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Revision 1

Tier 1 Risk-Based Soil Concentrations Protective of Ecological Receptors at the Hanford Site

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

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Approved for Public Release;
Further Dissemination Unlimited

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Executive Summary

A framework for derivation of ecological risk-based concentrations in soil is presented in this document for use in remedial investigations (RIs) and feasibility studies (FSs) at the Hanford Site. This framework is intended to be iterative, incorporating additional information as appropriate to improve decision making.

This iterative approach is in accordance with the steps outlined in EPA 540-R-97-006,[1] and the simplified and site-specific ecological evaluations described in WAC 173-340-7492[2] and WAC 173-340-7493.[3] The framework for development of these risk-based concentrations consists of the following progressive tiers that are more Hanford-specific and more accurately represent the conceptual ecological soil exposure pathway with each tier:

- Generic Screening Levels represent initial, conservative screening values readily available from published sources that are intended to differentiate between contaminants of potential ecological concern (COPECs) that clearly present no risk and those for which additional evaluation may be warranted.
- Tier 1—Values incorporate data that represent Hanford Site-specific receptors.
- Tier 2—Values incorporate additional Hanford Site-specific information to obtain values that better reflect Hanford Site conditions.
- Tier 3—Values are waste site-specific or location-specific and are based on data (e.g., bioaccumulation sampling, bioassays, and exposure factors) collected for specific locations at the Hanford Site.

Development of Tiers 2 and 3 values is not discussed in this report and will be addressed in separate documents as appropriate.

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[1] EPA 540-R-97-006, 1997, *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments: Interim Final*, OSWER 9285.7-25, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://www.epa.gov/swerrims/riskassessment/ecorisk/ecorisk.htm.

[2] WAC 173-340-7492, "Model Toxics Control Act—Cleanup," "Simplified Terrestrial Ecological Evaluation Procedures," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/wac/default.aspx?cite=173-340-7492.

[3] WAC 173-340-7493, "Model Toxics Control Act—Cleanup," "Site-Specific Terrestrial Ecological Evaluation Procedures," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/wac/default.aspx?cite=173-340-7493.

Chapter 1 discusses the application of these values within the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*[4] (CERCLA) process. In the CERCLA process, a range of conservative risk-based screening values and benchmarks may be used in an ecological risk assessment (ERA) conducted as part of an RI. These values can be used for investigation planning, for use in screening analytical data to identify COPECs, media, and receptors that require further evaluation, and for evaluation of remedial alternatives. As described in this document, these values may be further refined to more ecologically relevant values with information collected in the RI. Based on the results from the ERA, ecological preliminary remediation goals PRGs used in the FS are identified from these risk-based values.

Chapter 2 presents a discussion of the tiered process for the derivation of these ecological risk-based concentrations. This is a framework that is iterative in nature, allowing the incorporation of additional site-specific information into the ecological risk-based concentrations. The initial step in this tiered process is the derivation of the Generic Screening Levels are. Conceptually, the Generic Screening Levels should represent the most conservative ecological risk-based concentrations. However, the Generic Screening Levels are drawn from a range of sources and reflect some variation in the types of effect levels and quality of data used in their calculation and in certain cases, the wildlife Tier 1 values may be lower than Generic Screening Levels. These occurrences need to be taken into consideration when using any of these values for screening contaminant concentrations in soil. Calculation of Tier 2 values for wildlife, which would incorporate additional Hanford Site-specific information, may be appropriate for further evaluation of contaminants where wildlife Tier 1 values may be lower than Generic Screening Levels.

The risk-based concentrations developed in this document can be used as screening levels for evaluating sampling and analytical data, and can used as PRGs in an FS. Depending on site-specific conditions, a value at any tier in the process can be used either for screening data or as a PRG. Further description of the decision-making cycle in the tiered process is discussed further in Section 1.2 of this document.

Chapter 3 summarizes the methods and assumptions for developing Tier 1 values. Tier 1 values for wildlife were developed using wildlife exposure models established or

[4] *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 USC 9601, et seq. Available at: http://uscode.house.gov/download/pls/42C103.txt.

accepted by regulatory agencies. Data and assumptions that reflect bird and mammal species found at the Hanford Site were used to develop Tier 1 values.

Chapter 4 summarizes the uncertainties associated with the Tier 1 risk-based soil concentrations. Some of the Tier 1 values for wildlife should be used with caution in remediation planning and with a full understanding of their associated uncertainties. In cases where the ecological screening level value or a PRG for any particular COPEC become drivers for remedial decision making in an RI/FS, a discussion of the uncertainties should be presented in the ERA accompanying the RI/FS. In certain cases, refinement of the Tier 1 value to Tier 2 value may be desirable prior to using an ecological risk-based value in remedial decision making. Examples of uncertainty discussions for some contaminants have been included in this document. These examples provide a framework for the types of uncertainty discussions for any contaminant that should be incorporated into the risk characterization portion of an ERA, and when making decisions to proceed to the next level of refinement within the tiered process.

This report has not proposed Tier 1 values for plants or soil invertebrates at this time, as is discussed in Chapter 4. The lowest effect levels in soil from published sources for plants and soil invertebrates have been summarized in this report; however, the uncertainties in the literature data sets of effect levels identified in this report preclude development of Tier 1 values for use in data screening or for PRGs. Activities being conducted during 2011 to support development of ecological risk-based values for plants and soil invertebrates include:

- Incorporating plant and soil invertebrate bioassay data, collected as part of the River Corridor Baseline Risk Assessment (DOE/RL-2007-21),[5] along with additional literature and information into the development of ecological values
- Conducting additional plant and soil invertebrate bioassays using Hanford Site soils to estimate effect levels using a broader range of soil concentrations (DOE/RL-2010-118)[6]

[5] DOE/RL-2007-21, 2008, *Risk Assessment Report for the 100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment*, Draft B, 3 vols., U.S. Department of Energy, Richland Operations Office, Richland, Washington.

[6] DOE/RL-2010-118, 2011, *Sampling and Analysis Plan for Ex Situ Plant and Invertebrate Bioassays to Evaluate Terrestrial Environments Across the Hanford Site*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

- Evaluating revegetation success at interim-closed and revegetated waste sites cleaned up under Interim Action Records of Decision in the River Corridor

Chapter 5 presents a summary of the generic and Tier 1 values that were identified or derived for this report and a discussion of their application. The ecological risk-based values presented in this report result from a tiered process in which values are refined, as needed, with additional literature-derived or site-specific information, using more complex methods to develop values that are more representative of ecological exposure pathways at the Hanford Site. The tiered approach is in accordance with guidance from EPA 540-R-97-006, OSWER Directive 9285.7-55,[7] and the ecological evaluation procedure presented in WAC 173-340-7490,[8] WAC 173-340-7491,[9] and WAC 173-340-7492 and -7493. Central to the concept of a systematic, informed progression is an iterative process (i.e., cycles) of decision making involving evaluation, deliberation, data collection, and communication. All of these steps should be focused on deciding: (1) whether or not the ecological risk-based concentrations at the current tier are sufficient to support cleanup decision making (a process for exiting the tiered approach is available at each tier), (2) if the information available at the current tier is determined to be insufficient, whether or not progression to a higher tier of refinement warrants the additional effort. The need for refinement to a higher tier of ecological risk-based concentration is based on the uncertainties in the current-tier value, the confidence in the data used in developing the value, and the relevance of the assumptions used in its development to site conditions. Incorporation of additional information will result in a risk-based concentration that better reflects site-specific conditions. However, such refinement could result in a concentration value that is either higher or lower than the previous-tier value. Selection of a particular tier for use in screening data or for PRG development should take into consideration the level of confidence in the value and its relevance to site-specific conditions.

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[7] OSWER Directive 9285.7-55, 2003, *Guidance for Developing Ecological Soil Screening Levels*, Attachment 1-3, *Evaluation of Dermal Contact and Inhalation Exposure Pathways for the Purposes of Setting EcoSSLs*, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: http://www.epa.gov/ecotox/ecossl/pdf/ecossl_attachment_1-3.pdf.

[8] WAC 173-340-7490, "Model Toxics Control Act—Cleanup," "Terrestrial Ecological Evaluation Procedures," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340-7490.

[9] WAC 173-340-7491, "Model Toxics Control Act—Cleanup," "Exclusions from a Terrestrial Ecological Evaluation," *Washington Administrative Code*, Olympia, Washington. Available at: http://apps.leg.wa.gov/WAC/default.aspx?cite=173-340-7491.

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Terms

AUF	area use factor
BAF	bioaccumulation factor
BCG	Biota Concentration Guide
BW	body weight
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
COPEC	contaminant of potential ecological concern
CSM	conceptual site model
DOE	U.S. Department of Energy
EC10	concentration causing effects to 10 percent of exposed population
EC20	concentration causing effects to 20 percent of exposed population
EC50	concentration causing effects to 50 percent of exposed population
Ecology	Washington State Department of Ecology
EcoSSL	Ecological Soil Screening Level
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
ERA	ecological risk assessment
ERAGS	*Ecological Risk Assessment Guidance for Superfund*
FIR	food intake rate
FS	feasibility study
HI	hazard index
HQ	hazard quotient
IRIS	Integrated Risk Information System
LC50	concentration lethal to 50 percent of exposed population
LOAEC	lowest observed adverse effects concentration
LOAEL	lowest observed adverse effect level
LOEC	lowest observed effect concentration
MATC	maximum acceptable toxicant concentration
MTCA	Model Toxics Control Act

NOAEC	no observed adverse effects concentration
NOAEL	no observed adverse effect level
NOEC	no observed effect concentration
ORNL	Oak Ridge National Laboratory
PAH	polyaromatic hydrocarbon
PNEC	predicted no effect concentration
PRG	preliminary remediation goal
RCBRA	River Corridor Baseline Risk Assessment
RI	remedial investigation
SAP	sampling and analysis plan
SLERA	Screening Level Ecology Risk Assessment
SMDP	scientific management decision point
SSL	soil screening level
TEE	terrestrial ecological evaluation
TRV	toxicity reference value
USACHPPM	U. S. Army Center for Health Promotion and Preventive Medicine
WIR	water ingestion rate

1 Introduction

A framework for derivation of ecological risk-based concentrations in soil for use in remedial investigations (RIs) and feasibility studies (FSs) at the Hanford Site is presented in this document. This framework is intended to be iterative, incorporating additional information as appropriate to improve decision making. This iterative approach is in accordance with the steps outlined in EPA 540-R-97-006, *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments: Interim Final*, hereafter referred to as ERAGS, and the simplified and site-specific ecological evaluations described by the Washington State Department of Ecology (Ecology) in WAC 173-340-7492, "Model Toxics Control Act—Cleanup," "Simplified Terrestrial Ecological Evaluation Procedures," and WAC 173-340-7493, "Model Toxics Control Act—Cleanup," "Site-Specific Terrestrial Ecological Evaluation Procedures." Under both Ecology and U.S. Environmental Protection Agency (EPA) guidance, an initial screening step is performed to identify areas or contaminants that present no unacceptable risks to ecological receptors from those that warrant additional evaluation. Later steps in the ecological risk assessment (ERA) process integrate site-specific data and ecologically more realistic exposure and effects assumptions to provide improved risk estimates. The framework for development of these risk-based concentrations consists of the following progressively more site-specific and biologically realistic tiers:

- **Generic Screening Levels** represent initial, conservative screening values from readily available published literature and agency sources.
- **Tier 1 Values** are also based on agency developed or accepted methods, that have been calculated specifically for bird and mammal species present at the Hanford Site. Sources and derivation of Tier 1 values are presented in this report.
- **Tier 2 Values** represent Hanford Site-specific values. They build on the Tier 1 values but differ in that they incorporate additional Hanford-specific data.
- **Tier 3 Values** represent waste site-specific or location-specific risk-based concentrations. These would be based on data (e.g., bioaccumulation sampling, bioassays, and exposure factors) collected for specific waste sites or locations at the Hanford Site. Tier 3 values have not been developed for any contaminants at this time.

These ecological risk-based concentrations in soil represent values, which are intended to protect a range of receptors from adverse effects, that can be used in *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) RI/FSs. In the CERCLA process, a range of conservative ecotoxicological screening values and benchmarks may be used in an ERA conducted as part of an RI. These values can be used as screening levels for investigation planning; for screening analytical data to identify contaminants of potential ecological concern (COPECs), media, and receptors that require further evaluation; and for evaluating remedial alternatives. As described in this document, these screening values may be further refined with information collected in the RI. Based on the ERA results, an ecological preliminary remediation goal (PRG), that is used in the FS, is identified from these values. PRGs are applied in the detailed evaluation of remedial alternatives in the FS. Based on considerations of the nine criteria in the detailed evaluation of remedial alternatives, the PRGs are refined into final contaminant-specific cleanup levels, using the PRGs as the point of departure (EPA 540-R-98-031, *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*).

1.1 Overview of Ecological Soil Screening Level Selection and/or Derivation

The tiered approach begins with identifying readily available soil screening levels (SSLs) for terrestrial plants, soil invertebrates, birds, and mammals extracted from published regulatory agency and related sources. These SSLs are soil-based analyte concentration values developed with generic, conservative assumptions. Through the tiered approach, these values are then refined as needed with additional literature-derived or site-specific information and using more complex methods to develop screening level values that are more representative of ecological exposure pathways at the Hanford Site. Central to the tiered approach is an iterative process of evaluation and deliberation. The objective of this iterative process is to decide:

- Whether or not a risk-based value in its current form is sufficient for use as a screening level or an ecological PRG to support cleanup decision making
- Whether or not progression to a higher tier of complexity in development of risk-based values would reduce uncertainty and/or increase confidence in the value used for cleanup decision making to warrant the additional effort if the information available at the current tier is determined to be insufficient

The tiered approach is in accordance with guidance developed by the EPA (principally EPA 540-R-97-006 and OSWER Directive 9285.7-55, *Guidance for Developing Ecological Soil Screening Levels*) and the ecological evaluation procedure presented in WAC 173-340-7490 through WAC 173-340-7493 ("Model Toxics Control Act—Cleanup," "Terrestrial Ecological Evaluation Procedures;" "Exclusions from a Terrestrial Ecological Evaluation;" "Simplified Terrestrial Ecological Evaluation Procedures;" and "Site-Specific Terrestrial Ecological Evaluation Procedures"). A primary purpose for this document is to facilitate the evaluation and deliberation process through a presentation of the data, assumptions, and methods used in this tiered approach. The following subsections discuss these various tiers in further detail.

1.1.1 Generic Screening Levels

Generic Screening Levels for plants, soil invertebrates, birds, and mammals are obtained from existing published and accepted sources: EPA (Ecological Soil Screening Levels [EcoSSLs]), Washington State Department of Ecology (Ecological Indicator Soil Concentrations), Oak Ridge National Laboratory (ORNL) Screening-Level Benchmarks, and the U.S. Department of Energy (DOE) Biota Concentration Guides (BCGs). Generic Screening Values are not specific to the Hanford Site; rather, they represent conservative, literature-based screening values. Because of their inherent conservatism, Generic Screening Levels are intended to differentiate between contaminants that clearly present no risk and those for which additional evaluation may be warranted.

Further descriptions of each Generic Screening Level are presented in Chapter 2. These values are most useful for identifying COPECs in an ERA and are not specifically intended for use in making cleanup decisions. However, in the absence of any other ecological risk-based concentrations and based on project-specific factors, decision makers at the Hanford Site (i.e., DOE, EPA, and Ecology) may consider using Generic Screening Levels as ecological PRGs in RI/FSs.

