No offsite contamination

   Please provide an explanation for your answer:_____

_____
_____
_____
_____

5. Are there visible indications of stressed habitats or receptors on or near (i.e., within 0.5 miles) the site that may be the result of a chemical release? If yes, explain. Attach photographs if available.

   _____

_____
_____
_____
_____
_____

6. Is the location of the contamination such that receptors might be reasonably expected to come into contact with it? For soil, this means contamination in the soil 0 to 5 feet below ground surface (bgs). If yes, explain.

   _____

_____
_____
_____
_____
_____
_____

7. Are receptors located in or using habitats where chemicals exist in air, soil, sediment or surface water? If yes, explain.

   _____

_____

   _____

_____
_____

8. Could chemicals reach receptors via groundwater? Can chemicals leach or dissolve to groundwater? Are chemicals mobile in groundwater? Does groundwater discharge into receptor habitats? If yes, explain.

_____
_____
_____
_____
_____
_____
_____

9. Could chemicals reach receptors through runoff or erosion? Answer the following questions:

What is the approximate distance from the contaminated area to the nearest watercourse or arroyo?

- ❑ 0 feet (i.e., contamination has reached a watercourse or arroyo)
- ❑ 1-10 feet
- ❑ 11-20 feet
- ❑ 21-50 feet
- ❑ 51-100 feet
- ❑ 101-200 feet
- ❑ > 200 feet
- ❑ > 500 feet
- ❑ > 1000 feet

What is the slope of the ground in the contaminated area?

- ❑ 0-10%
- ❑ 10-30%
- ❑ > 30%

What is the approximate amount of ground and canopy vegetative cover in the contaminated area?

- ❑ < 25%
- ❑ 25-75%
- ❑ > 75%

Is there visible evidence of erosion (e.g., a rill or gully) in or near the contaminated area?

- ❑ Yes
- ❑ No
- ❑ Do not know

Do any structures, pavement, or natural drainage features direct run-on flow (i.e., surface flows originating upstream or uphill from the area of concern) into the contaminated area?

- ❑ Yes
- ❑ No
- ❑ Do not know

10. Could chemicals reach receptors through the dispersion of contaminants in air (e.g., volatilization, vapors, fugitive dust)? If yes, explain.

_____
_____
_____
_____
_____
_____

11. Could chemicals reach receptors through migration of non-aqueous phase liquids (NAPLs)? Is a NAPL present at the site that might be migrating towards receptors or habitats? Could NAPL discharge contact receptors or their habitat?

_____
_____
_____
_____
_____
_____
_____

12. Could receptors be impacted by external irradiation at the site? Are gamma emitting radionuclides present at the site? Is the radionuclide contamination buried or at the surface?

_____
_____
_____
_____
_____
_____
_____

PHOTOGRAPHIC DOCUMENTATION

During the site visit(s), photographs should be taken to document the current conditions at the site and to support the information entered in the checklist. For example, photographs may be used to document the following:

- The nature, quality, and distribution of vegetation at the site
- Receptors or evidence of receptors
- Potentially important ecological features, such as ponds and drainage ditches
- Potential exposure pathways
- Any evidence of contamination or impact

The following space may be used to record photo subjects.

SUMMARY OF OBSERVATIONS AND SITE SETTING

Include information on significant source areas and migration pathways that are likely to constitute complete exposure pathways.

_____

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Checklist Completed by_____

Affiliation_____

Author Assisted by_____

Date_____

TABLE 3
EXAMPLES OF SENSITIVE ENVIRONMENTS

National Parks and National Monuments

Designated or Administratively Proposed Federal Wilderness Areas

National Preserves

National or State Wildlife Refuges

National Lakeshore Recreational Areas

Federal land designated for protection of natural ecosystems

State land designated for wildlife or game management

State designated Natural Areas

Federal or state designated Scenic or Wild River

All areas that provide or could potentially provide critical habitat[1] for state and federally listed Threatened or Endangered Species, those species that are currently petitioned for listing, and species designated by other agencies as sensitive or species of concern

All areas that provide or could potentially provide habitat for state protected species as defined in the Wildlife Code, Chapter 17 of the New Mexico Statutes

All areas that provide or could potentially provide habitat for migratory birds as protected by the Migratory Bird Treaty Act (16 U.S.C. §§ 703-712)

All areas that provide or could potentially provide habitat for bald eagles and golden eagles as protected by the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d)

All areas that provide or could potentially provide habitat for song birds as protected by the State of New Mexico statute (New Mexico Statute, 1978, Chapter 17, Game and Fish, 17-2-13)

---

1 Critical habitats are defined by the Endangered Species Act (50 CFR §424.02(d)) as:

> 1) Specific areas within the geographical area currently occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (ii) that may require special management considerations or protection, and 2) Specific areas outside the geographical area occupied by a species at the time it is listed upon a determination by the Secretary [of Interior] that such areas are essential for the conservation of the species.

All areas that provide or could potentially provide habitat for hawks, vultures and owls as protected by the State of New Mexico statute (New Mexico Statute, 1978, Chapter 17, Game and Fish, 17-2-14)

All areas that provide or could potentially provide habitat for horned toads and Bullfrogs as protected by the State of New Mexico statute (New Mexico Statute, 1978, Chapter 17, Game and Fish, 17-2-15 and 16, resp.)

All perennial waters (e.g., rivers, lakes, playas, sloughs, ponds, etc.)

All ephemeral drainage (e.g., arroyos, puddles/pools, intermittent streams, etc.) that provide significant wildlife habitat or that could potentially transport contaminants off site to areas that provide wildlife habitat

All riparian habitats

All perennial and ephemeral wetlands (not limited to jurisdictional wetlands)

All areas that are potentially important breeding, staging, and overwintering habitats as well as other habitats important for the survival of animals during critical periods of their life cycle.

ATTACHMENT B
ECOLOGICAL SITE EXCLUSION CRITERIA CHECKLIST AND DECISION TREE

NEW MEXICO ECOLOGICAL EXCLUSION CRITERIA CHECKLIST

The following questions are designed to be used in conjunction with the Ecological Exclusion Criteria Decision Tree (Figure 1). After answering each question, refer to the Decision Tree to determine the appropriate next step. In some cases, questions will be omitted as the user is directed to another section as indicated by the flow diagram in the Decision Tree. For example, if the user answers "yes" to Question 1 of Section I, he or she is directed to proceed to Section II.

I. Habitat

In the following questions, "affected property" refers to all property on which a release has occurred or is believed to have occurred, including off-site areas where contamination may have occurred or migrated.

1. Are any of the below-listed sensitive environments at, adjacent to, or in the locality[1] of the affected property?

   - National Park or National Monument
   - Designated or administratively proposed Federal Wilderness Area
   - National Preserve
   - National or State Wildlife Refuge
   - Federal or State land designated for wildlife or game management
   - State designated Natural Areas
   - All areas that are owned or used by local tribes
   - All areas that are potentially important breeding, staging, and overwintering habitats as well as other habitats important for the survival of animals during critical periods of their life cycle
   - All areas that provide or could potentially provide habitat for state and federally listed Threatened or Endangered Species, those species that are currently petitioned for listing, and species designated by other agencies as sensitive or species of concern
   - All areas that provide or could potentially provide habitat for state protected species as defined in the Wildlife Code, Chapter 17 of the New Mexico Statutes
   - All areas that provide or could potentially provide habitat for migratory birds as protected by the Migratory Bird Treaty Act (16 U.S.C. §§ 703-712)
   - All areas that provide or could potentially provide habitat for bald eagles and golden eagles as protected by the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d)
   - All areas that provide or could potentially provide habitat for song birds as protected by the state of New Mexico statute (New Mexico Statute, 1978, Chapter 17, Game and Fish, 17-2-13)

---

1 *Locality* of the site refers to any area where an ecological receptor is likely to contact site-related chemicals. The locality of the site considers the likelihood of contamination migrating over time and places the site in the context of its general surrounding. Therefore, the locality is typically larger than the site and the areas adjacent to the site.

- All areas that provide or could potentially provide habitat for hawks, vultures and owls as protected by the state of New Mexico statute (New Mexico Statute, 1978, Chapter 17, Game and Fish, 17-2-14)
- All areas that provide or could potentially provide habitat for horned toads and bullfrogs as protected by the state of New Mexico statute (New Mexico Statute, 1978, Chapter 17, Game and Fish, 17-2-15 and 16, respectively)

2. Does the affected property contain land areas which were not listed in Question 1, but could be considered viable ecological habitat? The following are examples (but not a complete listing) of viable ecological habitats:

   - Wooded areas
   - Shrub/scrub vegetated areas
   - Open fields (prairie)
   - Other grassy areas
   - Desert areas
   - Any other areas which support wildlife and/or vegetation, excluding areas which support only opportunistic species (such as house mice, Norway rats, pigeons, etc.) that do not serve as prey to species in adjacent habitats.

   The following features are <u>not</u> considered ecologically viable:

   - Pavement
   - Buildings
   - Paved areas of roadways
   - Paved/concrete equipment storage pads
   - Paved manufacturing or process areas
   - Other non-natural surface cover or structure

3. Does the affected property contain any perennial or ephemeral aquatic features which were not listed in Question 1?

II. Receptors

1. Is any part of the affected property used for habitat, foraging area, or refuge by any rare, threatened, or endangered species (plant *or* animal), or otherwise protected species (e.g., raptors, migratory birds)?

2. Is any part of the affected property used for habitat, foraging area, or refuge by any species used as a recreational (e.g., game animals) and/or commercial resource?

3. Is any part of the affected property used for habitat, foraging area, or refuge by any plant or animal species? This includes plants considered "weeds" and opportunistic insect and

animal species (such as cockroaches and rats) if they are used as a food source for other species in the area.

III. Exposure Pathways

1. Could receptors be impacted by contaminants via direct contact?
   Is a receptor located in or using an area where it could contact contaminated air, soil[3], or surface water?

For Questions 2 and 3, note that one must answer "yes" to all three bullets in order to be directed to the "exclusion denied" box of the decision tree. This is because answering "no" to one of the questions in the bullet list indicates that a complete exposure pathway is not present. For example, in Question 2, if the chemical cannot leach or dissolve to groundwater (bullet 1), there is no chance of ecological receptors being exposed to the chemical through contact with contaminated groundwater. Similarly, the responses to the questions in Question 4 determine whether a complete pathway exists for exposure to NAPL.

2. Could receptors contact contaminants via groundwater?
   - Can the chemical leach or dissolve to groundwater[4]?
   - Can groundwater mobilize the chemical?
   - Could (does) contaminated groundwater discharge into known or potential receptor habitats?

3. Could receptors contact contaminants via runoff (i.e., surface water and/or suspended sediment) or erosion by water or wind?
   - Are chemicals present in surface soils?
   - Can the chemical be leached from or eroded with surface soils?
   - Is there a receptor habitat located downgradient of the leached/eroded surface soil?