1.1.2 Tier 1 Values

Tier 1 ecological risk-based concentration values are developed to reflect Hanford-specific conditions using information obtained from the literature. Overall guidance for the development of tiered values is the 8-step EPA process presented in ERAGS (EPA 540-R-97-006). Step 3 in the ERAGS (EPA 540-R-97-006) process is the baseline problem formulation, which calls for refinement of initial

screening levels and exposure assumptions and, therefore, supports the development of Tier 1 values. Development of the Tier 1 values also draws on EPA EcoSSL guidance (OSWER Directive 5285.7-55). The process for development of Tier 1 values also is consistent with Ecology's site-specific terrestrial ecological evaluation (TEE) procedure (WAC 173-340-7493). Development of Tier 1 values is discussed in detail in Chapter 3 of this document.

1.1.2.1 Wildlife

Tier 1 values in soil for wildlife were back-calculated from toxicity reference values (TRVs) using a wildlife exposure model. The TRVs used were based on both no and lowest observed adverse effects level (NOAELs and LOAELs). The Tier 1 values were calculated for bird and mammal species found at the Hanford Site. Exposure factors such as food and soil ingestion rates were derived for Hanford-specific wildlife from a review of the literature. Concentrations in food items were calculated with bioaccumulation models drawn primarily from EPA's EcoSSL guidance. Estimating exposures to insectivorous or omnivorous wildlife involved estimating bioaccumulation into soil invertebrates. The standard bioaccumulation models presented in the EcoSSL are based on accumulation of contaminants from soil to earthworms. It should be noted that application of earthworm bioaccumulation models at the Hanford Site introduces uncertainties into the exposure estimates and the resulting Tier 1 values because the soil invertebrate component of the food web at the site is primarily composed of arthropods. This uncertainty is addressed in Tier 2 values for wildlife.

The Tier 1 values for wildlife are more site-specific than the Generic Screening Levels, because they incorporate exposure factors for wildlife species that occur at the Hanford Site. However, bioaccumulation methods used for Tier 1 values, particularly from soil to soil invertebrates, are not Hanford Site-specific and are based on the same methods used for developing EcoSSLs.

1.1.2.2 Plants and Soil Invertebrates

Tier 1 risk-based concentration values for plants and soil invertebrates are not proposed at this time. However, these receptors are identified in the problem formulation (Section 3.1), and a focused review of ecological effects data available in the literature is presented in the exposure and effects assessment (Section 3.2). The review of the literature information suggests that there are substantial uncertainties with attempting to develop Tier 1 values for plants and soil invertebrates based solely on literature. Other lines of evidence should be considered for developing values for plants and soil invertebrates. These other lines of evidence are discussed further in Chapter 5.

1.1.3 Tier 2 Values

The development of Tier 2 values corresponds to exposure and effects assessment conducted as part of a baseline ERA within ERAGS (EPA 540-R-97-006), and reflect OSWER Directive 9285.7-28P, *Ecological Risk Assessment and Management Principles for Superfund Sites*, which encourages the use of site-specific ecological risk data to support cleanup decisions, whenever practicable. The process for development of Tier 2 values also is consistent with Ecology's site-specific TEE procedure (WAC 173-340-7493).

Note that calculated Tier 2 values for wildlife, plants, or soil invertebrates are not included in this document. Because of the complexity involved with data and analyses for Tier 2 values, a separate technical report will be prepared for them.

1.1.3.1 Wildlife

For wildlife, a primary difference between Tier 1 and Tier 2 values would be the use of bioaccumulation models (regressions and bioaccumulation factors [BAFs]) based on data and food chains present at the Hanford Site (e.g., arthropods in soil), rather than bioaccumulation estimated in earthworms.

1.1.3.2 Plants and Soil Invertebrates

For plants and soil invertebrates, Tier 2 values would combine literature-based effects data along with the results from toxicity bioassays conducted in soils from the Hanford Site. Development of Tier 2 values for plants and soil invertebrates would involve development of separate sampling and analysis plans (SAPs) and field sampling plans to support data collection. Some site-specific toxicity testing data for plants and soil invertebrates has been developed as part of the RCBRA (DOE/RL-2007-21). As discussed further in Chapter 5, these data will be evaluated further for use in developing Tier 2 ecological risk-based concentrations for plants and soil invertebrates.

1.1.4 Tier 3 Values

Tier 3 values represent waste site-specific or location-specific PRGs, based on data (e.g., bioaccumulation sampling, bioassays, and exposure factors) collected for specific locations at the Hanford Site. Development of Tier 3 values would involve development of separate SAPs and field sampling plans to support data collection. Tier 3 values would be the most refined and would be developed on an as needed basis to address specific receptor contaminant issues for which existing data are inadequate to reduce uncertainty about residual risks and environmental protection.

1.2 Decision Making Cycles in the Tiered Approach

The tiered approach presented in Figure 1-1 describes a general process for systematic, informed progression to increasingly more biologically realistic and site-specific ecological values for use in RI/FSs. Higher tiers reflect increasing complexity and greater investment of time and resources. Higher tiers also reflect more refined characterization of ecological risks, which may be important in cleanup decision making. Central to the concept of a systematic, informed progression is an iterative process (i.e., cycles) of decision making involving evaluation of existing information, deliberation, data collection, and communication. All of these steps should be focused on the following decisions:

- Whether or not the ecological risk-based concentrations at the current tier are sufficient to support cleanup decision making (a process for exiting the tiered approach is available at each tier)
- Whether or not progression to a higher tier of refinement would reduce uncertainties and/or increase confidence in risk-based concentrations to warrant the additional effort if the information available at the current tier is determined to be insufficient

Key points in the decision making cycles are presented in the following paragraphs.

In general, Generic Screening Levels should not be used as ecological PRGs. However, there should be a decision making cycle to make that specific judgment. In deciding whether a higher tier ecological value should be developed, the following factors should be considered (these factors typically will have been addressed as part of an ERA):

- Comparison between the Generic Screening Level, the background concentration in soil, and other PRGs in soil for protection of human health and groundwater

- Evaluation of the relevance of the assumptions used in the development of the Generic Screening Levels to site conditions
- Consideration of uncertainties with the Generic Screening Levels

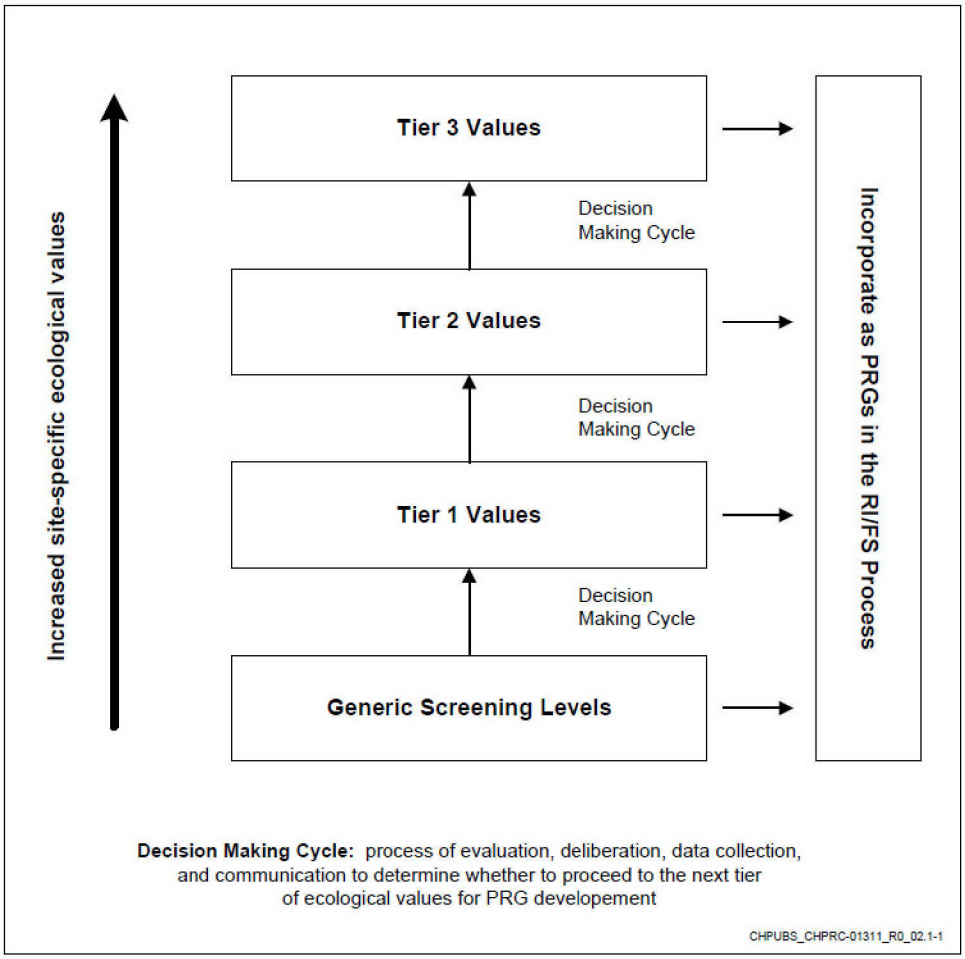

Figure 1-1. Tiered Approach to Ecological PRG Development

Proceeding from a Generic Screening Level to development of Tier 1 and/or Tier 2 values represents a scientific management decision point (SMDP) as defined in ERAGS (EPA 540-R-97-006). In cases where ecological risks are low (i.e., when waste site EPCs are close to or below Generic Screening Levels), where Generic Screening Levels are well above background concentrations in soil, where the investment of time and resources for refining ecological risk-based concentrations may outweigh the costs for cleanup, or for very simple waste sites, Generic Screening Levels may be suitable for use as PRGs. Otherwise, development of ecological risk-based concentrations should proceed to a higher tier because cleanup decision making would benefit from the additional analysis of ecological risk-based concentrations.

Selecting the appropriate value between Tiers 1 and 2 represents another SMDP as defined in ERAGS (EPA 540-R-97-006). The decision making cycle with these values involves determining if there is a need for a more refined ecological value. The question to be addressed in the SMDP is whether or not to proceed with the development and use of the values in the RI/FS process. The same factors discussed previously are considered in determining whether or not to use Tiers 1 and/or 2 values in the RI/FS

process. In addition, uncertainties in the data and assumptions used in developing the SSLs are evaluated to determine whether or not their incorporation introduces greater or lesser uncertainty than in the previous tier. The decision to develop Tier 2 values also takes into consideration the investment of time and resources for planning, field data collection, and analysis of data relative to the costs for proposed remediation based on Generic Screening Levels or Tier 1.

Moving to Tier 3 represents another SMDP and involves performing waste site-specific data collection. As with Tier 2 values, the decision to develop Tier 3 values takes into consideration the investment of time and resources for planning, field data collection, and analysis of data relative to the costs for proposed remediation based on Tiers 1 or 2 values.

2 Identification of Generic Screening Levels

Generic Screening Levels represent conservative screening concentrations in soil that are used as part of a Screening Level Ecological Risk Assessment (SLERA).[1] Within a SLERA, Generic Screening Levels are compared to the maximum concentrations in soil to differentiate between contaminants that clearly present no ecological risk and require no further evaluation, and those contaminants for which additional evaluation may be warranted. This additional evaluation may include exposure point concentration development using alternative statistics, such as the 95% UCL on the average, as described in EPA guidance and in WAC 173-340-740(7)(d)(1) if necessary. Generic Screening Levels are used in this document as the starting point for determining when further refinements in data or methods should be applied to a contaminant within this tiered process for developing ecological risk-based concentrations for use in screening and PRG development at the Hanford Site.

Generic Screening Levels are drawn from readily available values in published sources. For application at the Hanford Site, the following sources are used to obtain Generic Screening Levels:

- EPA EcoSSLs
- Ecology's Ecological Indicator Soil Concentrations, found in Ecology Publication 94-06, *Model Toxics Control Act Cleanup Regulation 173-340 WAC*, Table 749-3
- Screening benchmark concentrations in soil developed by ORNL (many of the Ecological Indicator Soil Concentrations published by Ecology were drawn from ORNL screening benchmark concentrations)
- BCGs for radionuclides that are presented in DOE-STD-1153-2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*

Values have been drawn from these sources for a broad range of chemical and radiological constituents that could be encountered in Hanford Site soils, as shown in Table 6-1. The list of constituents in Table 6-1 was drawn from existing ERAs conducted at the Hanford Site (DOE/RL-2007-21, *Risk Assessment Report for the 100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment*; DOE/RL-2007-50, *Central Plateau Ecological Risk Assessment Data Package Report*; and WMP-20570, *Central Plateau Terrestrial Ecological Risk Assessment Data Quality Objectives Summary Report – Phase I*).

Background concentrations in soil are obtained from multiple sources. Hanford Site background studies have been conducted for several inorganic constituents and radionuclides (DOE/RL-92-24, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*; DOE/RL-96-12, *Hanford Site Background: Part 2, Soil Background for Radionuclides*; and DOE/RL-95-55, *Hanford Site Background: Evaluation of Existing Soil Radionuclide Data*). For analytes without Hanford-specific background, Washington State background concentrations can be found in Ecology Publication 94-115, *Natural Background Soil Metals Concentrations in Washington State*. In addition, background concentrations for selected inorganic analytes can be found in PNNL-18577, *A Review of Metal Concentrations Measured in Surface Soil Samples Collected on and Around the Hanford Site*.

The following sections describe the Generic Screening Levels in further detail.

[1] A SLERA is the first two steps of EPA's eight-step process for ecological risk assessment outlined in EPA 540-R-97-006.

2.1 EPA Ecological Soil Screening Levels

EcoSSLs are values that can be used routinely to identify those contaminants of potential concern in soil requiring further evaluation in a baseline ERA. Although these screening levels were developed to be used specifically during a SLERA for Superfund sites, EPA envisions that any federal, state, or private environmental assessment or cleanup program could use these values to screen soil contaminants and sites in order to determine if additional site-specific ecological study was warranted. EPA cautions that EcoSSLs were not designed to be used as cleanup levels, and EPA emphasizes that it would be inappropriate to adopt or modify these EcoSSLs as cleanup standards (OSWER Directive 9285.7-55).

EcoSSLs were derived using standardized procedures for literature review, toxicity data selection, and data evaluation. Where acceptable data were judged to be adequate, four EcoSSL values were derived for each contaminant: one each for plants, soil invertebrates, birds, and mammals. This overall process for EcoSSL development is documented in EPA standard operating procedures.

Plant and soil invertebrate EcoSSL values were derived directly from an evaluation of selected published plant and soil invertebrate toxicity test data (measured toxic responses to known concentrations of contaminants in soil). The derivation of EcoSSLs for plants and invertabrates is described in Section 2.1.1.

The wildlife EcoSSL values were the result of a back calculation from a hazard quotient (HQ) of 1; the HQ is the ratio of the estimated exposure to an organism from a contaminant in soil and the TRV. An HQ of 1 is the condition where the level of exposure to a contaminant concentration in soil and the target effect levels (e.g., no effect and lowest effect level) are equal, indicating that adverse effects at or below that contaminant concentration meet the target. EPA used a generic food chain model to estimate the relationship between the concentration of the contaminant in soil and the level of exposure in the organism. The derivation of wildlife EcoSSLs is described in Section 2.1.2.

EcoSSLs were not developed for reptiles, amphibians, and soil microbes. EPA concluded that toxicity data for amphibians and reptiles were insufficient for EcoSSL development. While there has been some limited quantitative evaluation of ecological risks to reptiles and amphibians at the Hanford Site (DOE/RL-2007-21 and DOE/RL-2007-50) in general, Hanford Site ERAs will qualitatively address risks to reptiles and amphibians should these be identified as receptors of concern in a problem formulation. While EPA recognized the importance of soil microbial processes in terrestrial ecosystems, the data were believed to be insufficient, and the interpretation of test results was too uncertain for developing values for risk-based screening. Further discussion of soil microbes is presented in EP EcoSSL guidance, Attachment 1-2 (OSWER Directive 9285.7-55).

2.1.1 Derivation of EcoSSLs for Plants and Soil Invertebrates

EcoSSLs for plants and soil invertebrates were derived using data from tests performed within soil conditions favoring relatively high bioavailability for upland soils. The soil chemistry conditions of relatively high bioavailability were defined by low soil pH and organic matter content. From the studies reviewed, the measure of toxic effects to either plants or soil invertebrates were grouped into ecologically relevant endpoints including reproduction, population characteristics, and growth. Toxicity parameters used in deriving the EcoSSLs were the effective concentration affecting 20 percent of a test population (EC20), the maximum acceptable toxicant concentration (MATC), and the effective concentration affecting 10 percent of a test population (EC10). The MATC was calculated by EPA from studies that reported a no observed adverse effects concentration (NOAEC) and a lowest observed adverse effects concentration (LOAEC). The MATC was calculated as the geometric mean of the LOAEC and NOAEC. There was a preference for using “bounded” values; in other words, toxicity studies which reported

toxicity values that bounded both a LOAEC and a NOAEC. Studies reporting unbounded LOAECs or NOAECs were not considered to provide a reliable assessment of the dose-response and were not used by EPA for EcoSSL development. The EcoSSL for plants and soil invertebrates was calculated as the geometric mean of all the toxicity parameters from studies conducted under conditions of high bioavailability. The use of EC20, MATC, and EC10 as toxicity parameters means that EcoSSLs for plants and soil invertebrates are not based on NOAECs, with the exception of the MATC which is derived from the geometric mean of both the NOAEC and LOAEC.

2.1.2 Derivation of EcoSSLs for Wildlife

Wildlife EcoSSLs were developed for two groups of receptors: mammals and birds. As described previously, the wildlife EcoSSL values were the result of a back calculation from an HQ of 1, using the following wildlife risk model:

$$HQ = \frac{Exposure\ (mg/kg\ bw - day)}{TRV\ (mg/kg\ bw - day)}$$

where:

TRV = toxicity reference value

Birds and mammals experience chemical exposure through multiple pathways, including ingestion of abiotic media (surface water and sediment/soil) and biotic media (food), as well as inhalation and dermal contact. To assess this multiple pathway exposure, modeling is often employed. The end product, or exposure estimate, for birds and mammals is a dosage (amount of chemical in milligrams per kilogram receptor body weight [BW] per day [mg/kg/day]) rather than a media concentration, which is the case for the other receptors. Further descriptions of exposure models are presented in Section 3.2.

EcoSSLs for birds and mammals are derived using exposure factors for herbivores (mourning dove and meadow vole), insectivores (American woodcock and short tailed shrew), and carnivores (long tailed weasel and red tailed hawk). The contaminant concentrations in biota types (B_{ij}) composing wildlife diets (plants, soil invertebrates, or small mammals) are estimated assuming the concentration of contaminant "j" in food type "i" could be predicted from the contaminant concentration in soil ($Soil_j$) using bioaccumulation models. Bioaccumulation models were either derived within the EcoSSL process or obtained from existing sources (e.g., ORNL bioaccumulation reports). The following hierarchy of bioaccumulation modeling methods is used by EPA to estimate wildlife EcoSSLs:

- Existing regression equations are from ES/ER/TM-220, *Development and Validation of Bioaccumulation Models for Earthworms*; ES/ER/TM-219, *Development and Validation of Bioaccumulation Models for Small Mammals*; and BJR/OR-133, *Empirical Models for the Uptake of Inorganic Chemicals from Soil by Plants*.
- New regression equations were developed specifically for the EcoSSL using paired soil biota concentration data; new regression equations were developed if regressions were not available from the literature.
- BAFs were identified from the literature or estimated from paired soil biota concentration data if suitable regressions were not available.
- BAFs were estimated using modeling if BAFs were not available from the literature or measured data.

- For instances where data were not available to complete any of the previously listed options in the hierarchy, it was necessary to make assumptions concerning the bioaccumulation of contaminants for soil into biota types; this method was used very infrequently for developing EcoSSLs.

The wildlife TRV used in the development of EcoSSLs is defined as:

> *Dose above which ecologically relevant effects might occur to wildlife species following chronic dietary exposure and below which it is reasonably expected that such effects will not occur.*

As described in EPA guidance, literature was reviewed to select TRVs appropriate for calculating wildlife EcoSSLs. The primary objective of the literature review was to identify the following values:

- A no observed adverse effect level (NOAEL), which is the highest dose that does not cause a statistically significant adverse effect.
- A lowest observed adverse effect level (LOAEL), which is the lowest dose that caused a statistically significant adverse effect.

The TRV was calculated as the geometric mean of NOAELs for growth and reproduction effects. In cases where the geometric mean NOAEL was higher than the lowest bounded LOAEL (bounded refers to a LOAEL that has a paired NOAEL), the TRV was set at the highest bounded NOAEL below the lowest bounded LOAEL.

Finally, the lowest EcoSSL among the bird and mammal species of these trophic groups was selected as the final bird and mammal EcoSSLs published by EPA.

2.2 ORNL Ecotoxicological Screening Benchmarks

ORNL ecotoxicological screening benchmarks have been developed or obtained for the following types of exposure and classes of endpoint groups:

- Exposure of aquatic biota to chemicals in water (ES/ER/TM-96/R2, *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota at Oak Ridge Reservation: 1996 Revision*)
- Exposure of benthic biota to chemicals in sediments (ES/ER/TM-95/R4, *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Sediment-Associated Biota: 1997 Revision*)
- Exposure of terrestrial plants to chemicals in soil (ES/ER/TM-85/R3, *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Terrestrial Plants: 1995 Revision*)
- Exposure of soil invertebrates to chemicals in soil (ES/ER/TM-126/R2, *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision*)
- Exposure of wildlife to chemicals in orally ingested materials (ES/ER-TM-86/R3, *Toxicological Benchmarks for Wildlife: 1996 Revision*)

Only the benchmark values for plants and soil invertebrates have been used in this document for the development of ecological PRGs at the Hanford Site. The following overview of the ORNL benchmarks is drawn from ORNL/TM-13615, *A Guide to the ORNL Ecotoxicological Screening Benchmarks: Background, Development and Application.*

The ORNL ecotoxicological screening benchmarks are concentrations of chemicals in ambient media that are believed to represent acceptable concentrations with respect to selected ecological receptors. In general, if the benchmark concentrations are not exceeded, further analysis of that contaminant and ecological receptor is not warranted. The intended purpose of the ORNL ecotoxicological benchmarks is to screen chemical concentrations in environmental media to identify chemicals that are present at a sufficiently high concentration to present a potential risk to ecological receptors. These COPECs require further assessment to determine whether they do in fact pose significant risks.

The ORNL ecotoxicological benchmarks should not be used as remedial goals or as concentrations that pose significant risks. Rather, risk estimates for the chemicals of potential ecological concern and remedial goals for the chemicals of ecological concern (i.e., chemicals that are estimated to pose a significant risk) should be based on a weighing of the available evidence, including any site-specific toxicity tests or biological surveys. Even if the risk estimates and remedial goals are based solely on conventional, single chemical toxicity data, the ORNL benchmarks should not be automatically adopted as thresholds for significant risk. Rather, the risk assessors should return to the primary literature to determine what studies and data are most relevant to their site and assessment endpoints.

Noteworthy limitations identified with the benchmarks include their reliance on laboratory toxicity testing data and the use of models to extrapolate from toxicity testing endpoints to ERA endpoints. The benchmarks rely on single chemical toxicity testing data and do not incorporate potential effects from exposure to multiple contaminants. The guidelines for their use state a default assumption additivity of toxic effects; however, it becomes necessary to define a lower limit for significant contribution of a chemical to combined toxicity. Because the benchmarks are based on conventional laboratory toxicity data, their relationship to field exposures is uncertain. In particular, laboratory tests are generally designed to expose organisms to highly bioavailable and toxic forms of the test chemical under conditions that maximize exposure. For example, soil toxicity tests are usually performed with soluble forms of chemicals, and the tests are performed without aging the soil to allow for sequestration of the chemical. In general, these considerations mean that the benchmarks are conservative because the bioavailability and toxicity of the chemical in the field are generally lower than in the laboratory (ORNL/TM-13615).

The ORNL benchmarks for the toxicity to plants from chemical contaminants in soil were based on thresholds for effects on growth and reproduction derived from published toxicity studies conducted in soil or solution. The benchmarks are concentrations of chemicals that correspond to the lowest observed effect concentration (LOEC) for the 10th percentile of plant species tested. The ORNL benchmarks for toxicity to soil invertebrates and heterotrophic processes from chemical contaminants in soil represent thresholds (LOECs) for statistically significant effects on growth, reproduction, or activity. The toxicity benchmarks were derived by rank ordering the LOEC values, then selecting a value that approximated the 10th percentile. If 10 or fewer values were available for a chemical, the lowest LOEC was used. If the 10th percentile fell between LOEC values, a value was chosen by interpolation. If a chemical concentration in soil represented a 50 percent or higher reduction in survivorship of plants, the concentration was divided by 5 to approximate the more sensitive endpoints of growth or production.

2.3 Ecological Indicator Soil Concentrations

Ecology has developed Ecological Indicator Soil Concentrations for protection of terrestrial plants and animals as part of the TEE procedures presented in the Model Toxic Control Act (MTCA) regulations for the cleanup of contaminated sites (WAC-173-340-7490 through 7493). The TEE defines the following goals and procedures:

- Determining whether a release of hazardous substances to soil may pose a threat to the terrestrial environment
- Characterizing existing or potential threats to terrestrial plants or animals exposed to hazardous substances in soil
- Establishing site-specific cleanup standards for the protection of terrestrial plants and animals

The Ecological Indicator Soil Concentrations presented in Ecology Publication 94-6, Table 749-3, represent soil concentrations that are expected to be protective at any MTCA site and are provided for use in eliminating hazardous substances from further consideration under WAC 173-340-7493(2)(a)(i). The Ecological Indicator Soil Concentrations for plants are predominantly based on plant benchmarks published in ORNL's ES/ER/TM-85/R3. The Ecological Indicator Soil Concentrations for soil biota are based on soil invertebrate benchmarks published in ORNL's ES/ER/TM-126/R2. Ecological Indicator Soil Concentrations for wildlife represent the lowest value calculated using an exposure model with assumptions for a vole (mammalian herbivore), American robin (avian insectivore), or shrew (mammalian insectivore). The exposure model and exposure factors for these wildlife receptors are presented in Table 749-4 in the WAC. BAFs and TRVs used in calculating the wildlife values are presented in WAC Table 749-5. However, Tables 749-4 and 749-5 in the *Washington Administrative Code* requirements do not provide the citations for the exposure factors, BAFs, or TRVs, so Ecological Indicator Soil Concentrations for wildlife are not readily comparable with wildlife EcoSSLs.

Where Ecological Indicator Soil Concentrations values are exceeded, the following options are provided for demonstrating that the hazardous substance does not pose a threat to ecological receptors at a site, or for developing site-specific remedial standards for eliminating threats to ecological receptors:

- WAC 173-340-7493(1)(c)—Conduct a site-specific TEE (steps presented in this document, for risk-based Tier 1, 2, or 3 values that can be used in PRG development, conform with the procedures of a site-specific TTE).
- WAC 173-340-7493(2)(a)(ii)—Identify any complete potential pathways for exposure of plants or animals to the chemicals of concern (the problem formulation presented in this document conforms with the procedure for identifying complete ecological exposure pathways).
- WAC 173-340-7493(3)—If it is determined during the problem formulation step that further evaluation is necessary, the soil concentrations listed in Table 749-3 may be used as the cleanup level at the discretion of the person conducting the evaluation. Alternatively, one or more of several TEE methods identified in the TEE procedures may be used. The following alternative TEE methods are being applied to the development of ecological risk-based concentrations in soil for use in identifying risk-based concentrations appropriate for use at the Hanford Site:
  - Literature survey
  - Soil bioassays
  - Wildlife exposure model
  - Weight of evidence

2.3.1 Literature Survey

Under WAC 173-340-7493(3)(a), an analysis based on a literature survey can be conducted for the purposes of developing a soil concentration for chemicals not listed in Table 749-3, identifying a soil concentration for the protection of plants or soil biota more relevant to site-specific conditions than the value listed in Table 749-3, or obtaining a value for any of the wildlife exposure model variables listed in

Table 749-5 to calculate a soil concentration for protection of wildlife more relevant to site-specific conditions than the values listed in Table 749-3. As described in WAC 173-340-7493(4), TRVs or soil concentrations established from the literature will represent the lowest relevant LOAEL found in the literature. DOE recognizes that the TRVs used are from data used by EPA in the development of EcoSSLs. For chemicals for which EPA did not develop an EcoSSL, the lowest LOAEL TRVs for population level endpoints were selected. DOE has been able to confirm that sensitive species have been used to develop the LOAEL-based PRGs and that these substitute receptor species are sufficiently protective of the wildlife in the region, including sensitive species. BAF values will represent a reasonable maximum value from relevant information found in the literature. In assessing relevance, the following principles will be considered:

- Literature benchmark values should be obtained from studies that have test conditions as similar as possible to site conditions.
- The literature benchmark values or TRVs should correspond to the exposure route being assessed.
- The TRV or BAF value will be as appropriate as possible for the receptor being assessed. The TRV should be based on a significant endpoint.
- The literature benchmark value or TRV should preferably be based on chronic exposure.
- The literature benchmark value, TRV, or BAF should preferably correspond to the chemical form being assessed. Exceptions may apply for TRVs where documented biological transformations occur following uptake of the chemical or where chemical transformations are known to occur in the environment under conditions appropriate to the site.

2.3.2 Soil Bioassays

Under WAC 173-340-7493(3)(b)(ii), soil concentrations protective of soil biota or plants may also be established with soil bioassays that use species ecologically relevant to the site rather than standard test species. Species that do or could occur at the site are considered ecologically relevant. Soil bioassays would be used to develop site-specific, ecological risk-based concentrations or make site-specific cleanup decisions under Tier 3.

2.3.3 Wildlife Exposure Model

Equations and exposure parameters used in calculating soil concentrations protective of terrestrial wildlife (Tables 749-3, 749-4, and 749-5). Under WAC 173-340-7493(3)(c), changes to this model may be approved by the department under the following conditions:

- Alternative values for parameters listed in Table 749-5 may be used if they can be demonstrated to be more relevant to site-specific conditions (e.g., the value is based on a chemical form of a hazardous substance actually present at the site). An alternative value obtained from the literature will be supported by a literature survey.
- Receptor species of concern or exposure pathways identified in the problem formulation step may be added to the model if appropriate on a site-specific basis.
- A substitution for one or more of the receptor species listed in Table 749-4 may be made if there is scientifically supportable evidence that a receptor identified in Table 749-4 is not characteristic or a reasonable surrogate for a receptor that is characteristic of the ecoregion where the site is located (WAC 173-340-7493(7)).