4. Could receptors contact contaminants via migration of non-aqueous phase liquids (NAPL)?
   - Is NAPL present at the site?
   - Is NAPL migrating toward potential receptors or habitats?
   - Could NAPL discharge impact receptors or habitats?

3 For soil, this means contamination less than 5 feet below ground surface (bgs).

4 Information on the environmental fate of specific chemicals can be found on the Internet at *http://www.epa.gov/opptintr/chemfact/* or at a local library in published copies of the *Hazardous Substances Data Bank*.

Figure 1 -Ecological Exclusion Criteria Decision Tree
(Refer to corresponding checklist for the full text of each question)

Figure 1 - Exclusion Criteria Decision Tree (continued)

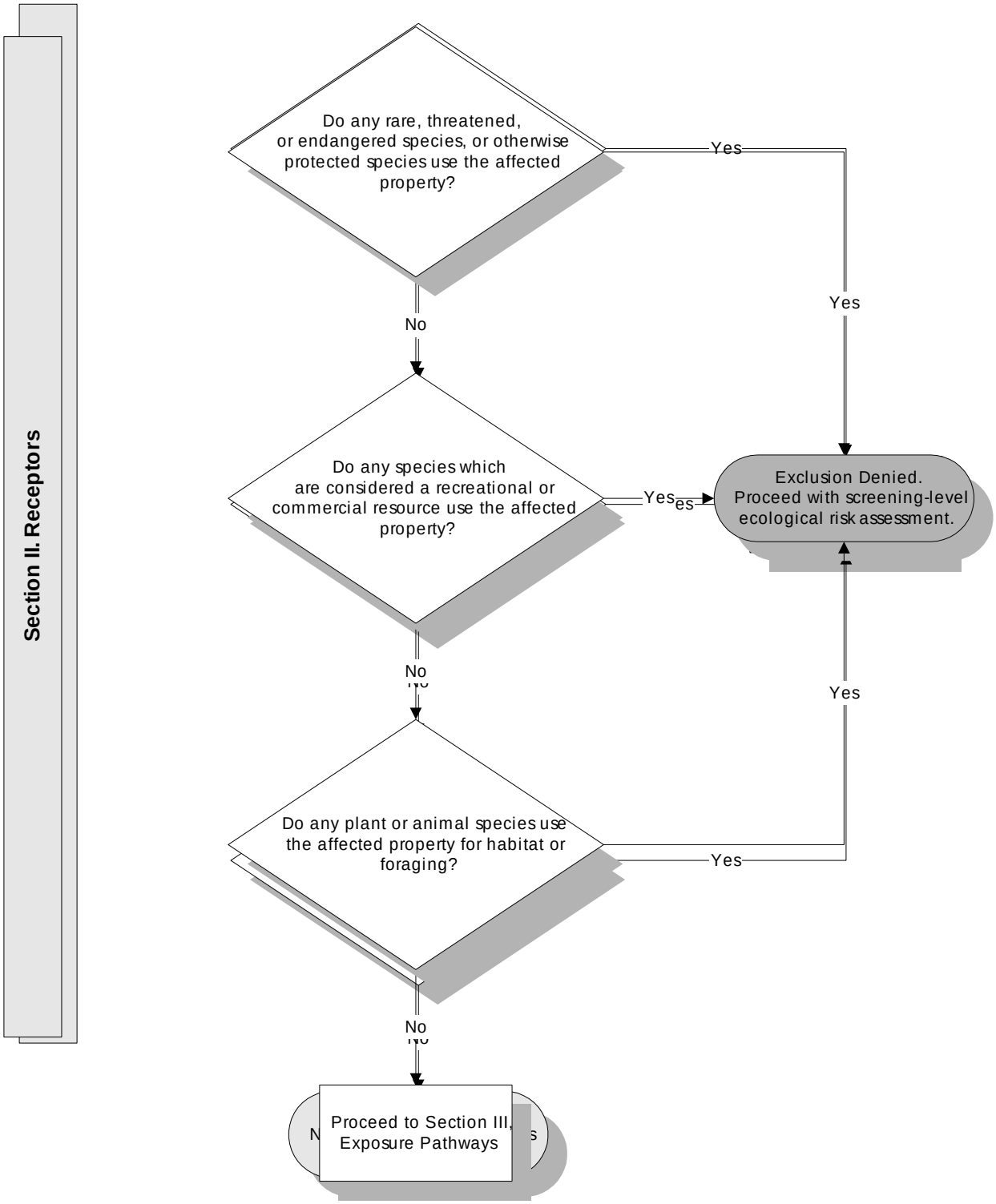
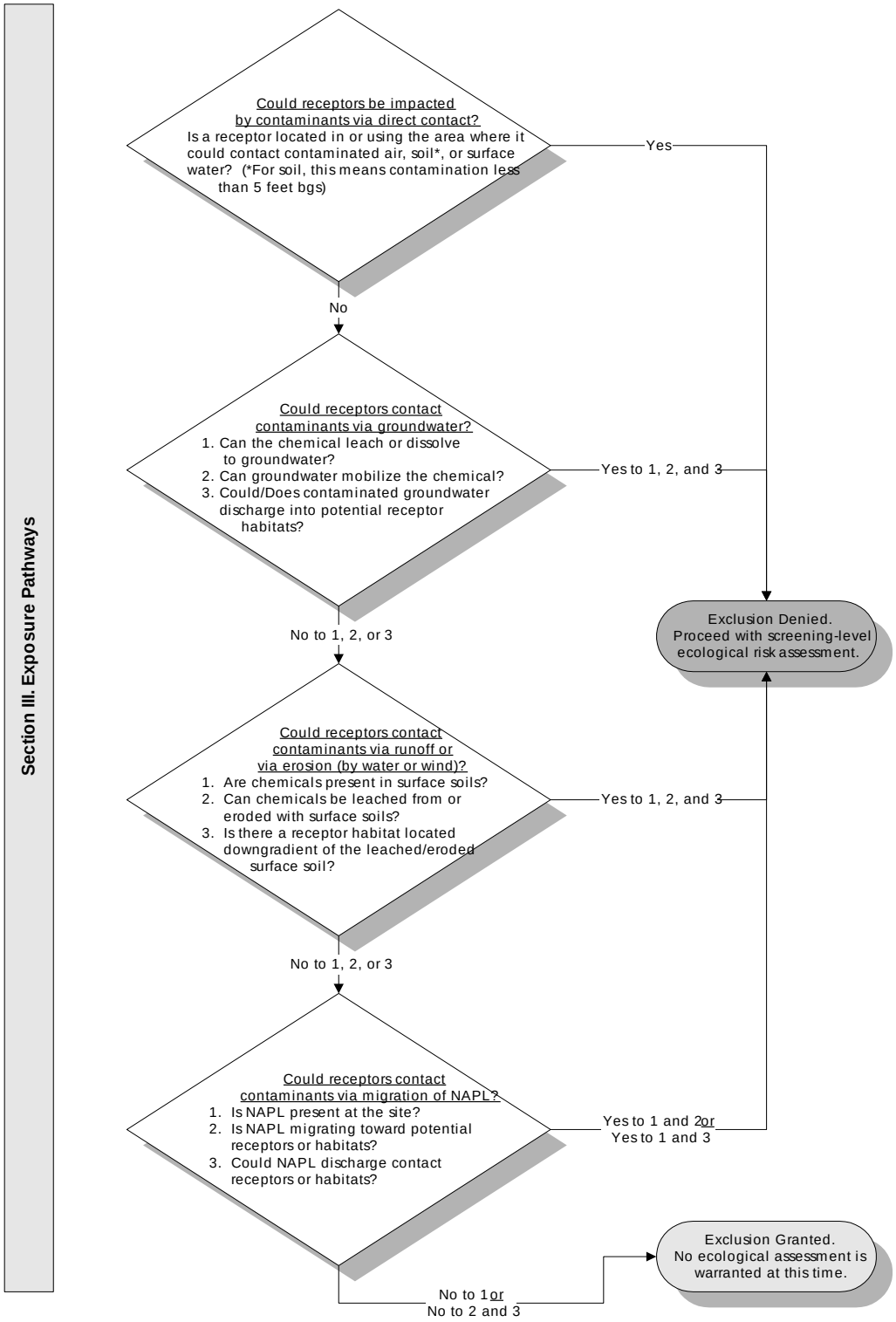


Figure 1 - Exclusion Criteria Decision Tree (continued)


Section III. Exposure Pathways
Could receptors be impacted by contaminants via direct contact?
Is a receptor located in or using the area where it could contact contaminated air, soil*, or surface water? (*For soil, this means contamination less than 5 feet bgs)
Yes
No
Could receptors contact contaminants via groundwater?
1. Can the chemical leach or dissolve to groundwater?
2. Can groundwater mobilize the chemical?
3. Could/Does contaminated groundwater discharge into potential receptor habitats?
Yes to 1, 2, and 3
No to 1, 2, or 3
Could receptors contact contaminants via runoff or via erosion (by water or wind)?
1. Are chemicals present in surface soils?
2. Can chemicals be leached from or eroded with surface soils?
3. Is there a receptor habitat located downgradient of the leached/eroded surface soil?
Yes to 1, 2, and 3
No to 1, 2, or 3
Could receptors contact contaminants via migration of NAPL?
1. Is NAPL present at the site?
2. Is NAPL migrating toward potential receptors or habitats?
3. Could NAPL discharge contact receptors or habitats?
Yes to 1 and 2 or
Yes to 1 and 3
Exclusion Denied.
Proceed with screening-level ecological risk assessment.
Exclusion Granted.
No ecological assessment is warranted at this time.
No to 1 or
No to 2 and 3