2.3.4 Weight of Evidence

As described in WAC 173-340-7493(f), a weight of evidence approach will include a balance in the application of literature, field, and laboratory data, recognizing that each has particular strengths and weaknesses. Site-specific data will be given greater weight than default values or assumptions where appropriate. Hanford Site-specific approaches include the calculation of wildlife values, based on receptor species found at the Hanford Site as part of Tier 1 and 2 values, and the use of soil bioassay results to develop risk-based values or assess risks for plants and soil invertebrates as part of Tiers 2 and 3 values.

2.4 Biota Concentration Guides for Radionuclides

Two radionuclide effect thresholds, as determined by consensus of international radiation regulatory agencies, form the basis for effect thresholds used to develop screening levels of radionuclides in soil for protection of plants and animals. General guidance from ICRP-60, *Recommendations of the International Commission on Radiological Protection*; IAEA 332, *Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards*; and *Sources and Effects of Ionizing Radiation* (UNSCEAR, 2000) concluded that radiological doses to aquatic animals (including vertebrates and invertebrates) and to terrestrial plants and terrestrial animals (invertebrates and vertebrates) should not exceed 1.0 rad/day for terrestrial plants and 0.1rad/day for terrestrial animals, respectively. Provided that radiation exposure does not exceed these biota dose levels, the consensus opinion of the international radiological organizations is that ecological populations will be protected. DOE has adopted these effect thresholds and integrated them into the graded approach (DOE-STD-1153-2002).

The DOE graded approach includes a screening method and the following more detailed levels of analysis for demonstrating compliance with applicable dose limits for protection of biota:

- A general screening involves comparing maximum radionuclide concentrations in environmental media (i.e., soil) with a set of BCGs to evaluate compliance with the biota dose limits.
- Site-specific screening involves more realistic site representative grouped parameters (e.g., BAFs) in place of conservative default parameters, using mean radionuclide concentrations in place of maximum values, and taking into account time dependence and spatial extent of contamination.
- Site-specific analysis employs a kinetic allometric modeling methodology. Multiple parameters that represent contribution to an organism's internal dose can be modified to represent site and organism-specific characteristics. These parameters include body mass, consumption rates of food or soil, inhalation rate, lifespan, and biological elimination rates. Development of the organism-specific characteristics involve using allometric equations that relate these parameters to body mass.
- Site-specific biota dose assessment involves the collection and analysis of biota samples.

The BCGs for terrestrial plants and animals represent Generic Screening Levels for radionuclides in soil for assessing ecological risks at the Hanford Site. The BCGs for radionuclides use conservative assumptions for internal and external exposure. While existing effects data support the application of these dose limits to representative individuals within populations of plants and animals, the assumptions and parameters applied in the derivation of the BCGs are based on a maximally exposed individual, representing a conservative approach for screening purposes. The following assumptions are used for estimating doses from external exposure for purposes of developing BCGs:

- The source medium is infinite in extent and contains uniform concentrations of radionuclides (i.e., there are no hot spots).

- The exposed organism is very small; consequently, 100 percent of the radionuclide energies are absorbed.
- Organisms exposed to soil are uniformly surrounded by the source medium.

The following assumptions are used to estimate doses from internal exposure for the purpose of developing BCGs:

- All radionuclide decay energies are retained in tissue (100 percent of energies absorbed).
- Exposure for a given radionuclide includes all decay chain progeny.
- All radionuclides are uniformly distributed such that all target tissues may be affected.

BCGs can be calculated using dose models, equations, and default parameters that are presented in DOE-STD-1153-2002. The soil values that were calculated using these default methods are found in Table 6-4 of DOE-STD-1153-2002. These dose models, equations, and default parameters are also incorporated using DOE/EH-0676, *RESRAD-BIOTA: A Tool for Implementing a Graded Approach to Biota Dose Evaluation, User's Guide, Version 1*), which presents three levels of analysis corresponding to the following levels in the graded approach:

- Level 1—General screening approach
- Level 2—Site-specific screening with representative parameters
- Level 3—Site-specific analysis using the kinetic allometric modeling methodology

The BCGs presented in Table 6-1 were calculated using the Level 1 analysis in DOE/EH-0676.

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3 Development of Tier 1 Values

This chapter presents a description of the methodology used to develop the Tier 1 values. The Tier 1 values reflect the level of refinement associated with the baseline problem formulation step in the ERAGS process (EPA 540-R-97-006).

3.1 Problem Formulation

The problem formulation includes a general description of the Hanford Site setting, identification of COPECs, identification of the important aspects of the site to be protected (referred to as assessment endpoints), the means by which the assessment endpoints are evaluated (measures of exposure and effects), and previous site investigations. The end product of the problem formulation is a conceptual site model (CSM) that describes the contaminant sources and transport mechanisms, evaluates potential exposure pathways, and identifies the representative species that were used to assess ecological risk to those and other similar species. The following subsections summarize the information relevant to the development of Tier 1 concentration values.

3.1.1 Simplified Ecological Exposure Model

Development of the ecological exposure model involves characterizing the exposure pathways and ecological receptors that might be associated with the habitat types in the upland portions of the Hanford Site. Appropriate exposure pathways and representative endpoint species for the upland portions of the Hanford Site were developed based on information developed from previously conducted ERAs. Primary sources of information used in the development of the ecological exposure model include DOE/RL-2007-50, WMP-20570, and DOE/RL-2007-21.

With consideration of the ecological setting, land use, and COPEC release mechanisms known at Hanford Site upland areas, the following ecological exposure pathways considered the most plausible are graphically displayed in Figure 3-1:

- Potential current and future direct contact of vegetation with constituents in surface soil (less than 4.6 m [15 ft]) below ground surface as defined by the Standard Point of Compliance in Ecology Publication 94-06
- Potential current or future direct contact with, or ingestion of, surface soil by terrestrial invertebrates (e.g., beetles and ants)
- Direct contact with, or ingestion of, surface soil by terrestrial avian and mammalian wildlife
- Dietary exposure to COPECs bioaccumulated in food items (e.g., plants or prey) and subsequently consumed by terrestrial avian and mammalian wildlife
- Exposure to emissions from radionuclides bioaccumulated and retained within the tissues of plants, terrestrial invertebrates, and terrestrial wildlife
- External exposure of plants, terrestrial invertebrates, and terrestrial wildlife to emissions from radionuclides in soil

3.1.2 Assessment Endpoints

Assessment endpoints are an expression of the important ecological values that are to be protected at a site (Suter, 1993, *Ecological Risk Assessment*; EPA/630/R-95/002F, *Guidelines for Ecological Risk Assessment*; Suter et al., 2000, *Ecological Risk Assessment for Contaminated Sites*). Assessment endpoints are based on known information concerning the contaminants present, the study area, the

ecological CSM, and risk hypotheses. There are three components to each assessment endpoint: an entity (e.g., migratory birds), an attribute of that entity (e.g., individual survival), and a measure (e.g., a measurable value, such as an effect level). Measures are described following the general description of assessment endpoints (EPA/630/R-95/002F; Suter et al., 2000).

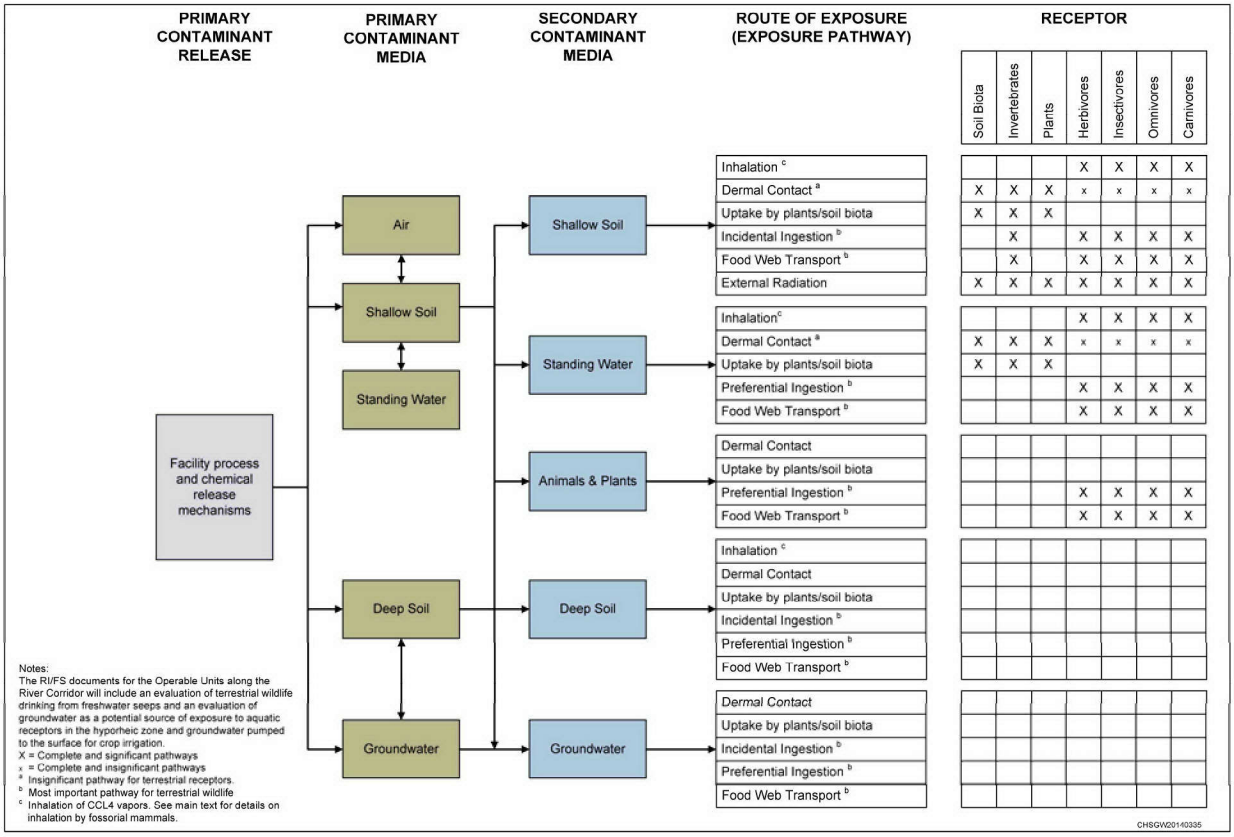

Figure 3-1. Conceptual Ecological Exposure Model for Hanford Site Terrestrial Habitats

The assessment endpoint entities for the Hanford Site were selected based on the following principal criteria:

- Ecological relevance
- Societal relevance
- Susceptibility (or high exposure) to known or potential stressors at the Hanford Site

The attribute selected for each entity was based on the organizational level of the entity and the primary criteria that were used to select it. Entities and attributes were selected for community and population levels of assessment. The maximum acceptable adverse effect levels generally selected for population level and community level assessment endpoints are LOECs or LOAELs (Efroymson et al., 1998). For

some assessment endpoints such as threatened and endangered species, there is no acceptable adverse effect level; consequently, NOECs or NOAELs would be used for these endpoints.[2]

A food web model for the terrestrial portion of the Hanford Site (Figure 3-2) has been developed based upon an understanding of the ecology of the area and documented in WMP-20570.

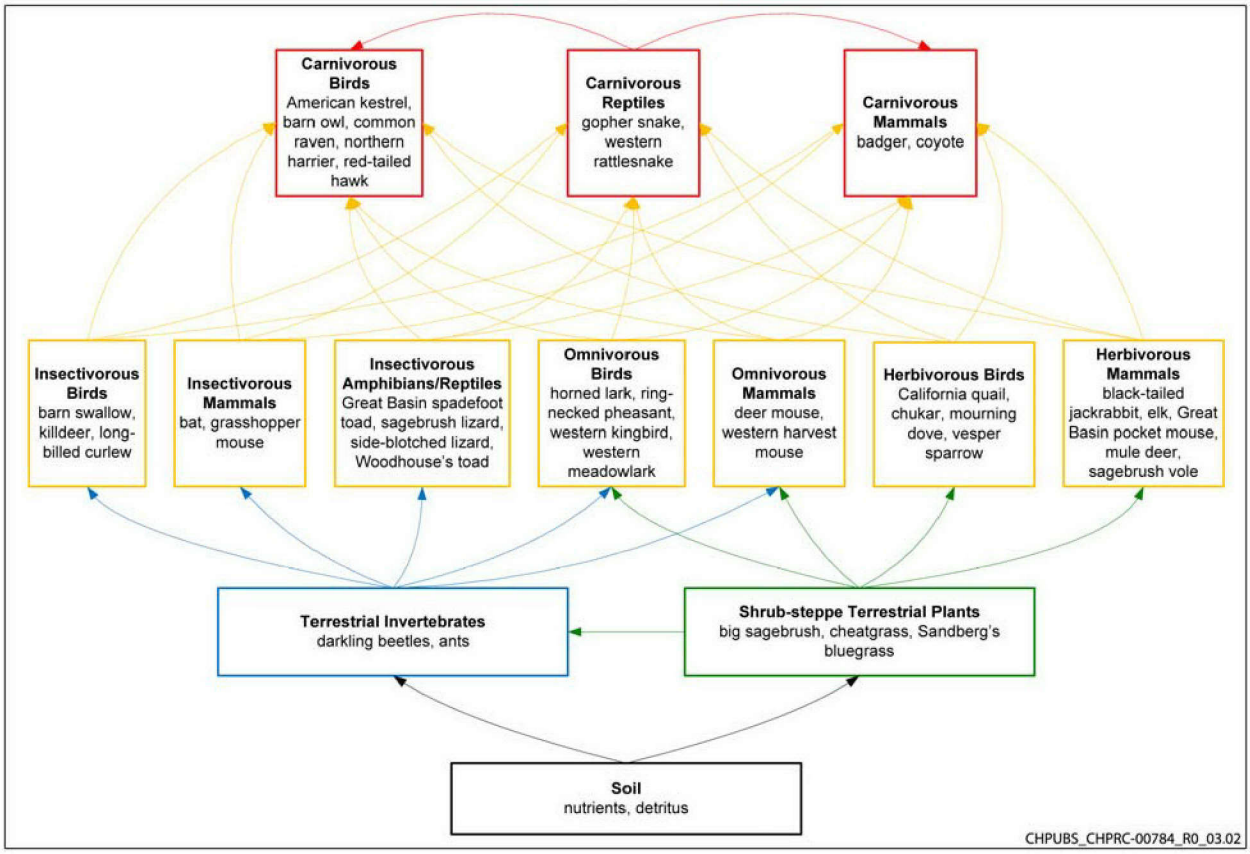

Figure 3-2. Hanford Site Terrestrial Food Web

Previous investigations have identified the following entities (represented by trophic guilds), and their associated organizational level, for consideration during ERAs within the terrestrial portion of the Hanford Site:

- Terrestrial plants—community level
- Terrestrial invertebrates—community level
- Herbivorous birds—population level
- Herbivorous mammals—population level
- Insectivorous birds—population level
- Insectivorous mammals—population level
- Omnivorous birds—population level
- Omnivorous mammals—population level

[2] Presence of federal or state listed endangered or threatened species should be evaluated on a project-specific basis. When they are suspected or known to be present, PRGs that afford greater protection (e.g., NOAEL or NOEC based) may be needed.

- Carnivorous birds—population level
- Carnivorous mammals—population level
- Reptiles[3]

To calculate Tier 1 values, endpoint species representative of functional groups that could use the site were identified. For example, a red-tailed hawk may be considered representative of raptors visiting the site. Consistent with EPA 540-R-97-006, EPA/630/R-95/002F, and WAC 173-340-7493, endpoint species should preferably be ones that have ecological relevance, are of societal value, are susceptible to chemical stressors at the site, and allow risk managers to meet policy goals. These factors were used to select representative receptor species common to the terrestrial portion of the Hanford Site that are within the described trophic guilds. The representative receptor species selected for each of the trophic guilds are as follows:

- Herbivorous birds—California quail (*Callipepla californica*)
- Herbivorous mammals—Great Basin pocket mouse (*Perognathus parvus*)
- Insectivorous birds—killdeer (*Charadrius vociferus*)
- Insectivorous mammals—northern grasshopper mouse (*Onychomys leucogaster*)
- Omnivorous birds—western meadowlark (*Sturnella neglecta*)
- Omnivorous mammals—deer mouse (*Peromyscus maniculatus*)
- Carnivorous birds (raptors)—red-tailed hawk (*Buteo jamaicensis*)
- Carnivorous mammals—badger (*Taxidea taxus*)

Individual species for terrestrial vegetation and invertebrates are not selected for evaluation.

3.1.3 Measures of Exposure and Effects

Measures (formerly referred to as measurement endpoints) are measurable attributes used to evaluate the risk hypotheses and are predictive of effects on the assessment endpoints (EPA/630/R-95/002F). The three categories of measures include the following:

- Measures of exposure are used to evaluate intake of a contaminant from contact with environmental media (e.g., soil). Measures of exposure can be an EPC of a COPEC in an environmental medium or food item. A measure of exposure also can be a dose occurring through ingestion, inhalation, or dermal contact with a contaminant in an environmental medium. Risk-based concentrations are estimated by back-calculating from a target dose associated with the selected assessment endpoint to a corresponding concentration in soil (see Section 3.2 for further discussion).

- Measures of effect are used to evaluate the response of an organism that is exposed to a stressor. Measures of effects include TRVs for wildlife and LOECs in soil for plants and soil invertebrates.

- Measures of ecosystem and receptor characteristics are used to evaluate the ecosystem characteristics that influence the assessment endpoints, the distribution of stressors, and the characteristics of the assessment endpoints that may affect exposure or response to the stressor. Measures of ecosystem and receptor characteristics are also used to characterize ecological risks as part of a baseline ERA. These kinds of ecological information are not used directly in calculations of risk-based concentrations. However, measures of ecosystem and receptor characteristics may represent additional lines of

[3] Although part of the terrestrial food web for the Hanford Site, effects data for reptiles and amphibians are not sufficient for the purpose of developing soil screening levels.

evidence used along with risk-based concentrations or PRGs in evaluating remedial alternatives in an RI/FS.

3.2 Exposure and Effects Analysis

The exposure assessment identifies exposure pathways associated with the representative receptor species listed in Section 3.1.2. It also describes the models used to calculate risk-based concentrations.
The effects assessment presents TRVs that have been derived from available literature-based toxicity information on COPECs for use in determining potential adverse effects for ecological receptors.
The TRVs are combined with the exposure information, described in the following subsections, to calculate Tier 1 values.

3.2.1 Exposure Characterization

The exposure characterization describes the exposure models and assumptions for each representative receptor species.

3.2.1.1 Chemical Exposure of Terrestrial Plants and Soil Invertebrates

Terrestrial plants and soil invertebrates experience exposure primarily through the soil in which they live. This exposure occurs as a consequence of living in a contaminated medium (i.e., receptors are directly exposed to COPECs). Although other exposure pathways (e.g., dietary exposure for invertebrates or foliar uptake) may contribute to total exposure for these receptors, exposure through the soil predominates. Consequently, estimates of exposure for terrestrial plants and soil invertebrates are represented directly by the concentration of COPECs in the soil (mg/kg).

3.2.1.2 Chemical Exposure of Birds and Mammals

Birds and mammals experience chemical exposure through multiple pathways, including ingestion of surface water, sediment/soil, and biotic media (food), in addition to inhalation and dermal contact. To assess this multiple pathway exposure, modeling can be or is often employed. The end product, or exposure estimate, for birds and mammals is a dosage (amount of chemical in milligrams per kilogram receptor BW per day [mg/kg/day]). The general form of the model used to estimate exposure of birds and mammals to chemicals in environmental media is as follows (Suter et al., 2000):

$$E_t = E_o + E_d + E_i$$

where:

E_t = total chemical exposure experienced by wildlife

E_o = oral exposure

E_d = dermal exposure

E_i = inhalation exposure

Oral exposure occurs through the consumption of contaminated food, water, or sediment/soil; dermal exposure occurs when contaminants are absorbed directly through the skin; and inhalation exposure occurs when volatile compounds or fine particulates are inhaled into the lungs. Although methods are available for assessing dermal exposure to humans (EPA/600/8-91/011B, *Dermal Exposure Assessment: Principles and Applications*), data necessary to estimate dermal exposure generally are not available for wildlife (EPA/600/R-93/187, *Wildlife Exposure Factors Handbook*).

Similarly, methods and data necessary to estimate wildlife inhalation exposures are poorly developed (EPA/600/R-93/187) or limited.[4] Recent publications have suggested the inclusion of inhalation and dermal pathways for developing TRVs for VOCs in fossorial mammals ("Efforts to Standardize Wildlife Toxicity Values Remain Unrealized," [Mayfield and Fairbrother, 2012]; "Wildlife Ecological Screening Levels for Inhalation of Volatile Organic Chemicals" [Gallegos et al., 2007]); and pesticides in birds ("A Comprehensive Re-Analysis of Pesticide Dermal Toxicity in Birds and Comparison with the Rat" [Mineau, 2012]), respectively. Olfactory bulb uptake in fossorial mammals affords a significant exposure route to Mn and Cd in soils was noted in "Olfactory Bulb Intake and Determination of Biotransfer Factors in the California Ground Squirrel (*Spermophilus Beecheyi*) Exposed to Manganese and Cadmium in Environmental Habitats," (Bench et al., 2001). However, at most waste sites at Hanford, VOCs and pesticides were not the primary COPECs identified in past investigations and methods for olfactory exposure and risk characaterization are not well established.Additionally, a wildlife receptor's exposure to contaminants by inhalation and dermal contact usually contributes little to its overall exposure (OSWER Directive 9285.7-55). Dermal exposure also is likely to be low, even in burrow dwelling animals, because of the presence of protective dermal layers (e.g., feathers, fur, or scales). Therefore, for the purposes of developing these Tier 1 concentration values, both dermal and inhalation exposure were assumed to be negligible.[5]

Total chemical exposure experienced by wildlife (E_t) is assumed to be equal to oral exposure (E_o). By replacing E_o with a generalized exposure model modified from Suter et al., 2000, the previous equation was rewritten as follows:

$$E_t = \left[\left[\sum_{i=1}^{n} B_{ij} \times P_i \times FIR\right] + \left[Soil_j \times P_s \times FIR\right] + \left[Water_j \times WIR\right]\right] x\, AUF$$

where:

E_t	=	total exposure (mg/kg/day)
$Soil_j$	=	chemical concentration in soil (mg/kg dry weight)
P_s	=	proportion of total food intake that is soil (kg soil/kg food)
FIR	=	food intake rate (kg food/kg BW/day, dry weight)
B_{ij}	=	chemical concentration in biota type (i) (mg/kg, dry weight)
P_i	=	proportion of biota type (i) in diet (unitless)
$Water_j$	=	chemical concentration in water (mg/L)
WIR	=	water ingestion rate (L water/kg BW/day)
AUF	=	area use factor (area of site/home range of receptor) (unitless)

The focus of this document is the development of ecological risk-based concentrations for upland environments and terrestrial organisms. Therefore, exposure pathways associated with water are not

[4] For assessing inhalation exposures, some data for mammals are available through the IRIS database, and a limited set of inhalation benchmarks for wildlife have been developed (Gallegos et al., 2007, "Wildlife Ecological Screening Levels for Inhalation of Volatile Organic Chemicals").

[5] If the CSM indicates that volatile organic compounds are a significant COPEC, focused analyses of the inhalation pathway may be warranted. Risk-based concentrations or PRGs for this pathway, however, are beyond the scope of this report.

addressed here. Large mammalian wildlife using the upland areas do move down to the Columbia River riparian area and drink from the freshwater seeps and from the Columbia River. Bats and birds frequenting or residing in these areas also can use the seeps along the Columbia River to meet their daily needs. A semi-quantitative evaluation of the ingestion of seep water was performed and is discussed with the risk characterization for the River Corridor Operable Units. Should risk-based concentrations or PRGs be required for riparian or near shore environments along the River Corridor (DOE/RL-2007-21), development of these values will be addressed in a separate document[12]. Additionally, 100 percent site use was assumed for calculation of Tier 1 concentration values resulting in an AUF of 1. The remaining parameters and assumptions for the exposure model consist of wildlife exposure parameters and bioaccumulation models, which are provided in the following subsections.

Wildlife Exposure Parameters. Species-specific exposure parameters are required to estimate exposure. These include BW, food intake rate (FIR), diet composition, and percent of diet as incidental soil ingestion. The following assumptions are part of the calculation of wildlife exposures:

- Incidental soil ingestion is not included as part of the total dietary composition, but instead is added to the total; for calculation purposes, it is treated as a percentage in addition to total dietary intake.
- All animals are assumed to be year-round residents, and migration away from areas contaminated with COPECs is not assumed to occur.
- Bioavailability of chemical constituents is assumed to be equivalent to the chemical form used for developing TRVs in the toxicity studies.

The exposure parameters and source references used for each representative receptor species are summarized in Tables 6-2 and 6-3. All weight-based exposure parameters are listed on a dry weight basis. Species-specific biological information was unavailable for some parameters. When this occurred, allometric equations that express general biological relationships for broader classes of animals were used to estimate the exposure parameters (Nagy, 2001, "Food Requirements of Wild Animals: Predictive Equations for Free-living Mammals, Reptiles, and Birds"). These allometric conversions are discussed in the following subsection.

The daily FIRs, in grams of food consumed per day, were either derived from literature sources (California quail and red-tailed hawk) or were estimated using trophic group-specific or taxa-specific allometric equations provided by Nagy, 2001, as follows:

$$\text{Omnivorous birds (g/day)} = 0.670 * BW^{0.627} \text{ (used for western meadowlark)}$$

$$\text{Charadriiformes (g/day)} = 0.522 * BW^{0.769} \text{ (used for killdeer)}$$

$$\text{Granivorous mammals (g/day)} = 0.659 * BW^{0.413} \text{ (used for Great Basin pocket mouse)}$$

$$\text{Omnivorous mammals (g/day)} = 0.432 * BW^{0.678} \text{ (used for deer mouse)}$$

$$\text{Insectivorous mammals (g/day)} = 0.373 * BW^{0.622} \text{ (used for grasshopper mouse)}$$

$$\text{Carnivorous mammals (g/day)} = 0.153 * BW^{0.834} \text{ (used for badger)}$$

[12] The RI/FS reports for the River Corridor Operable units present sediment PRGs that are consistent with values used in both the RCBRA (DOE/RL-21, 2007) and the *Columbia River Component Risk Assessment: Volume 1 Ecological Risk Assessment* (DOE/RL-2010-117) and represent the values porposed as state freshwater sediment cleanup values and presented in *Development of Benthic SQVs for Freshwater Sediments in Washington, Oregon, and Idaho* (Ecology Publication 11-09-054, 2011).

where:

BW = median body weight (g) based on data summarized in Table 6-3

The FIRs are then normalized to BW by converting to kilograms of food per kilogram of BW per day for the calculation of Tier 1 values. Red-tailed hawk and California quail FIRs represent the high-end estimate derived in EPA/600/R-93/187 as referenced in Table 6-2.

Estimation of Bioaccumulation into Food Items. The concentrations of COPECs in the food items were estimated rather than measured. For the purposes of exposure estimation, partitioning of constituents from environmental media to prey was estimated from literature values and models. The models presented in the EPA EcoSSLs methodology (OSWER Directive 9285.7-55) were used preferentially for estimation of bioaccumulation into biota from soil. Consistent with the approach employed for the EcoSSLs, regression-based models (if available) and median BAFs from the source selected by EPA were used. In the absence of applicable bioaccumulation models, a default value of 1 was assumed (as in the case of boron uptake to small mammals). In all cases, it was assumed that tissue uptake occurs under steady state conditions.

Available literature indicates that bioaccumulation is generally nonlinear and often decreases as the medium concentration increases (Sample et al., 1999, "Literature-Derived Bioaccumulation Models for Earthworms: Development and Validation"). This information is available in recent literature for several polyaromatic hydrocarbons (PAHs), metals, and Aroclors (BJR/OR-133, ES/ER/TM-219, and ES/ER/TM-220). Log linear bioaccumulation regression models were used to estimate the uptake of inorganics, as follows, when recommended in the EPA EcoSSL methodology (OSWER Directive 9285.7-55) and the original references:

$$\ln\left(Conc.COPEC_{prey}\right) = \left[B0 + B1\left(\ln\left[Conc.COPECsoil\right]\right)\right]$$

where:

$Conc.COPEC_{prey}$ = concentration of chemical in prey (mg/kg dry weight)

$B0$ = slope

$B1$ = intercept

$Conc.COPEC_{soil}$ = soil EPC (mg/kg dry weight)

The bioaccumulation models were selected from the following sources, which have been listed in order of preference by food type:

- Soil-to-Vegetation
  - OSWER Directive 9285.7-55, Attachment 4-1, Tables 4a and 4b
  - BJR/OR-133—dry weight plant BAFs and regression models
  - Beresford et al., 2008, "Derivation of Transfer Parameters for Use Within the ERICA Tool and the Default Concentration Ratios for Terrestrial Biota"—BAFs for grasses and herbs for radionuclides
  - USACHPPM, 2004, *Development of Terrestrial Exposure and Bioaccumulation Information for the Army Risk Assessment Modeling System (ARAMS)*

- Soil-to-Terrestrial Invertebrate
  - OSWER Directive 9285.7-55, Attachment 4-1, Tables 4a and 4b
  - ES/ER/TM-220—dry weight earthworm BAFs and regression models
  - Sample et al., 1999
  - Beresford et al., 2008—BAFs for detritivorous invertebrates for radionuclides
  - USACHPPM, 2004
- Soil-to-Small Mammals/Birds
  - OSWER Directive 9285.7-55, Attachment 4-1, Tables 4a and 4b
  - ES/ER/TM-219—dry weight small mammal BAFs and regression models
  - Beresford et al., 2008—BAFs for rodent mammals for radionuclides
  - ORNL-5786, *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture*
  - RTI, 2005, *Methodology for Predicting Cattle Biotransfer Factors*

Some bioaccumulation models for small mammals were diet-to-small mammal tissue rather than soil-to-small mammals. In these cases, a small mammal diet consisting of 100 percent soil invertebrates was assumed in calculating exposure estimates. Additionally, models to estimate uptake in birds, lizards, and other vertebrate prey items are lacking. Therefore, uptake relationships for all vertebrate prey items are assumed to be equivalent to small mammals of the same trophic level (e.g., herbivore and omnivore).

Table 6-4 lists the BAFs and regression models used to estimate chemical concentrations in food items for the receptors evaluated.