ATTACHMENT C

TIER 1 TOXICITY REFERENCE VALUES (TRVs) AND ECOLOGICAL SCREENING LEVELS (ESLs) AND TIER 2 TRVs

TABLE C-1: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE DEER MOUSE

	Tier 1				Tier 2		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
VOCs							
Acetone	1.00E+01	chronic cs	EcoRisk 3.2[b]	9.09E+01	5.00E+01	chronic cs	EcoRisk 3.2
Benzene	2.64E+01	chronic cs	EcoRisk 3.2	2.40E+02	2.64E+02	chronic cs	EcoRisk 3.2
2-Butanone (MEK)	1.77E+03	chronic cs	EcoRisk 3.2	1.61E+04	4.57E+03	chronic cs	EcoRisk 3.2
Carbon disulfide	2.50E-01	chronic cs	EcoRisk 3.2	2.27E+00	2.50E+00	chronic cs	EcoRisk 3.2
Chlorobenzene	6.00E+01	chronic cs	EcoRisk 3.2	5.45E+02	6.00E+02	chronic cs	EcoRisk 3.2
Chloroform	1.50E+01	chronic cs	EcoRisk 3.2	1.36E+02	4.10E+01	chronic cs	EcoRisk 3.2
1,2-Dichlorobenzene	2.50E+00	chronic cs	EcoRisk 3.2	2.27E+01	2.50E+01	chronic cs	EcoRisk 3.2
1,3-Dichlorobenzene	2.50E+00	chronic cs	EcoRisk 3.2	2.27E+01	2.50E+01	chronic cs	EcoRisk 3.2
1,4-Dichlorobenzene	2.50E+00	chronic cs	EcoRisk 3.2	2.27E+01	1.00E+01	chronic cs	EcoRisk 3.2
1,1-Dichloroethane	3.82E+02	chronic cs	EcoRisk 3.2	3.47E+03	3.82E+03	chronic cs	EcoRisk 3.2
1,2-Dichloroethane	4.97E+01	chronic cs	EcoRisk 3.2	4.52E+02	4.97E+02	chronic cs	EcoRisk 3.2
1,1-Dichloroethene	3.00E+01	chronic cs	EcoRisk 3.2	2.73E+02	3.00E+02	chronic cs	EcoRisk 3.2
cis-1,2-Dichloroethene	4.52E+01	chronic cs	EcoRisk 3.2	4.11E+02	4.52E+02	chronic cs	EcoRisk 3.2
trans-1,2-Dichloroethene	4.52E+01	chronic cs	EcoRisk 3.2	4.11E+02	4.52E+02	chronic cs	EcoRisk 3.2
2-Hexanone	8.27E+00	chronic GMM	EcoRisk 3.2	7.52E+01	3.15E+01	chronic GMM	EcoRisk 3.2
Methylene chloride	5.85E+00	chronic cs	EcoRisk 3.2	5.32E+01	5.00E+01	chronic cs	EcoRisk 3.2
4-Methyl-2-pentanone (MIBK)	2.50E+01	chronic cs	EcoRisk 3.2	2.27E+02	2.50E+02	chronic cs	EcoRisk 3.2
1,1,2,2-Tetrachloroethane	4.43E+01	chronic	ATSDR 1996	4.03E+02			
Tetrachloroethene	2.00E+00	chronic cs	EcoRisk 3.2	1.82E+01	1.00E+01	chronic cs	EcoRisk 3.2
Toluene	2.60E+01	chronic cs	EcoRisk 3.2	2.36E+02	2.60E+02	chronic cs	EcoRisk 3.2
1,2,4-Trichlorobenzene	1.48E+00	chronic cs	EcoRisk 3.2	1.35E+01	1.48E+01	chronic cs	EcoRisk 3.2
1,1,1-Trichloroethane	9.99E+02	chronic cs	EcoRisk 3.2	9.08E+03	9.99E+03	chronic cs	EcoRisk 3.2
1,1,2-Trichloroethane	3.90E+00	chronic	IRIS	3.55E+01			
Trichloroethene	1.00E+02	chronic cs	EcoRisk 3.2	9.09E+02	1.00E+03	chronic cs	EcoRisk 3.2
Trichlorofluoromethane	2.12E+02	chronic GMM	EcoRisk 3.2	1.93E+03	1.42E+03	chronic GMM	EcoRisk 3.2
Vinyl chloride	1.70E-01	chronic cs	EcoRisk 3.2	1.55E+00	1.70E+00	chronic cs	EcoRisk 3.2

TABLE C-1: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE DEER MOUSE

	Tier 1				Tier 2		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
Xylene (total)	2.10E+00	chronic cs	EcoRisk 3.2	1.91E+01	2.60E+00	chronic cs	EcoRisk 3.2
SVOCs							
Benzyl alcohol	1.43E+02	chronic cs	EcoRisk 3.2	1.30E+03	1.43E+03	chronic cs	EcoRisk 3.2
Bis(2-ethylhexyl) phthalate	1.83E+01	chronic cs	EcoRisk 3.2	1.66E+02	1.83E+02	chronic cs	EcoRisk 3.2
Butyl benzyl phthalate	1.59E+02	chronic cs	EcoRisk 3.2	1.45E+03	1.59E+03	chronic cs	EcoRisk 3.2
Carbazole	2.28E+01	chronic cs	EcoRisk 3.2	2.07E+02	2.28E+02	chronic cs	EcoRisk 3.2
2-Chlorophenol	5.00E-01	chronic cs	EcoRisk 3.2	4.55E+00	5.00E+00	chronic cs	EcoRisk 3.2
Di-n-butyl phthalate	1.34E+03	chronic GMM	EcoRisk 3.2	1.22E+04	3.18E+03	chronic GMM	EcoRisk 3.2
Diethyl phthalate	4.60E+03	chronic cs	EcoRisk 3.2	4.18E+04	4.60E+04	chronic cs	EcoRisk 3.2
Dimethyl phthalate	6.80E+01	chronic cs	EcoRisk 3.2	6.18E+02	6.80E+02	chronic cs	EcoRisk 3.2
Di-n-octyl phthalate	6.51E+01	chronic cs	EcoRisk 3.2	5.92E+02	6.51E+02	chronic cs	EcoRisk 3.2
Hexachlorobenzene	7.10E+00	chronic cs	EcoRisk 3.2	6.45E+01	7.10E+01	chronic cs	EcoRisk 3.2
2-Methylphenol	2.20E+02	chronic cs	EcoRisk 3.2	2.00E+03	2.20E+03	chronic cs	EcoRisk 3.2
2-Nitroaniline	3.00E+00	chronic cs	EcoRisk 3.2	2.73E+01	6.00E+00	chronic cs	EcoRisk 3.2
Nitrobenzene	5.90E+00	chronic cs	EcoRisk 3.2	5.36E+01	5.90E+01	chronic cs	EcoRisk 3.2
Pentachlorophenol	8.42E+00	chronic GMM	EcoRisk 3.2	7.65E+01	8.42E+01	chronic GMM	EcoRisk 3.2
Phenol	6.00E+01	chronic cs	EcoRisk 3.2	5.45E+02	6.00E+02	chronic cs	EcoRisk 3.2
Pesticides/Herbicides							
4,4'-DDD	5.83E+00	chronic GMM	EcoRisk 3.2	5.30E+01	1.17E+01	chronic GMM	EcoRisk 3.2
4,4'-DDE	9.02E+00	chronic GMM	EcoRisk 3.2	8.20E+01	2.27E+01	chronic GMM	EcoRisk 3.2
4,4'-DDT	1.39E-01	chronic cs	EcoRisk 3.2	1.26E+00	6.94E-01	chronic cs	EcoRisk 3.2
Aldrin	2.00E-01	chronic cs	EcoRisk 3.2	1.82E+00	1.00E+00	chronic cs	EcoRisk 3.2
alpha-BHC	8.70E+01	chronic cs	EcoRisk 3.2	7.91E+02	8.70E+02	chronic cs	EcoRisk 3.2
alpha-Chlordane	1.18E+00	chronic cs	EcoRisk 3.2	1.07E+01	1.18E+01	chronic cs	EcoRisk 3.2
beta-BHC	4.00E-01	chronic cs	EcoRisk 3.2	3.64E+00	2.00E+00	chronic cs	EcoRisk 3.2
delta-BHC	1.40E-02	chronic cs	EcoRisk 3.2	1.27E-01	1.40E-01	chronic cs	EcoRisk 3.2
Dieldrin	1.50E-02	chronic cs	EcoRisk 3.2	1.36E-01	3.00E-02	chronic cs	EcoRisk 3.2

TABLE C-1: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE DEER MOUSE

	Tier 1				Tier 2		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
Endosulfan I	1.50E-01	chronic cs	EcoRisk 3.2	1.36E+00	1.50E+00	chronic cs	EcoRisk 3.2
Endosulfan II	1.50E-01	chronic cs	EcoRisk 3.2	1.36E+00	1.50E+00	chronic cs	EcoRisk 3.2
Endrin	9.20E-02	chronic cs	EcoRisk 3.2	8.36E-01	9.20E-01	chronic cs	EcoRisk 3.2
gamma-BHC (Lindane)	1.40E-02	chronic cs	EcoRisk 3.2	1.27E-01	1.40E-01	chronic cs	EcoRisk 3.2
gamma-Chlordane	1.18E+00	chronic cs	EcoRisk 3.2	1.07E+01	1.18E+01	chronic cs	EcoRisk 3.2
Heptachlor	1.00E-01	chronic cs	EcoRisk 3.2	9.09E-01	1.00E+00	chronic cs	EcoRisk 3.2
Methoxychlor	4.00E+00	chronic cs	EcoRisk 3.2	3.64E+01	8.00E+00	chronic cs	EcoRisk 3.2
Aroclors							
Aroclor 1016	1.49E+00	chronic GMM	EcoRisk 3.2	1.35E+01	4.26E+00	chronic GMM	EcoRisk 3.2
Aroclor 1260	1.38E+01	chronic GMM	EcoRisk 3.2	1.25E+02	3.33E+01	chronic GMM	EcoRisk 3.2
Aroclor 1254	6.11E-01	chronic GMM	EcoRisk 3.2	5.55E+00	3.37E+00	chronic GMM	EcoRisk 3.2
PAHs							
Acenaphthene	7.00E+01	chronic cs	EcoRisk 3.2	6.36E+02	7.00E+02	chronic cs	EcoRisk 3.2
Acenaphthylene	7.00E+01	chronic cs	EcoRisk 3.2	6.36E+02	7.00E+02	chronic cs	EcoRisk 3.2
Anthracene	1.00E+02	chronic cs	EcoRisk 3.2	9.09E+02	1.00E+03	chronic cs	EcoRisk 3.2
Benzo(a)anthracene	1.70E-01	chronic cs	EcoRisk 3.2	1.55E+00	1.70E+00	chronic cs	EcoRisk 3.2
Benzo(a)pyrene	5.58E+00	chronic GMM	EcoRisk 3.2	5.07E+01	1.77E+01	chronic GMM	EcoRisk 3.2
Benzo(b)fluoranthene	4.00E+00	chronic cs	EcoRisk 3.2	3.64E+01	4.00E+01	chronic cs	EcoRisk 3.2
Benzo(ghi)perylene	7.20E+00	chronic cs	EcoRisk 3.2	6.54E+01	7.20E+01	chronic cs	EcoRisk 3.2
Benzo(k)fluoranthene	7.20E+00	chronic cs	EcoRisk 3.2	6.54E+01	7.20E+01	chronic cs	EcoRisk 3.2
Chrysene	1.70E-01	chronic cs	EcoRisk 3.2	1.55E+00	1.70E+01	chronic cs	EcoRisk 3.2
Dibenzo(a,h)anthracene	1.33E+00	chronic cs	EcoRisk 3.2	1.21E+01	1.33E+01	chronic cs	EcoRisk 3.2
Fluoranthene	1.25E+01	chronic cs	EcoRisk 3.2	1.14E+02	1.25E+02	chronic cs	EcoRisk 3.2
Fluorene	1.25E+02	chronic cs	EcoRisk 3.2	1.14E+03	2.50E+02	chronic cs	EcoRisk 3.2
Indeno(1,2,3-cd)pyrene	7.20E+00	chronic cs	EcoRisk 3.2	6.54E+01	7.20E+01	chronic cs	EcoRisk 3.2
Naphthalene	1.43E+01	chronic GMM	EcoRisk 3.2	1.30E+02	4.02E+01	chronic GMM	EcoRisk 3.2
Phenanthrene	5.14E+00	chronic cs	EcoRisk 3.2	4.67E+01	5.14E+01	chronic cs	EcoRisk 3.2

TABLE C-1: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE DEER MOUSE

	Tier 1				Tier 2		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
Pyrene	7.50E+00	chronic cs	EcoRisk 3.2	6.82E+01	7.50E+01	chronic cs	EcoRisk 3.2
Dioxin/Furans							
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	5.62E-07	chronic GMM	EcoRisk 3.2	5.11E-06	3.76E-06	chronic GMM	EcoRisk 3.2
Metals							
Aluminum (note: pH dependent)	6.20E+01	chronic	ATSDR 1999	5.64E+02	1.30E+02	chronic	ATSDR 1999
Antimony	5.90E-02	chronic cs	EcoRisk 3.2	5.36E-01	5.90E-01	chronic cs	EcoRisk 3.2
Arsenic	1.04E+00	chronic cs	EcoRisk 3.2	9.45E+00	1.66E+00	chronic cs	EcoRisk 3.2
Barium	5.18E+01	chronic GMM	EcoRisk 3.2	4.71E+02	5.18E+02	chronic GMM	EcoRisk 3.2
Beryllium	5.32E-01	chronic cs	EcoRisk 3.2	4.84E+00	5.32E+00	chronic cs	EcoRisk 3.2
Boron	2.80E+01	chromic cs	EcoRisk 3.2	2.55E+02	2.80E+02	chronic cs	EcoRisk 3.2
Cadmium	7.70E-01	chronic cs	EcoRisk 3.2	7.00E+00	7.70E+00	chronic cs	EcoRisk 3.2
Chromium (total)	2.40E+00	chronic GMM	EcoRisk 3.2	2.18E+01	2.40E+01	chronic GMM	EcoRisk 3.2
Chromium (hexavalent)	9.24E+00	chronic GMM	EcoRisk 3.2	8.40E+01	9.24E+01	chronic GMM	EcoRisk 3.2
Cobalt	7.33E+00	chronic GMM	EcoRisk 3.2	6.66E+01	7.33E+01	chronic GMM	EcoRisk 3.2
Copper	5.60E+00	chronic cs	EcoRisk 3.2	5.09E+01	9.34E+00	chronic cs	EcoRisk 3.2
Lead	4.70E+00	chronic cs	EcoRisk 3.2	4.27E+01	8.90E+00	chronic cs	EcoRisk 3.2
Manganese	5.15E+01	chronic GMM	EcoRisk 3.2	4.68E+02	5.15E+02	chronic GMM	EcoRisk 3.2
Mercury (inorganic)	1.41E+00	chronic cs	EcoRisk 3.2	1.28E+01	1.41E+01	chronic cs	EcoRisk 3.2
Nickel	1.70E+00	chronic cs	EcoRisk 3.2	1.55E+01	3.40E+00	chronic cs	EcoRisk 3.2
Selenium	1.43E-01	chronic cs	EcoRisk 3.2	1.30E+00	2.15E-01	chronic cs	EcoRisk 3.2
Silver	6.02E+00	chronic cs	EcoRisk 3.2	5.47E+01	6.02E+01	chronic cs	EcoRisk 3.2
Thallium	7.10E-03	chronic cs	EcoRisk 3.2	6.45E-02	7.10E-02	chronic cs	EcoRisk 3.2
Vanadium	4.16E+00	chronic cs	EcoRisk 3.2	3.78E+01	8.31E+00	chronic cs	EcoRisk 3.2
Zinc	7.54E+01	chronic GMM	EcoRisk 3.2	6.85E+02	7.54E+02	chronic GMM	EcoRisk 3.2
Miscellaneous							
Cyanide (CN-)	6.87E+01	chronic cs	EcoRisk 3.2	6.24E+02	6.87E+02	chronic cs	EcoRisk 3.2
Nitrite	5.07E+02	chronic cs	Sample 1996	4.61E+03			

TABLE C-1: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE DEER MOUSE

	Tier 1				Tier 2		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
Explosives							
Dinitrobenzene, 1,3-	1.13E-01	chronic cs	EcoRisk 3.2	1.03E+00	2.64E-01	chronic cs	EcoRisk 3.2
Dinitrotoluene, 2,4-	2.68E+00	chronic cs	EcoRisk 3.2	2.44E+01	2.68E+01	chronic cs	EcoRisk 3.2
Dinitrotoluene, 2,6-	1.77E+00	chronic cs	EcoRisk 3.2	1.61E+01	1.77E+01	chronic cs	EcoRisk 3.2
Dinitrotoluene, 2-Amino-4,6-	1.39E+01	chronic cs	EcoRisk 3.2	1.26E+02	1.39E+02	chronic cs	EcoRisk 3.2
Dinitrotoluene, 4-Amino-2,6-	9.59E+00	chronic cs	EcoRisk 3.2	8.72E+01	9.59E+01	chronic cs	EcoRisk 3.2
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	8.94E+00	chronic GMM	EcoRisk 3.2	8.13E+01	2.83E+01	chronic GMM	EcoRisk 3.2
Nitroglycerin	9.64E+01	chronic cs	EcoRisk 3.2	8.76E+02	1.02E+03	chronic cs	EcoRisk 3.2
Nitrotoluene, m-	1.07E+01	chronic cs	EcoRisk 3.2	9.73E+01	1.07E+02	chronic cs	EcoRisk 3.2
Nitrotoluene, o-	8.91E+00	chronic cs	EcoRisk 3.2	8.10E+01	8.91E+01	chronic cs	EcoRisk 3.2
Nitrotoluene, p-	1.96E+01	chronic cs	EcoRisk 3.2	1.78E+02	1.96E+02	chronic cs	EcoRisk 3.2
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetra (HMX)	7.50E+01	chronic cs	EcoRisk 3.2	6.82E+02	2.00E+02	chronic cs	EcoRisk 3.2
PETN	7.00E+01	chronic cs	EcoRisk 3.2	6.36E+02	7.00E+02	chronic cs	EcoRisk 3.2
Tetryl (Trinitrophenylmethylnitramine)	1.30E+00	chronic cs	EcoRisk 3.2	1.18E+01	6.20E+00	chronic cs	EcoRisk 3.2
Trinitrobenzene, 1,3,5-	1.34E+01	chronic cs	EcoRisk 3.2	1.22E+02	1.34E+02	chronic cs	EcoRisk 3.2
Trinitrotoluene, 2,4,6-	3.47E+01	chronic cs	EcoRisk 3.2	3.15E+02	1.60E+02	chronic cs	EcoRisk 3.2
Agent Breakdown Products							
DIMP	3.00E+02	chronic	ATSDR 1988	2.73E+03	3.75E+02	chronic	IRIS
IMPA	2.79E+02	chronic	IRIS	2.54E+03	1.16E+02	chronic	IRIS
MPA	2.79E+02	chronic	IRIS	2.54E+03	1.16E+02	chronic	IRIS
Thiodiglycol	5.00E+02	chronic	USACHPPM 1999	4.55E+03			

[a]chronic cs - TRV based on a critical study (two or less data), chronic GMM - TRV based on geometric mean (three or more relevant data), [b] EcoRisk 3.2 - includes uncertainty factors for extrapolation to chronic NOAEL and LOAEL (see Uncertainty Factor's tab

TABLE C-2: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE HORNED LARK							
Surrogate: American Robin (Avian Omnivore)	**Tier 1**				**Tier 2**		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
VOCs							
Acetone	2.01E+02	chronic	EcoRisk 3.2	9.51E+02	2.01E+03	chronic	EcoRisk 3.2
Chlorobenzene	6.00E+01	chronic	EcoRisk 3.2	2.84E+02	6.00E+02	chronic	EcoRisk 3.2
1,2-Dichloroethane	4.60E+00	chronic cs	EcoRisk 3.2	2.18E+01	9.10E+00	chronic cs	EcoRisk 3.2
Hexachlorobenzene	5.00E+00	chronic cs	EcoRisk 3.2	2.37E+01	5.00E+01	chronic cs	EcoRisk 3.2
2-Hexanone	1.00E+00	chronic cs	EcoRisk 3.2	4.73E+00	1.00E+01	chronic cs	EcoRisk 3.2
Xylene (total)	1.07E+02	chronic cs	EcoRisk 3.2	5.06E+02	1.07E+03	chronic cs	EcoRisk 3.2
SVOCs							
Bis(2-ethylhexyl) phthalate	1.10E+00	chronic cs	EcoRisk 3.2	5.20E+00	1.10E+01	chronic cs	EcoRisk 3.2
2-Chlorophenol	1.13E+00	chronic cs	EcoRisk 3.2	5.34E+00	1.13E+01	chronic cs	EcoRisk 3.2
Di-n-butyl phthalate	1.40E-01	chronic cs	EcoRisk 3.2	6.62E-01	1.40E+00	chronic cs	EcoRisk 3.2
Pentachlorophenol	6.73E+00	chronic cs	EcoRisk 3.2	3.18E+01	6.73E+01	chronic cs	EcoRisk 3.2
Pesticides/Herbicides							
4,4'-DDD	1.60E-02	chronic GMM	EcoRisk 3.2	7.57E-02	8.30E-02	chronic GMM	EcoRisk 3.2
4,4'-DDE	4.80E-01	chronic GMM	EcoRisk 3.2	2.27E+00	2.40E+00	chronic GMM	EcoRisk 3.2
4,4'-DDT	2.01E+00	chronic GMM	EcoRisk 3.2	9.51E+00	5.96E+00	chronic GMM	EcoRisk 3.2
alpha-Chlordane	2.14E+00	chronic cs	EcoRisk 3.2	1.01E+01	1.07E+01	chronic cs	EcoRisk 3.2
beta-BHC	3.83E+01	chronic cs	EcoRisk 3.2	1.81E+02	3.83E+02	chronic cs	EcoRisk 3.2
Dieldrin	7.09E-02	chronic cs	EcoRisk 3.2	3.35E-01	3.78E+00	chronic cs	EcoRisk 3.2
Endosulfan I	1.00E+01	chronic cs	EcoRisk 3.2	4.73E+01	1.00E+02	chronic cs	EcoRisk 3.2
Endosulfan II	1.00E+01	chronic cs	EcoRisk 3.2	4.73E+01	1.00E+02	chronic cs	EcoRisk 3.2
Endrin	1.00E-02	chronic cs	EcoRisk 3.2	4.73E-02	1.00E-01	chronic cs	EcoRisk 3.2
gamma-BHC (Lindane)	5.60E-01	chronic cs	EcoRisk 3.2	2.65E+00	2.25E+00	chronic cs	EcoRisk 3.2
gamma-Chlordane	2.14E+00	chronic cs	EcoRisk 3.2	1.01E+01	1.07E+01	chronic cs	EcoRisk 3.2
Heptachlor	9.20E-01	chronic cs	EcoRisk 3.2	4.35E+00	9.20E+00	chronic cs	EcoRisk 3.2
Methoxychlor	2.58E+01	chronic cs	EcoRisk 3.2	1.22E+02	2.58E+02	chronic cs	EcoRisk 3.2