3.2.1.3 Radionuclide Exposure to Wildlife

Exposure to radionuclides differs from chemical exposure. Aquatic or terrestrial biota receive exposure to radionuclides through a combination of both internal and external pathways. Internal exposure is a function of radiation emitted from radionuclides that are retained in tissues. External exposure is due to radiation from radionuclides in soil, sediment, and water with which biota come into contact (or come near). For the purposes of developing Tier 1 values, radionuclide exposure was estimated based on the internal and external radiation exposure models incorporated into DOE-STD-1153-2002. In particular, the kinetic-allometric modeling methodology, which is part of the site-specific analysis portion of the graded approach, was used to calculate Tier 1 values for radionuclides in the wildlife receptor species. That kinetic-allometric modeling methodology is incorporated into Level 3 of the RESRAD-BIOTA Version 1.5 tool, DOE/EH-0676 (DOE-STD-1153-2002).

Tier 1 values for 22 radionuclides were calculated for the four bird and four mammal species resident at the Hanford Site (California quail, western meadowlark, killdeer, red-tailed hawk, Great Basin pocket gopher, deer mouse, grasshopper mouse, and badger), based on the following modified exposure assumptions:

- Species-specific BWs, diet composition, and incidental soil ingestion rates were modified as reported in Table 6-2.

- Exposure longevity and geometry factors were modified on a species-specific basis based on values reported in Table 6-11. Default allometric equations within the RESRAD-BIOTA model (DOE/EH-0676) were used for additional exposure parameters (e.g., inhalation rates).
- BAFs for radionuclides, extracted from the Environmental Risk from Ionizing Contaminants: Assessment and Management database (Beresford et al., 2008), were used as presented in Table 6-4.

As with Level 1 BCGs (used as Generic Screening Levels), Tier 1 values for radionuclides were calculated assuming 100 percent site use, which likely overestimates the exposure for most wildlife species.

3.2.2 Effects Assessment

The ecological effects assessment consists of an evaluation of available toxicity or other effects information that can be used to interpret the significance of the exposures to COPECs relative to potential adverse effects to ecological receptors. Data that can be used include literature-derived or site-specific single chemical toxicity data, site-specific ambient media toxicity tests, and site-specific field surveys (Suter et al., 2000). Calculation of Tier 1 values was based exclusively on single chemical toxicity data from literature sources. The following results were obtained from the effects assessment:

- TRVs for wildlife, which are then combined with the exposure models described in Section 4.2.1.2 to calculate Tier 1 values for nonradioactive contaminants, are tabulated.
- Tabulation of LOEC values for plants and soil invertebrates can be used in developing multiple lines of evidence regarding ecological risks to these receptors. At this time, Tier 1 values have not been developed in this document for plants and soil invertebrates.

Toxicity Reference Values for Wildlife. Both NOAEL and LOAEL based TRVs were identified for wildlife (birds and mammals) and were used to derive the Tier 1 values for wildlife presented in Chapter 4. The TRVs for birds and mammals were obtained from various sources and focus was given to the most recent sources and those derived or endorsed by EPA and Ecology (as evidenced by their use in either EcoSSLs or in Ecology Publication 94-06). The primary literature source used was EcoSSLs. The toxicity studies used were initially selected from the following sources, which have been listed in order of preference:

- OSWER Directives 9285.7-56, *Ecological Soil Screening Levels for Dieldrin: Interim Final*; 9285.7-57, *Ecological Soil Screening Levels for DDT and Metabolites: Interim Final*; 9285.7-60, *Ecological Soil Screening Level for Aluminum: Interim Final*; 9285.7-61, *Ecological Soil Screening Levels for Antimony: Interim Final*; 9285.7-62, *Ecological Soil Screening Levels for Arsenic: Interim Final*; 9285.7-63, *Ecological Soil Screening Levels for Barium: Interim Final*; 9285.7-64, *Ecological Soil Screening Levels for Beryllium: Interim Final*; 9285.7-65, *Ecological Soil Screening Levels for Cadmium: Interim Final*; 9285.7-66, *Ecological Soil Screening Levels for Chromium: Interim Final*; 9285.7-67, *Ecological Soil Screening Levels for Cobalt: Interim Final*; 9285.7-68, *Ecological Soil Screening Levels for Copper: Interim Final*; 9285.7-69, *Ecological Soil Screening Level for Iron: Interim Final*; 9285.7-70, *Ecological Soil Screening Levels for Lead: Interim Final*; 9285.7-71, *Ecological Soil Screening Levels for Manganese: Interim Final*; 9285.7-72, *Ecological Soil Screening Levels for Selenium: Interim Final*; 9285.7-73, *Ecological Soil Screening Levels for Zinc: Interim Final*; 9285.7-75, *Ecological Soil Screening Levels for Vanadium: Interim Final*; 9285.7-76, *Ecological Soil Screening Levels for Nickel: Interim Final*; 9285.7-77, *Ecological Soil Screening Levels for Silver: Interim Final*; and 9285.7-78, *Ecological Soil Screening Levels for Polycyclic Aromatic Hydrocarbons (PAHs): Interim Final*
- Other available literature—primarily ES/ER/TM-86/R3

- NOAEL and LOAEL values selected for chemicals and reported in the EPA Integrated Risk Information System (IRIS)
- NOAEL and LOAEL values presented in Wildlife Toxicity Assessments developed by USACHPPM

For analytes with EcoSSLs for birds and mammals, the NOAEL used to derive the final EcoSSL was selected as the NOAEL for development of Tier 1 values. In some cases, this value was the highest NOAEL below the LOAEL for studies evaluating growth and reproduction endpoints. In these cases, the paired LOAEL from the study with the highest NOAEL was selected as the LOAEL for development of a Tier 1 value. In other cases, the geometric mean of the NOAELs for growth and reproduction endpoints was selected for calculating the EcoSSL. In those cases, the LOAEL for development of a Tier 1 value was the lowest LOAEL above the geometric mean NOAEL. In rare cases (e.g., arsenic TRVs for birds), a study not cited in the EcoSSLs was selected because the study was of higher quality and had more ecologically relevant endpoints than those used to develop the EcoSSL values.

For analytes lacking EcoSSLs, other secondary and primary sources of studies were utilized. As possible, the primary literature sources were obtained and evaluated. Appropriate toxicity studies were selected based on several criteria:

- Studies were of chronic exposures or exposures during a critical stage of life (e.g., reproduction).
- Exposure was oral through food to ensure that data were representative of oral exposures expected for wildlife in the field.
- Emphasis was placed on studies of reproductive impacts to ensure relevancy to population level effects.
- Studies presented adequate information to evaluate and determine the magnitude of exposure and effects (or no effects concentrations).

Specifically, toxicity studies were selected to serve as the TRV if exposure was chronic or during reproduction (a critical life stage), the dosing regimen was sufficient to identify both a NOAEL and an LOAEL, and the study considered ecologically relevant effects (e.g., growth, reproduction, or survival). If multiple studies for a given COPEC meet these criteria, the study generating the lowest reliable toxicity value was selected to be the TRV.

The selected bird and mammal TRVs and study descriptions are presented in Tables 6-5 and 6-6, respectively. Summaries of the studies from which the NOAELs and LOAELs were extracted, and descriptions of the derivation of the TRV values, are presented in Appendix A.

3.2.3 Literature-Based Effects Data for Plants and Soil Invertebrates

Effects data and study descriptions for plants and soil invertebrates were extracted from EcoSSLs and ORNL reports[13]. These data, along with geometric means (calculated if suitable data were available), are presented in Tables 6-7 and 6-8 for plants and invertebrates, respectively. Data were restricted to the following measures of effects for each chemical:

- LOECs

[13] Note that plant and soil invertebrate effects data were extracted as presented in the ORNL or EcoSSL reports. ES/ER/TM-85/R3 (1997) justifies the use of LOECs as opposed to NOECs as the approach is consistent with the approach used to develop ER-Ls for sediment, soil benchmarks are based on community-level effects, and the benchmarks have been shown to be conservative in practice.

- MATCs (geometric mean of NOEC and LOEC)
- LC50s
- EC10s
- EC20s
- EC50s

Effect measures were representative of the most ecologically relevant endpoints (reproduction, survival, and development), exposure routes (plants, uptake via seed coat and/or roots; or invertebrates, oral and dermal exposure), and exposure period (chronic).

For many constituents, particularly metals, the available LOECs, MATCs, EC10, and EC20 values provide a large range of concentrations, sometimes two or three orders of magnitude. In general, values at the low-end of the concentration range also fall within the range of Generic Screening Levels and background concentrations in soil. These two factors create difficulty in selecting a risk-based concentration using a statistic drawn from the available literature data. Use of a lower percentile value, such as 10th or 20th percentile provides risk-based concentrations that resemble Generic Screening Levels or background concentrations in soil. Values at the high ends of the concentration ranges could create a high bias to central tendency values such as medians or geometric means. Based on these uncertainties, this document did not attempt to select literature-based values for use as Tier 1 risk-based concentrations for plants and soil invertebrates. As discussed in Chapter 5, other lines of evidence, particularly site-specific information should be identified to support development of Tier 2 values for plants and soil invertebrates. The range of literature-based concentrations and study conditions for toxicity tests with plants and soil invertebrates have been provided in this document for use as an additional line of evidence for use in developing Tier 2 values.

3.3 Risk Characterization

In the risk characterization, exposure and effects data are integrated to draw conclusions concerning the presence, nature, and magnitude of effects that may exist at a site. Risk is not directly evaluated in this report. Instead, exposure and effects data are used to calculate Tier 1 values that represent COPEC concentrations in soil that are associated with minimal likelihood of adverse effects (i.e., risk).

This section presents the methodology used to calculate Tier 1 values for nonradionuclide and radionuclide COPECs for community level and population level receptors that are common to and representative of the Central Plateau Area. These Tier 1 values are developed using approaches consistent with EPA risk assessment protocols (EPA 910/R-97/005, *EPA Region 10 Supplemental Ecological Risk Assessment Guidance for Superfund*; EPA 540-R-97-006; and EPA/630/R-95/002F) and Ecology Publication 94-06. The Tier 1 values are calculated for the most plausible potential exposure pathways (Section 2.1) for site-related constituents in surface soil at the Central Plateau Area.

This section also includes a discussion of the uncertainties and limitations associated with the risk assessment data and methodology. Other key uncertainties and assumptions associated with each of these steps are identified and discussed throughout the report.

3.3.1 Tier 1 Values for Wildlife

Because Generic Screening Levels for birds and mammals do not take into account receptors or conditions present at the Hanford Site, they may be overly conservative and, in certain cases, produce concentrations that are below local background concentrations in soil. Therefore, refinements that integrate updated data and exposure estimations for bird and mammal receptor species resident at the Hanford Site were developed. These refinements, identified as Tier 1 values for birds and mammals, were calculated for nonradionuclides in soil using the following basic equation:

$$1 = \frac{\sum (DFI) \times \left[(P_v \times C_v) + (P_i \times C_i) + (P_m \times C_m) + (SSL + P_s) \right]}{TRV}$$

where:

SSL	=	soil screening level
DFI	=	daily ingestion rate of all food items (kg/kg BW/day dry wt.)
P_v	=	proportion of diet represented by vegetation (unitless)
C_v	=	concentration in vegetation tissue (mg/kg dry wt.)
P_i	=	proportion of diet represented by terrestrial invertebrates (unitless)
C_i	=	concentration in soil invertebrate tissue (mg/kg dry wt.)
P_m	=	proportion of diet represented by small mammals/birds (unitless)
C_m	=	concentration in small mammal tissue (mg/kg dry wt.)
P_s	=	proportion of diet represented by incidentally ingested soil (unitless)

The TRV denotes the level of toxicity of the chemical, as reported from literature sources (Section 3.2.2). The chemical concentration in the food item (vegetation, soil invertebrate, and small mammal) is estimated by using BAFs or bioaccumulation regression models to extrapolate to the food source. This equation is solved using the Microsoft Office Excel® goal-seek tool, such that exposure (the numerattor) equals the TRV (the denominator). Tier 1 values for birds and mammals were derived for NOAEL (Table 6-9) and LOAEL (Table 6-10) TRVs. The exposure calculation worksheets, used to calculate the Tier 1 values based on NOAELs and LOAELs for birds and mammals, are provided in Tables A-1 through A-16, respectively (Appendix A).

3.3.2 Tier 1 Values for Radionuclides

Tier 1 radionuclide values for birds and mammals are presented in Table 6-12. Appendix B presents the detailed chemical-specific and receptor-specific exposure parameters, employed within RESRAD-BIOTA (DOE/EH-0676), to calculate the Tier 1 values for 22 radionuclides for each of the eight receptors selected.

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4 Uncertainties

This chapter discusses the uncertainties with the methods employed in the development of Generic Screening Levels and Tier 1 values. Some of these values should be used cautiously in remediation planning, with a full understanding of their associated uncertainties. For some inorganic constituents in soil, the Tier 1 values calculated in this report for some wildlife species are lower than Generic Screening Levels derived from MTCA. Overall, the Generic Screening Levels should be the most conservative values available. However, depending both on how recently the generic values were developed and the nature of the assumptions used, there may be some contaminants in which more refined values (i.e., Tier 1) for some species may be lower than generic values. Examples of contaminants in which Tier 1 values for wildlife are lower than generic values provided from MTCA are provided in Section 4.2. These examples provide a framework for the kinds of uncertainties discussions that should be incorporated into the risk characterization portion of an ERA, and when making decisions to proceed to the next level of refinement within the tiered process.

4.1 Uncertainties in Development of Tier 1 Values—General Considerations

The following uncertainties and limitations are associated with the proposed methodology and available data for development of Tier 1 values:

- Data concerning soil ingestion rates were not available for the bird and mammal receptors identified in the conceptual exposure model for the Hanford Site. Consequently, the soil ingestion rates were estimated based on assumed similarities to other species for which data were available. The suitability of these assumptions to the species onsite is unknown and may correspondingly underestimate or overestimate exposure. Consequently, Tier 1 values may be either overconservative or underconservative.

- Detailed life history data specific to the Hanford Site are not available; therefore, exposure parameters were either modeled on the basis of allometric relationships (e.g., FIRs) or data from the same species in other portions of its range. Because diet composition as well as food, water, and soil ingestion rates can differ among individuals and locations, published parameter values may not accurately reflect individuals present at the Hanford Site. Consequently, Tier 1 values may be either overconservative or underconservative. For example, diets used to establish Generic Screening Levels based on MTCA procedures (e.g., Ecological Indicator Soil Concentrations in Table 749-3) focus on selected food items but do not provide 100 percent of the receptor's diet. The Tier 1 values were derived with a model incorporating prey tissue items that comprise 100 percent of the receptor's diet. Therefore, the assumed contributions of ingestion of contaminants of prey tissues for the Tier 1 values would be greater than those used to develop the MTCA values (Tier 1 values for wildlife are usually higher than MTCA values through the use of more realistic BAFs).