TABLE C-2: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE HORNED LARK							
Surrogate: American Robin (Avian Omnivore)	**Tier 1**				**Tier 2**		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
Aroclors							
Aroclor 1260	2.15E+00	chronic GMM	EcoRisk 3.2	1.02E+01	3.04E+00	chronic GMM	EcoRisk 3.2
Aroclor 1254	1.00E-01	chronic cs	EcoRisk 3.2	4.73E-01	1.00E+00	chronic cs	EcoRisk 3.2
PAHs							
Benzo(a)anthracene	1.07E-01	chronic cs	EcoRisk 3.2	5.06E-01	1.07E+00	chronic cs	EcoRisk 3.2
Naphthalene	1.50E+01	chronic cs	EcoRisk 3.2	7.10E+01	1.50E+02	chronic cs	EcoRisk 3.2
Pyrene	2.05E+01	chronic cs	EcoRisk 3.2	9.70E+01	2.05E+02	chronic cs	EcoRisk 3.2
Metals							
Aluminum (Note: pH dependent)	1.10E+02	chronic	Sample 1996	5.20E+02			
Arsenic	2.24E+00	chronic GMM	EcoRisk 3.2	1.06E+01	2.24E+01	chronic GMM	EcoRisk 3.2
Barium	7.35E+01	chronic GMM	EcoRisk 3.2	3.48E+02	1.31E+02	chronic GMM	EcoRisk 3.2
Boron	2.92E+00	chronic GMM	EcoRisk 3.2		1.45E+01	chronic GMM	EcoRisk 3.2
Cadmium	1.47E+00	chronic GMM	EcoRisk 3.2	6.95E+00	1.47E+01	chronic GMM	EcoRisk 3.2
Chromium (total)	2.66E+00	chronic GMM	EcoRisk 3.2	1.26E+01	2.66E+01	chronic GMM	EcoRisk 3.2
Chromium (hexavalent)	1.10E+01	chronic cs	EcoRisk 3.2	5.20E+01	1.10E+02	chronic cs	EcoRisk 3.2
Cobalt	7.61E+00	chronic GMM	EcoRisk 3.2	3.60E+01	7.61E+01	chronic GMM	EcoRisk 3.2
Copper	4.05E+00	chronic cs	EcoRisk 3.2	1.92E+01	1.21E+01	chronic cs	EcoRisk 3.2
Lead	1.63E+00	chronic cs	EcoRisk 3.2	7.71E+00	3.26E+00	chronic cs	EcoRisk 3.2
Manganese	1.79E+02	chronic GMM	EcoRisk 3.2	8.47E+02	1.79E+03	chronic GMM	EcoRisk 3.2
Mercury (inorganic)	1.90E-02	chronic cs	EcoRisk 3.2	8.99E-02	1.90E-01	chronic cs	EcoRisk 3.2
Molybdenum	3.50E+00	chronic cs	EcoRisk 3.2	1.66E+01	3.50E+01	chronic cs	EcoRisk 3.2
Nickel	6.71E+00	chronic cs	EcoRisk 3.2	3.17E+01	6.71E+01	chronic cs	EcoRisk 3.2
Selenium	2.90E-01	chronic cs	EcoRisk 3.2	1.37E+00	5.79E-01	chronic cs	EcoRisk 3.2
Silver	2.20E+00	chronic cs	EcoRisk 3.2	1.04E+01	2.02E+01	chronic cs	EcoRisk 3.2
Thallium	3.50E-01	chronic cs	EcoRisk 3.2	1.66E+00	3.50E+00	chronic cs	EcoRisk 3.2
Vanadium	3.44E-01	chronic cs	EcoRisk 3.2	1.63E+00	6.88E-01	chronic cs	EcoRisk 3.2
Zinc	6.61E+01	chronic GMM	EcoRisk 3.2	3.13E+02	6.61E+02	chronic GMM	EcoRisk 3.2

TABLE C-2: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE HORNED LARK							
Surrogate: American Robin (Avian Omnivore)	**Tier 1**				**Tier 2**		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
Miscellaneous							
Cyanide (CN-)	4.00E-02	chronic cs	EcoRisk 3.2	1.89E-01	4.00E-01	chronic cs	EcoRisk 3.2
Explosives							
Dinitrobenzene, 1,3-	4.22E-01	chronic cs	EcoRisk 3.2	2.00E+00	4.22E+00	chronic cs	EcoRisk 3.2
Dinitrotoluene, 2,6-	6.00E+01	chronic cs	EcoRisk 3.2	2.84E+02	6.00E+02	chronic cs	EcoRisk 3.2
Trinitrotoluene, 2,4,6-	9.75E+00	chronic cs	EcoRisk 3.2	4.61E+01	1.78E+01	chronic cs	EcoRisk 3.2
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	2.36E+00	chronic GMM	EcoRisk 3.2	1.12E+01	4.49E+00	chronic GMM	EcoRisk 3.2

[a]chronic cs - TRV based on a critical study (two or less data), chronic GMM - TRV based on geometric mean (three or more relevant data)
[b] EcoRisk 3.2 - includes uncertainty factors for extrapolation to chronic NOAEL and LOAEL (see Uncertainty Factor's tab)

TABLE C-3: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE KIT FOX

Surrogate: Red Fox (Mammalian to Carnivore)	**Tier 1**				**Tier 2**		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
VOCs							
Acetone	1.00E+01	chronic cs	EcoRisk 3.2	4.04E+02	5.00E+01	chronic cs	EcoRisk 3.2
Benzene	2.64E+01	chronic cs	EcoRisk 3.2	1.07E+03	2.64E+02	chronic cs	EcoRisk 3.2
2-Butanone (MEK)	1.77E+03	chronic cs	EcoRisk 3.2	7.15E+04	4.57E+03	chronic cs	EcoRisk 3.2
Carbon disulfide	2.50E-01	chronic cs	EcoRisk 3.2	1.01E+01	2.50E+00	chronic cs	EcoRisk 3.2
Chlorobenzene	6.00E+01	chronic cs	EcoRisk 3.2	2.42E+03	6.00E+02	chronic cs	EcoRisk 3.2
Chloroform	1.50E+01	chronic cs	EcoRisk 3.2	6.06E+02	4.10E+01	chronic cs	EcoRisk 3.2
1,2-Dichlorobenzene	2.50E+00	chronic cs	EcoRisk 3.2	1.01E+02	2.50E+01	chronic cs	EcoRisk 3.2
1,3-Dichlorobenzene	2.50E+00	chronic cs	EcoRisk 3.2	1.01E+02	2.50E+01	chronic cs	EcoRisk 3.2
1,4-Dichlorobenzene	2.50E+00	chronic cs	EcoRisk 3.2	1.01E+02	1.00E+01	chronic cs	EcoRisk 3.2
1,1-Dichloroethane	3.82E+02	chronic cs	EcoRisk 3.2	1.54E+04	3.82E+03	chronic cs	EcoRisk 3.2
1,2-Dichloroethane	4.97E+01	chronic cs	EcoRisk 3.2	2.01E+03	4.97E+02	chronic cs	EcoRisk 3.2
1,1-Dichloroethene	3.00E+01	chronic cs	EcoRisk 3.2	1.21E+03	3.00E+02	chronic cs	EcoRisk 3.2
cis-1,2-Dichloroethene	4.52E+01	chronic cs	EcoRisk 3.2	1.83E+03	4.52E+02	chronic cs	EcoRisk 3.2
trans-1,2-Dichloroethene	4.52E+01	chronic cs	EcoRisk 3.2	1.83E+03	4.52E+02	chronic cs	EcoRisk 3.2
2-Hexanone	8.27E+00	chronic GMM	EcoRisk 3.2	3.34E+02	3.15E+01	chronic GMM	EcoRisk 3.2
Hexachlorobenzene	7.10E+00	chronic cs	EcoRisk 3.2	2.87E+02	7.10E+01	chronic cs	EcoRisk 3.2
Methylene chloride	5.85E+00	chronic cs	EcoRisk 3.2	2.36E+02	5.00E+01	chronic cs	EcoRisk 3.2
4-Methyl-2-pentanone (MIBK)	2.50E+01	chronic cs	EcoRisk 3.2	1.01E+03	2.50E+02	chronic cs	EcoRisk 3.2
Tetrachloroethene	2.00E+00	chronic cs	EcoRisk 3.2	8.08E+01	1.00E+01	chronic cs	EcoRisk 3.2
Toluene	2.60E+01	chronic cs	EcoRisk 3.2	1.05E+03	2.60E+02	chronic cs	EcoRisk 3.2
1,2,4-Trichlorobenzene	1.48E+00	chronic cs	EcoRisk 3.2	5.98E+01	1.48E+01	chronic cs	EcoRisk 3.2
1,1,1-Trichloroethane	9.99E+02	chronic cs	EcoRisk 3.2	4.04E+04	9.99E+03	chronic cs	EcoRisk 3.2
Trichloroethene	1.00E+02	chronic cs	EcoRisk 3.2	4.04E+03	1.00E+03	chronic cs	EcoRisk 3.2
Trichlorofluoromethane	2.12E+02	chronic GMM	EcoRisk 3.2	8.56E+03	1.42E+03	chronic GMM	EcoRisk 3.2
Vinyl chloride	1.70E-01	chronic cs	EcoRisk 3.2	6.87E+00	1.70E+00	chronic cs	EcoRisk 3.2