- No site-specific data on COPEC concentrations in terrestrial plants, soil invertebrates, and small mammals or birds were used for Tier 1 wildlife exposure estimate calculations. Therefore, concentrations in these food items were estimated from literature reported bioaccumulation models (BAFs or regressions). The suitability of these bioaccumulation models to conditions at the Hanford Site is unknown. Consequently, modeled concentrations of COPECs in food items of wildlife may be either greater or less than concentrations under actual conditions and, consequently, Tier 1 values may be either overconservative or underconservative. For example, models used to develop the Generic Screening Levels, based on MTCA wildlife values (Table 749-3), rely upon BAFs to estimate the concentration of contaminants in invertebrate and plant tissues that are assumed to be linear and constant across all soil concentrations and do not account for other environmental

factors. While uptake factors for plants may be appropriate for small ranges of concentrations of some COPECs within nontoxic ranges (Jiang and Singh, 1994, "Effect of Different Forms and Sources of Arsenic on Crop Yield and Arsenic Concentration," and Carlson and Bazzaz, 1977, "Growth Reduction in American Sycamore (*Plantanus occidentalis* L.) Caused by Pb-Cd Interaction," as cited in BJR/OR-133), there is evidence to suggest that accumulation decreases with increasing soil concentration. Earthworm studies have shown this to be true (ES/ER/TM-220 and Neuhauser et al., 1995, "Toxicity of Metals to the Earthworm *Eisenia fetida*"). A number of empirically derived regression models have been developed describing the relationship of concentrations in biotic media to concentrations in their surrounding abiotic environmental media, which were incorporated into the methodology for establishing EPA's EcoSSLs for wildlife (OSWER Directive 9285.7-55). Hence, these models were employed in the development of the Tier 1 values, as available. For certain inorganics such as uranium, the default BAFs proscribed by MTCA that can be used to develop Generic Screening Levels for wildlife when an Ecological Indicator Soil Concentration is not available are considerably greater than literature-based, contaminant-specific values for BAFs. Tier 1 values often are higher than generic values because of the use of more realistic BAF values.

- Literature-derived toxicity data, based on laboratory studies, were used to derive Tier 1 values for wildlife receptor groups. It is assumed that effects observed in laboratory species were indicative of effects that would occur in wild species. The suitability of this assumption is unknown. Consequently, Tier 1 values may be either overconservative or underconservative. In certain cases, Tier 1 values were lower than Generic Screening Levels based on MTCA Ecological Indicator Soil Concentrations, because the Tier 1 values were based on a more recent assessment of toxicity data. TRVs used to develop Generic Screening Levels based on MTCA (Ecological Indicator Soil Concentrations presented in Table 749-3) were drawn from a review of toxicity values prepared by ORNL in the mid-1990s (ES/ER/TM-86/R3). When possible, the Tier 1 values were developed using a more comprehensive review of toxicological data presented in the EPA EcoSSL documents. In certain cases, the toxicity review conducted for EcoSSL development may identify an effect level lower than identified in the older ORNL document. Therefore, the process used for selecting effect levels as TRVs (e.g., selecting the lowest LOAEL above the highest or geometric mean NOAEL published for an EcoSSL) may produce a Tier 1 value that is more conservative than an MTCA Ecological Indicator Soil Concentration.

- Toxicity data were not available or were limited for some COPEC or receptor combinations. Therefore, screening level values could not be calculated for all receptors or COPECs, and the level (generic or Tier 1) varies by receptor and COPEC. Absence of values beyond Generic Screening Levels for plants and soil invertebrates can be addressed through performing site-specific bioassays, which are a component of Tiers 2 and 3. Development of Tiers 2 and 3 values is not discussed in this report.

- Bioavailability in the toxicity studies used for development of screening benchmarks and TRVs is generally high because many toxicity tests are performed using soluble salts of inorganic chemicals (as in the case of chromium toxicity to plants). Therefore, SSL values based solely on literature-derived toxicity values may be overconservative. For example, in the case of chromium toxicity to plants, the natural background value of chromium in Washington State soil was selected by Ecology (Ecology Publication 94-06, Table 749-3) rather than the ORNL plant toxicity values used for other analytes.

- Area use was conservatively assumed to be 100 percent for each receptor for the development of Tier 1 values for wildlife. The size of the site may be less than the foraging area for a particular

wildlife species. In particular, the Tier 1 values calculated here are likely overconservative for mammals and birds with larger home ranges.

- Bioavailability and toxicity of metals are functions of soil pH, with metals generally being more bioavailable and toxic at low pHs (OSWER Directive 9285.7-55). The pH for plant toxicity values ranges from 3 to 8.3 (mean = 6.3) (Table 6-7). The pH for invertebrate toxicity values ranges from 3.8 to 8.1 (mean = 5.6) (Table 6-8). The minimum soil pH reported in the River Corridor Baseline Risk Assessment (RCBRA) (DOE/RL-2007-21) for riparian and upland soil was 6.6. Soil pH in the Outer Area of the Central Plateau ranges from 3.6 to 9.9, with 93 percent of observations greater than 6.6 (based on a review of shallow soil data published in the Hanford Environmental Information System database). Because the range of pH values associated with plant and soil invertebrate toxicity includes values that are substantially less than those present throughout most of the Hanford Site, it is likely that Generic Screening Levels for plants and soil invertebrates developed under lower pH conditions do not accurately represent toxicity in Hanford Site soils.

4.2 Uncertainties in Development of Wildlife Screening Level Values—Specific Cases

The following sections provide some brief discussion of the uncertainties associated with the development of SSLs for selected contaminants and their application as ecological PRGs within an RI/FS. Ecological PRGs, in general, should be used cautiously in remedial decision making and should be applied with an understanding of the assumptions and uncertainties in their development. In cases where ecological PRGs for any particular COPEC become drivers for remedial decision making in an RI/FS, a discussion of the uncertainties should be presented in the ERA accompanying the RI/FS. The following subsections provide some selected examples of how uncertainties in the screening level development should be discussed. The uncertainties discussions will differ from contaminant to contaminant, based on the nature of the assumptions and data used in the screening level development process; therefore, the descriptions provided should be treated only as examples.

4.2.1 Uncertainties in Wildlife Values for Cadmium

Generic Screening Levels for cadmium that are available for bird species are the EcoSSL developed by EPA (0.77 mg/kg) and the Ecological Indicator Soil Concentration (14 mg/kg) published by Ecology. The Tier 1 value for cadmium for omnivorous birds (meadowlark, 5 mg/kg) and insectivorous birds (killdeer, 2 mg/kg) are lower than the Ecology value and higher than the EcoSSL. Selection of the TRV and the assumptions used in modeling wildlife exposure are responsible for the Tier 1values being lower than the Generic Screening Level based on Ecology's Soil Ecological Indicator Concentration.

4.2.1.1 TRV Selection

Ecology's Ecological Indicator Soil Concentration for avian wildlife is developed from a TRV that can be found in the ORNL screening benchmarks for wildlife (ES/ER/TM-86/R3). That TRV (20 mg/kg BW/day) was based on an LOAEL obtained in mallard ducks where the adverse effect observed was reduced reproductive potential (White and Finley, 1978, "Uptake and Retention of Dietary Cadmium in Mallard Ducks"). While this TRV is based on a measured effect that aligns with the target assessment endpoints for PRG development of population level effects (i.e., growth, survival, and reproduction) described in Section 2.2, 26 other studies that measured population level effects have produced lower LOAELs ranging from 2.37 to 14.7 mg/kg BW/day, as shown in the more comprehensive review produced by EPA for the cadmium EcoSSL (OSWER Directive 9285.7-65). As discussed in Section 3.2.2, development of Tier 1 values was based on the lowest LOAEL above the geometric mean NOAEL, which had been selected by EPA for EcoSSL development. This aligns with the process for

selecting TRVs described in EPA 540-R-97-006. The lowest value for a reproductive effect LOAEL, above the geometric mean NOAEL, was 2.37 mg/kg BW/day (Leach et al., 1979, "Cadmium and the Food Chain: The Effect of Dietary Cadmium on Tissue Composition in Chicks and Laying Hens"). The study by Leach et al., 1979, used longer exposure durations compared to White and Finley, 1978, and, therefore, may be more suitable for evaluating chronic exposures to cadmium. However, other studies provide higher LOAEL values for reproductive effects (OSWER Directive 9285.7-65), and use of the lowest value for the LOAEL potentially overstates ecological risks from cadmium (e.g., a higher concentration for cadmium in soil may also be protective of birds in these feeding guilds).

4.2.1.2 Estimation of Tissue Concentrations

Ingestion of soil invertebrates provides the largest contribution to total exposure of nonradionuclide inorganic constituents to omnivorous and insectivorous birds. For cadmium, estimated ingestion of soil invertebrates within the Tier 1 value models provides 97 percent of total exposure to the meadowlark (omnivorous bird) and over 99 percent of total exposure to the killdeer (insectivorous bird). Key factors in the wildlife exposure model used for calculating cadmium values in soil for these feeding guilds are the methods used to estimate the concentration of COPECs in components of the diet (e.g., prey items). Therefore, uncertainties in the methods to estimate the concentration of tissue in the diet will also result in uncertainties of the values. The concentration of cadmium in soil invertebrates in the diet of Hanford Site receptors has been calculated using an empirically derived regression model, based on accumulation in earthworms (ES/ER/TM-220). Using a bioaccumulation model based on an earthworm for the Hanford Site introduces uncertainties into the exposure estimates and the resulting Tier 1 values because the soil invertebrate component of the food web at the Hanford Site is primarily composed of arthropods (WMP-20570; DOE/RL-2001-54, *Ecological Evaluation of the Hanford 200 Areas – Phase I: Compilation of Existing 200 Areas Ecological Data*). Earthworms are unlikely to be found in the arid, sandy soils at the Hanford Site, whereas arthropods would be more appropriate as soil biota (DOE/RL-2001-54) found in the diets of birds and mammals foraging at the Hanford Site. Examples of soil invertebrates that would be part of the food web for the Hanford Site include darkling beetles and harvester ants (WMP-20570). Taxonomic and ecological differences between earthworms and arthropods suggest that earthworms may not be suitable surrogates for estimating bioaccumulation in arid environments. However, models for estimating bioaccumulation into earthworms are used because published models for arthropods are lacking. Evaluation of the available literature describing tissue concentrations of inorganic constituents in arthropods suggests that bioaccumulation rates for arthropods were equal or lower than for earthworms, and bioaccumulation of cadmium into insects generally was lower than for non-insect arthropods such as arachnids, centipedes, millipedes, and isopods (Sample and Arenal, 2001, *Development of Literature-based Bioaccumulation Models for Terrestrial Arthropods*). Based on these considerations, a bioaccumulation model based on earthworms introduces uncertainties into ingestion exposure of soil invertebrates by omnivorous and insectivorous birds under Hanford Site conditions. Available literature describing tissue concentrations in arthropods (Sample and Arenal, 2001) suggests that bioaccumulation rates are equal or lower than those for earthworms.

The available bioaccumulation model for earthworms is based on the underlying principle that the rates of accumulation decrease with increasing soil concentration and increasing body burden. This approach for estimating bioaccumulation, which is reflected in the regression model obtained from ES/ER/TM-220, and based on earthworm data, is considered more appropriate than applying a BAF that is constant across all soil concentrations. The method of estimating tissue concentrations used by Ecology to develop Ecological Indicator Soil Concentrations (Table 743-5) incorporates a BAF that is constant across all soil concentrations. Development of Tier 1 values used the more refined method of estimating bioaccumulation employing the regression model from ES/ER/TM-220 (this approach is also employed by EPA to develop EcoSSLs). However, if estimating soil invertebrate tissue concentrations using a

model based on earthworms overstates potential exposures for Hanford Site conditions, then a higher concentration for cadmium in soil may also be protective of birds in these feeding guilds.

4.2.1.3 Overall Assessment of Uncertainties with Cadmium

Generic Screening Levels are values published by regulatory agencies or widely recognized peer reviewed sources (e.g., ORNL reports). Tier 1 values are calculated values intended to represent biota present at the Hanford Site but were developed using information drawn from the literature. While further refinement of risk-based screening values is possible using additional site-specific considerations, the focus of this report was to develop SSLs using available literature information. In cases where cadmium in soil becomes a driver because of ecological risk, users of these Tier 1 values should be aware of the uncertainties in the values and mindful of the possibility that these Tier 1 values may be overly protective. In particular, users of these Tier 1 values should carefully consider further refinements using a BAF based on a food web that is appropriate for the Hanford Site (e.g., arthropods rather than the earthworm).

4.2.2 Uncertainties in Wildlife Values for Mercury

Uncertainties in the Tier 1 wildlife values for mercury in soil are related to the selected TRV and the methods used to estimate exposure through food ingestion. The Ecological Indicator Soil Concentration for inorganic mercury for wildlife is 5.5 mg/kg in soil, based on the robin (omnivorous bird). There is no EcoSSL available for inorganic mercury. Using TRVs and the wildlife exposure models provided by the State of Washington to calculate Ecological Indicator Soil Concentrations for the shrew (omnivorous mammal) and vole (herbivorous mammal) yields values of 9.6 mg/kg and 62.6 mg/kg, respectively (Table 749-3). The Tier 1 values for mercury are 21 mg/kg for the meadowlark (omnivorous bird); 4 mg/kg for the killdeer (insectivorous bird); 2 mg/kg for the deer mouse (omnivorous mammal); and 3 mg/kg for the grasshopper mouse (insectivorous mammal). The following subsections discuss how the various assumptions in the calculations provide these particular results.

4.2.2.1 TRV Selection

The TRV used to develop the Ecological Indicator Soil Concentration for the robin is drawn from the ORNL screening benchmarks for wildlife (ES/ER/TM-86/R3). That TRV (0.9 mg/kg BW/day) was based on an LOAEL obtained from a study on Japanese quail exposed to mercuric chloride for one year where the observed adverse effect was reduced reproductive potential (Hill and Shaffner, 1976, "Sexual Maturation and Productivity of Japanese Quail Fed Graded Concentrations of Mercuric Chloride"). The TRV used to develop the Tier 1 values for birds is 0.37 mg/kg BW/day as methyl mercury, which is the LOAEL obtained from a multi-generational study of mallard ducks where the observed adverse effect was reduced reproductive potential (Heinz, 1979, "Methylmercury: Reproductive and Behavioral Effects on Three Generations of Mallard Ducks"). The key uncertainty in the TRV selection for development of the Tier 1 values for terrestrial birds was use of a toxicity study assessing methyl mercury toxicity.

Less than 1 to 3 percent of the total mercury in surface soil is methyl mercury, and it will be bound largely to organic matter (EPA/452/R-97/008, *Mercury Study Report to Congress*). The other 97 to 99 percent of total soil mercury can be considered largely Hg(II) complexes, although a small fraction of mercury in typical soil will be elemental Hg. Soil conditions found at the Hanford Site (e.g., pH, temperature, and soil humic content) typically favor the formation of inorganic mercury compounds. Therefore, it is not likely that methyl mercury exposure would occur to the terrestrial species used to develop Tier 1 values.

Although the exposure duration of the Heinz (1979) study may be more reflective of chronic exposure, developing a screening level value for inorganic mercury based on methyl mercury toxicity represents an uncertainty in that value. Using the TRV derived from the Hill and Shaffner (1976) study on exposure to

mercuric chloride (e.g., using the 0.9 mg/kg BW/day TRV rather than 0.37 mg/kg BW/day value based on methyl mercury) would provide values that are about two-fold higher for bird species than the current Tier 1 value.