TABLE C-3: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE KIT FOX							
Surrogate: Red Fox (Mammalian to Carnivore)	**Tier 1**				**Tier 2**		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
Xylene (total)	2.10E+00	chronic cs	EcoRisk 3.2	8.48E+01	2.60E+00	chronic cs	EcoRisk 3.2
SVOCs							
Benzyl alcohol	1.43E+02	chronic cs	EcoRisk 3.2	5.78E+03	1.43E+03	chronic cs	EcoRisk 3.2
Bis(2-ethylhexyl) phthalate	1.83E+01	chronic cs	EcoRisk 3.2	7.39E+02	1.83E+02	chronic cs	EcoRisk 3.2
Butyl benzyl phthalate	1.59E+02	chronic cs	EcoRisk 3.2	6.42E+03	1.59E+03	chronic cs	EcoRisk 3.2
Carbazole	2.28E+01	chronic cs	EcoRisk 3.2	9.21E+02	2.28E+02	chronic cs	EcoRisk 3.2
2-Chlorophenol	5.00E-01	chronic cs	EcoRisk 3.2	2.02E+01	5.00E+00	chronic cs	EcoRisk 3.2
Di-n-butyl phthalate	1.34E+03	chronic GMM	EcoRisk 3.2	5.41E+04	3.18E+03	chronic GMM	EcoRisk 3.2
Diethyl phthalate	4.60E+03	chronic cs	EcoRisk 3.2	1.86E+05	4.60E+04	chronic cs	EcoRisk 3.2
Dimethyl phthalate	6.80E+01	chronic cs	EcoRisk 3.2	2.75E+03	6.80E+02	chronic cs	EcoRisk 3.2
Di-n-octyl phthalate	6.51E+01	chronic cs	EcoRisk 3.2	2.63E+03	6.51E+02	chronic cs	EcoRisk 3.2
Hexachlorobenzene	7.10E+00	chronic cs	EcoRisk 3.2	2.87E+02	7.10E+01	chronic cs	EcoRisk 3.2
2-Methylphenol	2.20E+02	chronic cs	EcoRisk 3.2	8.89E+03	2.20E+03	chronic cs	EcoRisk 3.2
2-Nitroaniline	3.00E+00	chronic cs	EcoRisk 3.2	1.21E+02	6.00E+00	chronic cs	EcoRisk 3.2
Nitrobenzene	5.90E+00	chronic cs	EcoRisk 3.2	2.38E+02	5.90E+01	chronic cs	EcoRisk 3.2
Pentachlorophenol	8.42E+00	chronic GMM	EcoRisk 3.2	3.40E+02	8.42E+01	chronic GMM	EcoRisk 3.2
Phenol	6.00E+01	chronic cs	EcoRisk 3.2	2.42E+03	6.00E+02	chronic cs	EcoRisk 3.2
Pesticides/Herbicides							
4,4'-DDD	5.83E+00	chronic GMM	EcoRisk 3.2	2.36E+02	1.17E+01	chronic GMM	EcoRisk 3.2
4,4'-DDE	9.02E+00	chronic GMM	EcoRisk 3.2	3.64E+02	2.27E+01	chronic GMM	EcoRisk 3.2
4,4'-DDT	1.39E-01	chronic cs	EcoRisk 3.2	5.62E+00	6.94E-01	chronic cs	EcoRisk 3.2
Aldrin	2.00E-01	chronic cs	EcoRisk 3.2	8.08E+00	1.00E+00	chronic cs	EcoRisk 3.2
alpha-BHC	8.70E+01	chronic cs	EcoRisk 3.2	3.51E+03	8.70E+02	chronic cs	EcoRisk 3.2
alpha-Chlordane	1.18E+00	chronic cs	EcoRisk 3.2	4.77E+01	1.18E+01	chronic cs	EcoRisk 3.2
beta-BHC	4.00E-01	chronic cs	EcoRisk 3.2	1.62E+01	2.00E+00	chronic cs	EcoRisk 3.2
delta-BHC	1.40E-02	chronic cs	EcoRisk 3.2	5.66E-01	1.40E-01	chronic cs	EcoRisk 3.2

TABLE C-3: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE KIT FOX

Surrogate: Red Fox (Mammalian to Carnivore)	**Tier 1**				**Tier 2**		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
Dieldrin	1.50E-02	chronic cs	EcoRisk 3.2	6.06E-01	3.00E-02	chronic cs	EcoRisk 3.2
Endosulfan I	1.50E-01	chronic cs	EcoRisk 3.2	6.06E+00	1.50E+00	chronic cs	EcoRisk 3.2
Endosulfan II	1.50E-01	chronic cs	EcoRisk 3.2	6.06E+00	1.50E+00	chronic cs	EcoRisk 3.2
Endrin	9.20E-02	chronic cs	EcoRisk 3.2	3.72E+00	9.20E-01	chronic cs	EcoRisk 3.2
gamma-BHC (Lindane)	1.40E-02	chronic cs	EcoRisk 3.2	5.66E-01	1.40E-01	chronic cs	EcoRisk 3.2
gamma-Chlordane	1.18E+00	chronic cs	EcoRisk 3.2	4.77E+01	1.18E+01	chronic cs	EcoRisk 3.2
Heptachlor	1.00E-01	chronic cs	EcoRisk 3.2	4.04E+00	1.00E+00	chronic cs	EcoRisk 3.2
Methoxychlor	4.00E+00	chronic cs	EcoRisk 3.2	1.62E+02	8.00E+00	chronic cs	EcoRisk 3.2
Aroclors							
Aroclor 1016	1.49E+00	chronic GMM	EcoRisk 3.2	6.02E+01	4.26E+00	chronic GMM	EcoRisk 3.2
Aroclor 1260	3.10E-02	chronic cs	EcoRisk 3.2	1.25E+00	3.10E-01	chronic cs	EcoRisk 3.2
Aroclor 1254	6.11E-01	chronic GMM	EcoRisk 3.2	2.47E+01	3.37E+00	chronic GMM	EcoRisk 3.2
PAHs							
Acenaphthene	7.00E+01	chronic cs	EcoRisk 3.2	2.83E+03	7.00E+02	chronic cs	EcoRisk 3.2
Acenaphthylene	7.00E+01	chronic cs	EcoRisk 3.2	2.83E+03	7.00E+02	chronic cs	EcoRisk 3.2
Anthracene	1.00E+02	chronic cs	EcoRisk 3.2	4.04E+03	1.00E+03	chronic cs	EcoRisk 3.2
Benzo(a)anthracene	1.70E-01	chronic cs	EcoRisk 3.2	6.87E+00	1.70E+00	chronic cs	EcoRisk 3.2
Benzo(a)pyrene	5.58E+00	chronic GMM	EcoRisk 3.2	2.25E+02	1.77E+01	chronic GMM	EcoRisk 3.2
Benzo(b)fluoranthene	4.00E+00	chronic cs	EcoRisk 3.2	1.62E+02	4.00E+01	chronic cs	EcoRisk 3.2
Benzo(ghi)perylene	7.20E+00	chronic cs	EcoRisk 3.2	2.91E+02	7.20E+01	chronic cs	EcoRisk 3.2
Benzo(k)fluoranthene	7.20E+00	chronic cs	EcoRisk 3.2	2.91E+02	7.20E+01	chronic cs	EcoRisk 3.2
Chrysene	1.70E-01	chronic cs	EcoRisk 3.2	6.87E+00	1.70E+01	chronic cs	EcoRisk 3.2
Dibenzo(a,h)anthracene	1.33E+00	chronic cs	EcoRisk 3.2	5.37E+01	1.33E+01	chronic cs	EcoRisk 3.2
Fluoranthene	1.25E+01	chronic cs	EcoRisk 3.2	5.05E+02	1.25E+02	chronic cs	EcoRisk 3.2
Fluorene	1.25E+02	chronic cs	EcoRisk 3.2	5.05E+03	2.50E+02	chronic cs	EcoRisk 3.2
Indeno(1,2,3-cd)pyrene	7.20E+00	chronic cs	EcoRisk 3.2	2.91E+02	7.20E+01	chronic cs	EcoRisk 3.2

TABLE C-3: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE KIT FOX

Surrogate: Red Fox (Mammalian to Carnivore)	**Tier 1**				**Tier 2**		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
Naphthalene	1.43E+01	chronic GMM	EcoRisk 3.2	5.78E+02	4.02E+01	chronic GMM	EcoRisk 3.2
Phenanthrene	5.14E+00	chronic cs	EcoRisk 3.2	2.08E+02	5.14E+01	chronic cs	EcoRisk 3.2
Pyrene	7.50E+00	chronic cs	EcoRisk 3.2	3.03E+02	7.50E+01	chronic cs	EcoRisk 3.2
Dioxin/Furans							
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	5.62E-07	chronic GMM	EcoRisk 3.2	2.27E-05	3.76E-06	chronic GMM	EcoRisk 3.2
Metals							
Aluminum (note: pH dependent)	6.20E+01	chronic	ATSDR 1999	2.50E+03	1.30E+02	chronic	ATSDR 1999
Antimony	5.90E-02	chronic cs	EcoRisk 3.2	2.38E+00	5.90E-01	chronic cs	EcoRisk 3.2
Arsenic	1.04E+00	chronic cs	EcoRisk 3.2	4.20E+01	1.66E+00	chronic cs	EcoRisk 3.2
Barium	5.18E+01	chronic GMM	EcoRisk 3.2	2.09E+03	5.18E+02	chronic GMM	EcoRisk 3.2
Beryllium	5.32E-01	chronic cs	EcoRisk 3.2	2.15E+01	5.32E+00	chronic cs	EcoRisk 3.2
Boron	2.80E+01	chronic cs	EcoRisk 3.2	1.13E+03	2.80E+02	chronic cs	EcoRisk 3.2
Cadmium	7.70E-01	chronic cs	EcoRisk 3.2	3.11E+01	7.70E+00	chronic cs	EcoRisk 3.2
Chromium (total)	2.40E+00	chronic GMM	EcoRisk 3.2	9.70E+01	2.40E+01	chronic GMM	EcoRisk 3.2
Chromium (hexavalent)	9.24E+00	chronic GMM	EcoRisk 3.2	3.73E+02	9.24E+01	chronic GMM	EcoRisk 3.2
Cobalt	7.33E+00	chronic GMM	EcoRisk 3.2	2.96E+02	7.33E+01	chronic GMM	EcoRisk 3.2
Copper	5.60E+00	chronic cs	EcoRisk 3.2	2.26E+02	9.34E+00	chronic cs	EcoRisk 3.2
Lead	4.70E+00	chronic cs	EcoRisk 3.2	1.90E+02	8.90E+00	chronic cs	EcoRisk 3.2
Manganese	5.15E+01	chronic GMM	EcoRisk 3.2	2.08E+03	5.15E+02	chronic GMM	EcoRisk 3.2
Mercury (inorganic)	1.41E+00	chronic cs	EcoRisk 3.2	5.70E+01	1.41E+01	chronic cs	EcoRisk 3.2
Nickel	1.70E+00	chronic cs	EcoRisk 3.2	6.87E+01	3.40E+00	chronic cs	EcoRisk 3.2
Selenium	1.43E-01	chronic cs	EcoRisk 3.2	5.78E+00	2.15E-01	chronic cs	EcoRisk 3.2
Silver	6.02E+00	chronic cs	EcoRisk 3.2	2.43E+02	6.02E+01	chronic cs	EcoRisk 3.2
Thallium	7.10E-03	chronic cs	EcoRisk 3.2	2.87E-01	7.10E-02	chronic cs	EcoRisk 3.2
Vanadium	4.16E+00	chronic cs	EcoRisk 3.2	1.68E+02	8.31E+00	chronic cs	EcoRisk 3.2
Zinc	7.54E+01	chronic GMM	EcoRisk 3.2	3.05E+03	7.54E+02	chronic GMM	EcoRisk 3.2
Miscellaneous							

TABLE C-3: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE KIT FOX

Surrogate: Red Fox (Mammalian to Carnivore)	**Tier 1**				**Tier 2**		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
Nitrite	5.07E+02	chronic cs	Sample 1996	2.05E+04			
Cyanide (CN-)	6.87E+01	chronic cs	EcoRisk 3.2	2.78E+03	6.87E+02	chronic cs	EcoRisk 3.2
Explosives							
Trinitrobenzene, 1,3,5-	1.34E+01	chronic cs	EcoRisk 3.2	5.41E+02	1.34E+02	chronic cs	EcoRisk 3.2
Dinitrobenzene, 1,3-	1.13E-01	chronic cs	EcoRisk 3.2	4.57E+00	2.64E-01	chronic cs	EcoRisk 3.2
Dinitrotoluene, 2,4-	2.68E+00	chronic cs	EcoRisk 3.2	1.08E+02	2.68E+01	chronic cs	EcoRisk 3.2
Dinitrotoluene, 2,6-	1.77E+00	chronic cs	EcoRisk 3.2	7.15E+01	1.77E+01	chronic cs	EcoRisk 3.2
Trinitrotoluene, 2,4,6-	3.47E+01	chronic cs	EcoRisk 3.2	1.40E+03	1.60E+02	chronic cs	EcoRisk 3.2
Dinitrotoluene, 2-Amino-4,6-	1.39E+01	chronic cs	EcoRisk 3.2	5.62E+02	1.39E+02	chronic cs	EcoRisk 3.2
Nitrotoluene, o-	8.91E+00	chronic cs	EcoRisk 3.2	3.60E+02	8.91E+01	chronic cs	EcoRisk 3.2
Nitrotoluene, m-	1.07E+01	chronic cs	EcoRisk 3.2	4.32E+02	1.07E+02	chronic cs	EcoRisk 3.2
Dinitrotoluene, 4-Amino-2,6-	9.59E+00	chronic cs	EcoRisk 3.2	3.87E+02	9.59E+01	chronic cs	EcoRisk 3.2
Nitrotoluene, p-	1.96E+01	chronic cs	EcoRisk 3.2	7.92E+02	1.96E+02	chronic cs	EcoRisk 3.2
PETN	7.00E+01	chronic cs	EcoRisk 3.2	2.83E+03	7.00E+02	chronic cs	EcoRisk 3.2
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	8.94E+00	chronic GMM	EcoRisk 3.2	3.61E+02	2.83E+01	chronic GMM	EcoRisk 3.2
Tetryl (Trinitrophenylmethylnitramine)	1.30E+00	chronic cs	EcoRisk 3.2	5.25E+01	6.20E+00	chronic cs	EcoRisk 3.2
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetra (HMX)	7.50E+01	chronic cs	EcoRisk 3.2	3.03E+03	2.00E+02	chronic cs	EcoRisk 3.2
Nitroglycerin	9.64E+01	chronic cs	EcoRisk 3.2	3.89E+03	1.02E+03	chronic cs	EcoRisk 3.2

[a]chronic cs - TRV based on a critical study (two or less data), chronic GMM - TRV based on geometric mean (three or more relevant data)
[b] EcoRisk 3.2 - includes uncertainty factors for extrapolation to chronic NOAEL and
LOAEL (see Uncertainty Factor's tab)

TABLE C-4: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE RED-TAILED HAWK							
Surrogate: American Kestrel (Avian Top Carnivore)	**Tier 1**				**Tier 2**		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
VOCs							
Acetone	2.01E+02	chronic cs	EcoRisk 3.2	7.32E+03	2.01E+03	chronic cs	EcoRisk 3.2
1,2-Dichloroethane	4.60E+00	chronic cs	EcoRisk 3.2	1.67E+02	9.10E+00	chronic cs	EcoRisk 3.2
Hexachlorobenzene	5.00E+00	chronic cs	EcoRisk 3.2	1.82E+02	5.00E+01	chronic cs	EcoRisk 3.2
2-Hexanone	1.00E+00	chronic cs	EcoRisk 3.2	3.64E+01	1.00E+01	chronic cs	EcoRisk 3.2
Xylene (total)	1.07E+02	chronic cs	EcoRisk 3.2	3.89E+03	1.07E+03	chronic cs	EcoRisk 3.2
SVOCs							
Bis(2-ethylhexyl) phthalate	1.10E+00	chronic cs	EcoRisk 3.2	4.00E+01	1.10E+01	chronic cs	EcoRisk 3.2
2-Chlorophenol	1.13E+00	chronic cs	EcoRisk 3.2	4.11E+01	1.13E+01	chronic cs	EcoRisk 3.2
Di-n-butyl phthalate	1.40E-01	chronic cs	EcoRisk 3.2	5.10E+00	1.40E+00	chronic cs	EcoRisk 3.2
Pentachlorophenol	6.73E+00	chronic cs	EcoRisk 3.2	2.45E+02	6.73E+01	chronic cs	EcoRisk 3.2
Pesticides/Herbicides							
4,4'-DDD	1.60E-02	chronic GMM	EcoRisk 3.2	5.82E-01	8.30E-02	chronic GMM	EcoRisk 3.2
4,4'-DDE	4.80E-01	chronic GMM	EcoRisk 3.2	1.75E+01	2.40E+00	chronic GMM	EcoRisk 3.2
4,4'-DDT	2.01E+00	chronic GMM	EcoRisk 3.2	7.32E+01	5.96E+00	chronic GMM	EcoRisk 3.2
alpha-Chlordane	2.14E+00	chronic cs	EcoRisk 3.2	7.79E+01	1.07E+01	chronic cs	EcoRisk 3.2
beta-BHC	3.83E+01	chronic cs	EcoRisk 3.2	1.39E+03	3.83E+02	chronic cs	EcoRisk 3.2
Dieldrin	7.09E-02	chronic cs	EcoRisk 3.2	2.58E+00	3.78E+00	chronic cs	EcoRisk 3.2
Endosulfan I	1.00E+01	chronic cs	EcoRisk 3.2	3.64E+02	1.00E+02	chronic cs	EcoRisk 3.2
Endosulfan II	1.00E+01	chronic cs	EcoRisk 3.2	3.64E+02	1.00E+02	chronic cs	EcoRisk 3.2
Endrin	1.00E-02	chronic cs	EcoRisk 3.2	3.64E-01	1.00E-01	chronic cs	EcoRisk 3.2
gamma-BHC (Lindane)	5.60E-01	chronic cs	EcoRisk 3.2	2.04E+01	2.25E+00	chronic cs	EcoRisk 3.2
gamma-Chlordane	2.14E+00	chronic cs	EcoRisk 3.2	7.79E+01	1.07E+01	chronic cs	EcoRisk 3.2
Heptachlor	9.20E-01	chronic cs	EcoRisk 3.2	3.35E+01	9.20E+00	chronic cs	EcoRisk 3.2
Methoxychlor	2.58E+01	chronic cs	EcoRisk 3.2	9.39E+02	2.58E+02	chronic cs	EcoRisk 3.2
Aroclors							
Aroclor 1260	2.15E+00	chronic GMM	EcoRisk 3.2	7.83E+01	3.04E+00	chronic cs	EcoRisk 3.2

TABLE C-4: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE RED-TAILED HAWK							
Surrogate: American Kestrel (Avian Top Carnivore)	**Tier 1**				**Tier 2**		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
Aroclor 1254	1.00E-01	chronic cs	EcoRisk 3.2	3.64E+00	1.00E+00	chronic cs	EcoRisk 3.2
PAHs							
Benzo(a)anthracene	1.07E-01	chronic cs	EcoRisk 3.2	3.89E+00	1.07E+00	chronic cs	EcoRisk 3.2
Naphthalene	1.50E+01	chronic cs	EcoRisk 3.2	5.46E+02	1.50E+02	chronic cs	EcoRisk 3.2
Pyrene	2.05E+01	chronic cs	EcoRisk 3.2	7.46E+02	2.05E+02	chronic cs	EcoRisk 3.2
Metals							
Aluminum (Note: pH dependent)	1.10E+02	chronic	Sample 1996	4.00E+03			
Arsenic	2.24E+00	chronic GMM	EcoRisk 3.2	8.15E+01	2.24E+01	chronic GMM	EcoRisk 3.2
Barium	7.35E+01	chronic GMM	EcoRisk 3.2	2.68E+03	1.31E+02	chronic GMM	EcoRisk 3.2
Boron	2.92E+00	chronic GMM	EcoRisk 3.2	1.06E+02	1.45E+01	chronic GMM	EcoRisk 3.2
Cadmium	1.47E+00	chronic GMM	EcoRisk 3.2	5.35E+01	1.47E+01	chronic GMM	EcoRisk 3.2
Chromium (total)	2.66E+00	chronic GMM	EcoRisk 3.2	9.68E+01	2.66E+01	chronic GMM	EcoRisk 3.2
Chromium (hexavalent)	1.10E+01	chronic cs	EcoRisk 3.2	4.00E+02	1.10E+02	chronic cs	EcoRisk 3.2
Cobalt	7.61E+00	chronic GMM	EcoRisk 3.2	2.77E+02	7.61E+01	chronic GMM	EcoRisk 3.2
Copper	4.05E+00	chronic cs	EcoRisk 3.2	1.47E+02	1.21E+01	chronic cs	EcoRisk 3.2
Lead	1.63E+00	chronic cs	EcoRisk 3.2	5.93E+01	3.26E+00	chronic cs	EcoRisk 3.2
Manganese	1.79E+02	chronic GMM	EcoRisk 3.2	6.52E+03	1.79E+03	chronic GMM	EcoRisk 3.2
Mercury (inorganic)	1.90E-02	chronic cs	EcoRisk 3.2	6.92E-01	1.90E-01	chronic cs	EcoRisk 3.2
Molybdenum	3.50E+00	chronic cs	EcoRisk 3.2	1.27E+02	3.50E+01	chronic cs	EcoRisk 3.2
Nickel	6.71E+00	chronic cs	EcoRisk 3.2	2.44E+02	6.71E+01	chronic cs	EcoRisk 3.2
Selenium	2.90E-01	chronic cs	EcoRisk 3.2	1.06E+01	5.79E-01	chronic cs	EcoRisk 3.2
Silver	2.02E+00	chronic cs	EcoRisk 3.2	7.35E+01	2.02E+01	chronic cs	EcoRisk 3.2
Thallium	3.50E-01	chronic cs	EcoRisk 3.2	1.27E+01	3.50E+00	chronic cs	EcoRisk 3.2
Vanadium	3.44E-01	chronic cs	EcoRisk 3.2	1.25E+01	6.88E-01	chronic cs	EcoRisk 3.2
Zinc	6.61E+01	chronic GMM	EcoRisk 3.2	2.41E+03	6.61E+02	chronic GMM	EcoRisk 3.2
Miscellaneous							
Cyanide (CN-)	4.00E-02	chronic cs	EcoRisk 3.2	1.46E+00	4.00E-01	chronic cs	EcoRisk 3.2

TABLE C-4: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE RED-TAILED HAWK							
Surrogate: American Kestrel (Avian Top Carnivore)	**Tier 1**				**Tier 2**		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type[a]**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type[a]**	**Source**
Explosives							
Dinitrobenzene, 1,3-	4.22E-01	chronic cs	EcoRisk 3.2	1.54E+01	4.22E+00	chronic cs	EcoRisk 3.2
Dinitrotoluene, 2,6-	6.00E+01	chronic cs	EcoRisk 3.2	2.18E+03	6.00E+02	chronic cs	EcoRisk 3.2
Trinitrotoluene, 2,4,6-	9.75E+00	chronic cs	EcoRisk 3.2	3.55E+02	1.78E+01	chronic cs	EcoRisk 3.2
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	2.36E+00	chronic GMM	EcoRisk 3.2	8.59E+01	4.49E+00	chronic GMM	EcoRisk 3.2

[a]chronic cs - TRV based on a critical study (two or less data), chronic GMM - TRV based on geometric mean (three or more relevant data)

[b] EcoRisk 3.2 - includes uncertainty factors for extrapolation to chronic NOAEL and LOAEL (see Uncertainty Factor's tab)

TABLE C-5: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR THE PRONGHORN ANTELOPE							
	Tier 1				Tier 2		
Constituent	**TRV NOAEL (mg/kg/day)**	**Type**	**Source**	**Screening Level (mg/kg)**	**TRV LOAEL (mg/kg/day)**	**Type**	**Source**
Metals							
Arsenic	1.25E-01	subchronic	NAS, 1972	3.61E+01	1.56E-01	subchronic	NAS, 1972
Cobalt	2.00E-01	chronic	NAS, 1980	5.77E+01	2.50E-01	chronic	NAS, 1980
Lead	6.00E-01	chronic	NAS, 1980	1.73E+02	7.50E-01	chronic	NAS, 1980
Manganese	2.00E+01	chronic	NAS, 1980	5.77E+03	2.50E+01	chronic	NAS, 1980
Molybdenum	4.00E+00	chronic	NAS, 1972	1.15E+03	5.00E+00	chronic	NAS, 1972
Nickel	1.00E+00	chronic	NAS, 1980	2.89E+02	1.25E+00	chronic	NAS, 1980
Silver	1.00E-02	acute	Gough, 1979	2.89E+00			
Vanadium	1.00E+00	chronic	NAS, 1980	2.89E+02	1.25E+00	chronic	NAS, 1980
Zinc	1.00E+01	chronic	NAS, 1980	2.89E+03	1.25E+01	chronic	NAS, 1980

TABLE C-6: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR PLANTS

	Tier 1			Tier 2		
Constituent	**Effect Concentration NOAEL (mg/kg)**	**Type[a]**	**Source**	**Effect Concentration LOAEL (mg/kg)**	**Type[a]**	**Source**
VOCs						
Hexachlorobenzene	1.00E+01	chronic cs	EcoRisk 3.2	1.00E+02	chronic cs	EcoRisk 3.2
Methylene chloride	1.67E+03	chronic cs	EcoRisk 3.2	1.67E+04	chronic cs	EcoRisk 3.2
Styrene	3.20E+00	chronic cs	EcoRisk 3.2	3.20E+01	chronic cs	EcoRisk 3.2
Tetrachloroethene	1.00E+01	chronic cs	EcoRisk 3.2	1.00E+02	chronic cs	EcoRisk 3.2
Toluene	2.00E+02	chronic cs	EcoRisk 3.2	2.00E+03	chronic cs	EcoRisk 3.2
Xylene (total)	1.00E+02	chronic cs	EcoRisk 3.2	1.00E+03	chronic cs	EcoRisk 3.2
SVOCs						
Dibenzofuran	6.17E+00	chronic cs	EcoRisk 3.2	6.17E+01	chronic cs	EcoRisk 3.2
Di-n-butyl phthalate	1.67E+02	chronic GMM	EcoRisk 3.2	6.01E+02	chronic GMM	EcoRisk 3.2
Diethyl phthalate	1.00E+02	chronic cs	EcoRisk 3.2	1.00E+03	chronic cs	EcoRisk 3.2
Hexachlorobenzene	1.00E+01	chronic cs	EcoRisk 3.2	1.00E+02	chronic cs	EcoRisk 3.2
2-Methylphenol	6.70E-01	chronic cs	EcoRisk 3.2	6.70E+00	chronic cs	EcoRisk 3.2
3-Methylphenol	6.90E-01	chronic cs	EcoRisk 3.2	6.90E+00	chronic cs	EcoRisk 3.2
Pentachlorophenol	5.00E+00	chronic GMM	EcoRisk 3.2	5.00E+01	chronic GMM	EcoRisk 3.2
Phenol	7.90E-01	chronic cs	EcoRisk 3.2	7.90E+00	chronic cs	EcoRisk 3.2
Pesticides/Herbicides						
gamma-BHC (Lindane)	1.00E-01	chronic cs	EcoRisk 3.2	1.00E+00	chronic cs	EcoRisk 3.2
alpha-Chlordane	2.24E+00	chronic cs	EcoRisk 3.2	2.24E+01	chronic cs	EcoRisk 3.2
gamma-Chlordane	2.24E+00	chronic cs	EcoRisk 3.2	2.24E+01	chronic cs	EcoRisk 3.2
4,4'-DDT	4.10E+00	chronic GMM	EcoRisk 3.2	6.10E+00	chronic GMM	EcoRisk 3.2
Dieldrin	1.00E+01	chronic cs	EcoRisk 3.2	1.00E+02	chronic cs	EcoRisk 3.2
Endrin	3.40E-03	chronic cs	EcoRisk 3.2	3.40E-02	chronic cs	EcoRisk 3.2
Heptachlor	4.08E-01	chronic cs	EcoRisk 3.2	4.08E+00	chronic cs	EcoRisk 3.2
Aroclors						
Aroclor 1254	1.63E+02	chronic GMM	EcoRisk 3.2	6.20E+02	chronic GMM	EcoRisk 3.2
PAHs						
Acenaphthene	2.50E-01	chronic cs	EcoRisk 3.2	2.50E+00	chronic cs	EcoRisk 3.2
Anthracene	6.88E+00	chronic GMM	EcoRisk 3.2	8.95E+00	chronic GMM	EcoRisk 3.2
Benzo(a)anthracene	1.80E+01	chronic cs	EcoRisk 3.2	1.80E+02	chronic cs	EcoRisk 3.2
Benzo(b)fluoranthene	1.80E+01	chronic cs	EcoRisk 3.2	1.80E+02	chronic cs	EcoRisk 3.2
Naphthalene	1.00E+00	chronic cs	EcoRisk 3.2	1.00E+01	chronic cs	EcoRisk 3.2
Metals						

TABLE C-6: TIER 1 TRVS AND ESLS AND TIER 2 TRVS FOR PLANTS

	Tier 1			Tier 2		
Constituent	**Effect Concentration NOAEL (mg/kg)**	**Type[a]**	**Source**	**Effect Concentration LOAEL (mg/kg)**	**Type[a]**	**Source**
Antimony	1.14E+01	chronic GMM	EcoRisk 3.2	5.80E+01	chronic GMM	EcoRisk 3.2
Arsenic	1.80E+01	chronic GMM	EcoRisk 3.2	9.10E+01	chronic GMM	EcoRisk 3.2
Barium	1.18E+02	chronic GMM	EcoRisk 3.2	2.61E+02	chronic GMM	EcoRisk 3.2
Beryllium	2.50E+00	chronic cs	EcoRisk 3.2	2.50E+01	chronic cs	EcoRisk 3.2
Boron	3.68E+01	chronic GMM	EcoRisk 3.2	8.66E+01	chronic GMM	EcoRisk 3.2
Cadmium	3.20E+01	chronic GMM	EcoRisk 3.2	1.60E+02	chronic GMM	EcoRisk 3.2
Chromium (hexavalent)	3.50E-01	chronic cs	EcoRisk 3.2	3.50E+00	chronic cs	EcoRisk 3.2
Cobalt	1.30E+01	chronic GMM	EcoRisk 3.2	1.34E+02	chronic GMM	EcoRisk 3.2
Copper	7.00E+01	chronic GMM	EcoRisk 3.2	4.97E+02	chronic GMM	EcoRisk 3.2
Lead	1.20E+02	chronic GMM	EcoRisk 3.2	5.76E+02	chronic GMM	EcoRisk 3.2
Manganese	2.20E+02	chronic GMM	EcoRisk 3.2	1.10E+03	chronic GMM	EcoRisk 3.2
Mercury (inorganic)	3.49E+01	chronic cs	EcoRisk 3.2	6.40E+01	chronic cs	EcoRisk 3.2
Nickel	3.80E+01	chronic GMM	EcoRisk 3.2	2.76E+02	chronic GMM	EcoRisk 3.2
Selenium	5.20E-01	chronic GMM	EcoRisk 3.2	3.40E+00	chronic GMM	EcoRisk 3.2
Silver	5.60E+02	chronic GMM	EcoRisk 3.2	2.81E+03	chronic GMM	EcoRisk 3.2
Thallium	5.00E-02	chronic cs	EcoRisk 3.2	5.00E-01	chronic cs	EcoRisk 3.2
Vanadium	6.00E+01	chronic cs	EcoRisk 3.2	8.00E+01	chronic cs	EcoRisk 3.2
Zinc	1.60E+02	chronic GMM	EcoRisk 3.2	8.12E+02	chronic GMM	EcoRisk 3.2
Explosives						
Dinitrotoluene, 2,4-	6.00E+00	EPA Eco SSL	EcoRisk 3.2	6.00E+01	EPA Eco SSL	EcoRisk 3.2
Trinitrotoluene, 2,4,6-	6.21E+01	chronic GMM	EcoRisk 3.2	1.26E+02	chronic GMM	EcoRisk 3.2
Dinitrotoluene, 2-Amino-4,6-	1.40E+01	EPA Eco SSL	EcoRisk 3.2	1.40E+02	EPA Eco SSL	EcoRisk 3.2
Dinitrotoluene, 4-Amino-2,6-	3.30E+01	EPA Eco SSL	EcoRisk 3.2	3.30E+02	EPA Eco SSL	EcoRisk 3.2
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetra (HMX)	2.74E+03	chronic GMM	EcoRisk 3.2	3.56E+03	chronic GMM	EcoRisk 3.2
Nitroglycerin	2.10E+01	EPA Eco SSL	EcoRisk 3.2	2.10E+02	EPA Eco SSL	EcoRisk 3.2

[a]chronic cs - TRV based on a critical study (two or less data), chronic GMM - TRV based on geometric mean (three or more relevant data)

[b] EcoRisk 3.2 - includes uncertainty factors for extrapolation to chronic NOAEL and LOAEL (see Uncertainty Factor's tab)