The TRVs used to calculate Ecological Indicator Soil Concentrations for inorganic mercury for a shrew (2.86 mg/kg BW/day) and a vole (2.18 mg/kg BW/day) are not found in the ORNL screening benchmarks for wildlife (ES/ER/TM-86/R3), and the adverse effects associated with those values are not known. The TRV used to develop the Tier 1 value for mammals is 0.16 mg/kg BW/day, which is the LOAEL in a three-generation reproductive study of rats exposed to methyl mercury chloride (Verschuuren et al., 1976a, "Toxicity of Methylmercury Chloride in Rats. II. Reproduction Study"). Use of a TRV based on methyl mercury toxicity data may not reflect the source of mercury exposure in soil to terrestrial receptors. Inorganic mercury compounds appear to be less toxic to mammals compared with methyl mercury compounds (ATSDR, 1999, "Toxicological Profile for Mercury"); adverse effects pertinent to the assessment endpoints of growth, survival, and reproduction occur at higher concentrations with inorganic mercury compounds compared with methyl mercury. Developing a screening level for inorganic mercury based on methyl mercury toxicity represents an uncertainty in that value. Although the selected TRV used to develop the Tier 1 values for mercury may be more reflective of long-term exposure, use of a TRV based on inorganic mercury would better reflect terrestrial exposure to mercury. For example, a short-term exposure study evaluating reproductive toxicity in female rats identified an NOAEL of 0.74 mg/kg BW/day and an LOAEL of 1.5 mg/kg BW/day (Heath et al., 2009, "The Effects of Chronic Mercuric Chloride Ingestion in Female Sprague–Dawley Rats on Fertility and Reproduction"). A short-term exposure study evaluating reproductive toxicity in male rats identified an LOAEL of 3 mg/kg BW/day (Boujbiha et al., 2009, "Testicular Toxicity in Mercuric Chloride Treated Rats: Association with Oxidative Stress"). While reproductive toxicity estimated from short-term studies (Heath et al., 2009; Boujbiha et al., 2009) is not directly comparable to multigenerational studies (Verschuuren et al., 1976a), the toxicity studies based on inorganic mercury suggest that the TRV used in this report for developing values for mammals may be overly conservative, and a higher concentration of inorganic mercury in soil might also be protective of omnivorous and insectivorous mammals.

To address these uncertainties associated with selection of TRVs for methyl mercury as opposed to inorganic mercury, avian and mammalian TRVs for inorganic mercury (mercuric chloride) have been included in Tables 6.5 and 6.6. Tier 1 wildlife values were then calculated using these TRVs. Note that although both NOAEL and LOAEL TRVs were available for birds, only a LOAEL was identified for mammals.

4.2.2.2 Estimation of Tissue Concentrations

Ingestion of soil invertebrates provides the largest contribution to total exposure of nonradionuclide inorganic constituents to omnivorous and insectivorous birds and mammals. For mercury, estimated ingestion of soil invertebrates provides 63 percent of total exposure to the meadowlark (omnivorous bird) and over 98 percent of total exposure to the killdeer (insectivorous bird); estimated ingestion of soil invertebrates provides 69 percent of total exposure to the deer mouse (omnivorous mammal) and 98 percent of total exposure to the grasshopper mouse (insectivorous mammal). As with cadmium, uncertainties with the estimation of mercury bioaccumulation are important factors in the screening level values for organisms in these feeding guilds, and using a bioaccumulation model for mercury that is based on data from earthworms (ES/ER/TM-220) introduces uncertainties into the exposure estimates and resulting values calculated for Hanford Site conditions. The soil invertebrate component of the food web at the site is primarily composed of arthropods (WMP-20570; DOE/RL-2001-54). Earthworms are unlikely to be found in the arid, sandy soils at the Hanford Site, whereas arthropods would be more appropriate as soil biota (DOE/RL-2001-54). Available literature describing tissue concentrations in

arthropods (Sample and Arenal, 2001) suggests that bioaccumulation rates are equal or lower than those for earthworms. If estimating soil invertebrate tissue concentrations using a model based on earthworms overstates potential exposures for Hanford Site conditions, then a higher concentration for mercury in soil may also be protective of birds and mammals in these feeding guilds.

4.2.2.3 Overall Assessment of Uncertainties for Mercury

The Tier 1 values for mercury were estimated in a conservative manner using available information characterizing toxicity from long-term exposure to bird and mammal species and wildlife exposure models derived from regulatory technical guidance. The forms of mercury used in these toxicological studies include both methyl (a form not likely found in the environment at the Hanford Site) and inorganic mercury (more likely to be found at the Hanford Site). Given that inorganic mercury is more likely to be present at the Hanford Site, the Tier 1 value for inorganic mercury should be used unless location-specific data suggests the presence of organic mercury. However when only the organic mercury value is used, if exposure concentrations are below the organic mercury value when used, then it is safe to assume that there are no risks attributable to inorganic mercury. Information developed in this report also suggests that a wildlife exposure model that incorporates food chain assumptions more appropriate for Hanford Site conditions (e.g., bioaccumulation from soil to arthropods, rather than from soil to earthworms) be considered.

4.2.3 Uncertainties in Wildlife Values for Uranium

The uncertainty in wildlife TRVs exists in both the selection of the value and the values themselves. Studies of adverse effects on wildlife can include differences in routes of exposure, duration of studies, endpoints measured, and statistical tests conducted to characterize observed effects. Thus, selecting a TRV from one study among many with varying study design creates some uncertainty.

The mammalian TRV for uranium was selected based on detailed reviews of available toxicity literature conducted by both Ecology and CHPRC. Ecology recommends a LOAEL of 1.3 mg/U/kg/d based on analyses in Sheppard et al. (2005). However, significant uncertainties and inconsistencies were identified with the derivation of this 1.3 mg/kg/d TRV. Consequently, the dose of 2.8 mg U/kg/d from Domingo et al. (1989a) was identified as the most appropariate LOAEL TRV for application at the Hanford Site as it was consistent with WAC 173-340-7493(4)(a). Details of these reviews are presented in Appendix C, Estimation of Tissue Concentrations.

An Ecological Indicator Soil Concentration was not derived for uranium; thus, Table 749-5 does not provide BAFs from which to estimate the concentration of uranium in prey tissues. In the absence of BAFs, MTCA prescribes that soil-to-invertebrate BAFs of 4.6 and soil-to-plant BAFs of 1.01 be used for all metals. Available literature suggests that the accumulation of uranium into biological tissues is much lower than the default values in MTCA for general metals. The use of MTCA default values for uranium would result in overly conservative refined Tier 1 values for wildlife. Thus, food chain models used to develop the Tier 1 values for uranium relied upon soil-to-plant, soil-to-invertebrate, and soil-to-small mammal BAFs of 0.021 (USACHPPM, 2004), 0.033 (ES/ER/TM-220), and 0.0002 (ORNL-5786), respectively. While these BAFs from the literature could either overestimate or underestimate actual tissue concentrations found at the Hanford Site, the uncertainty in using these values was considered lower than the uncertainty associated with using the default BAFs from MTCA.

4.2.3.1 Overall Assessment of Uncertainties with Uranium

The mammalian TRV for uranium was selected based on detailed reviews of available toxicity literature conducted by both Ecology and CHPRC. Ecology recommends a LOAEL of 1.3 mg/U/kg/d based on analyses in Sheppard et al. (2005). However, significant uncertainties and inconsistencies were identified

analyses in Sheppard et al. (2005). However, significant uncertainties and inconsistencies were identified with the derivation of this 1.3 mg/kg/d TRV. Consequently, the dose of 2.8 mg U/kg/d from Domingo et al. (1989a) was identified as the most appropriate LOAEL TRV for application at the Hanford Site as it was consistent with WAC 173-340-7493(4)(a). Details of these reviews are presented in Appendix C.

Should wildlife PRGs for uranium drive remedial decisions, users of these PRGs should carefully consider further refinements using a BAF based on a food web that is appropriate for the Hanford Site (e.g., arthropods rather than the earthworm) and possible further review of the TRVs.

4.3 Uncertainties in Plant and Invertebrate Values

In several cases, the LOEC data sets have such large variability that the geometric means derived from them are likely to overstate or understate potential toxicity in soil. In addition, these LOECs were drawn from studies in the literature that reflect a range of environmental conditions (e.g., soil pH, total organic carbon content in soil, soil type, and test species). Taken together, these studies may not characterize environmental conditions at the Hanford Site. For example, studies of plant toxicity of metals in low pH soils (<pH 6) may not reflect the potential toxicity in Hanford Site soils, where approximately 93 percent of pH measurements for soils from the Central Plateau are 6.6 or greater. Because bioaccumulation and toxicity of metals are enhanced in low pH soils, application of these results to the development of PRGs for the more neutral Hanford Site conditions would overstate the potential toxicity of plants in Hanford Site soils and, therefore, potentially result in overconservative values. Consequently, these LOEC datasets, and the geometric means based on them, are not recommended for use in developing values. The toxicity data from studies with low pH are included in order to summarize the data distributions of LOEC values for use in risk characterizations prepared as part of ERAs.

Existing ecological screening levels rely on ex situ laboratory studies with highly bioavailable forms of metals that exhibit toxicity at lower concentrations than those observed in natural conditions at the Hanford Site, including weathered soils with high variability in chemical concentrations and soil chemistry properties. These uncertainties support the need to create a study design to conduct toxicity testing for plants and invertebrates specific to soils at the Hanford Site; data collected from such toxicity testing could support a range of ERA activities, including the development of Hanford Site-specific screening levels or PRGs. Further discussion of a study design for collection of soil toxicity data is presented in DOE/RL-2010-118, *Sampling and Analysis Plan for Ex Situ Plant and Invertebrate Bioassays to Evaluate Terrestrial Environments Across the Hanford Site.*

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5 Summary and Discussion

Generic Screening Levels were identified for 113 of 137 COPECs considered (Table 6-1). Values were identified for 21 of 23 radionuclides, 28 of 29 metals/metalloids, 3 of 9 general inorganics, 17 of 25 volatile organic compounds, 19 of 20 individual PAHs or mixtures, 2 of 3 petroleum mixtures, 13 of 15 semivolatile organic compounds (including polychlorinated biphenyls), 0 of 1 herbicides, and 12 of 12 chlorinated pesticides. Overall, Generic Screening Levels were extracted from seven sources (excluding background values). The most robust data (i.e., values for multiple receptors for a given COPEC) were for metals and radionuclides, followed by PAHs, semivolatile organic compounds, and chlorinated pesticides. Mammals were the best represented receptor group (Generic Screening Levels were available for as many as 91 COPECs), followed by birds, plants, and soil invertebrates (Table 6-1).

Tier 1 values are also literature-based values, but they include broader, less conservative effect levels or have been calculated specifically for bird and mammal species present at the Hanford Site. Tier 1 values generally correspond to the effects values that would be employed in the baseline problem formulation as described in ERAGS (EPA 540-R-97-006). Tier 1 values were developed for a selected set of COPECs for four bird and four mammal species (e.g., California quail, western meadowlark, killdeer, red-tailed hawk, Great Basin pocket mouse, deer mouse, grasshopper mouse, and badger) representative of the Central Plateau at the Hanford Site. LOAEL-based values were developed for 88 and 107 COPECs for birds and mammals, respectively (Table 6-13).

Conceptually, the Generic Screening Levels should represent the most conservative ecological risk-based concentrations. However, the Generic Screening Levels are drawn from a range of sources and reflect some variation in the types of effect levels and quality of data used in their calculation. In certain cases, the wildlife Tier 1 values may be lower than Generic Screening Levels. These occurrences need to be taken into consideration when using any of these values for screening contaminant concentrations in soil.

The Tier 1 wildlife values that are based on LOAELs are higher than EcoSSLs for mammalian or avian species with the exceptions of nickel (for both mammalian and avian species), cobalt (avian), 2-methylnaphthalene (mammalian), and naphthalene (mammalian). In general, the differences between the Tier 1 values and EPA wildlife EcoSSLs are small, and they are associated with the differences in exposure factors when moving from generic wildlife species (EcoSSLs) to the Hanford-specific wildlife species (Tier 1 values). The state of Washington's Ecological Soil Indicator Concentrations for wildlife are frequently higher than the Tier 1 wildlife values derived in this report, based on the LOAELs. In most cases, the Tier 1 values are lower due to differences in the TRVs used by Ecology versus the TRVs used in this report (which were drawn in many cases from EPA's EcoSSL guidance). There are also differences in how the concentration of chemicals in prey tissue is estimated between the wildlife exposure model used by Ecology and the model used in this report. The TRVs and approach to estimating tissue concentration used to calculate the Tier 1 values in this report are drawn from EPA EcoSSL guidance, which reflects a more current data source than the data used for calculating the Ecological Indicator Soil Concentrations. For most chemicals, the lowest Tier 1 wildlife value is for an insectivorous or omnivorous receptor. Calculation of Tier 1 values for these receptors rely on bioaccumulation models that use data for accumulation into earthworms. Tier 2 values, which could be based on a bioaccumulation model more appropriate for the site such as those using arthropods and/or Hanford-specific bioaccumulation data, may provide greater refinement in ecological risk-based concentrations compared with the Tier 1 values presented in this report.

This report has not proposed Tier 1 values for plants or soil invertebrates at this time. The lowest effect levels (either LOECs or MATCs) for plants and soil invertebrates are summarized in Tables 6-7 and 6-8, respectively. As discussed in Section 4.3, the uncertainties in the literature data sets of effect levels

identified in this report preclude development of Tier 1 values for use in data screening or for PRGs. These uncertainties include data in the literature drawn from a range of environmental conditions that are not reflective of the Hanford Site (e.g., soil pHs below 5), and studies conducted under laboratory conditions with spiked concentrations of metals that are more bioavailable than the concentrations observed in weathered natural soils.

The following activities have subsequently been conducted to support development of ecological risk-based values for plants and soil invertebrates:

- Incorporating plant and soil invertebrate bioassay data collected as part of the RCBRA (DOE/RL-2007-21) into the development of Tier 2 ecological values
- Conducting additional plant and soil invertebrate bioassays using Hanford Site soils to estimate effect levels using a broader range of soil concentrations (DOE/RL-2010-118) to support development of Tier 2 values. The results of these bioassays are presented in ECF Hanford-11-0158.

The ecological risk-based values presented in this report are the results from a tiered process in which values are refined as needed with additional literature-derived or site-specific information and from using more complex methods to develop values that are more representative of ecological exposure pathways at the Hanford Site. The tiered approach is in accordance with guidance developed by EPA (principally, EPA 540-R-97-006 and OSWER Directive 9285.7-55) and the ecological evaluation procedure presented in WAC 173-340-7490 through WAC 173-340-7493. Central to the concept of a systematic, informed progression is an iterative process (i.e., cycles) of decision making involving evaluation, deliberation, data collection, and communication. All of these steps should be focused on deciding the following:

- Whether or not the ecological risk-based concentrations at the current tier are sufficient to support cleanup decision making (a process to exiting the tiered approach is available at each tier)
- Whether or not progression to a higher tier of refinement would reduce uncertainties and/or increase confidence in risk-based concentrations to warrant the additional effort if the information available at the current tier is determined to be insufficient

A primary objective of this document has been to support this evaluation and deliberation process through a presentation of the data, assumptions, and methods used in this tiered approach.

6 Tables

The tables, called out within the various sections of this document, are provided in this chapter.

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Table 6-1. Summary of Generic Screening Levels in Soil

Group	Soil Constituent	Units	EPA EcoSSLs					ORNL - ES/ER/TM-85/R3, ES/ER/TM-126/R2		DOE BCGs		Washington Dept. of Ecology - MTCA (WAC 173-340, Table 749-3)			Lowest Screening Benchmark by Receptor Type				Background Soil Concentrations [a]	Literature-derived Generic Screening Level [b]	Basis
			Plants	Invertebrate	Avian	Mammalian	Reference	Plants	Invertebrate	Terrestrial Plant	Terrestrial Animal	Plant	Soil Biota	Wildlife	Plant	Inverts	Avain, Mammalian, Wildlife	Overall Lowest Screening Benchmark			
Radionuclides	Americium-241	pCi/g	---	---	---	---	---	---	---	21500	3890	---	---	---	21500	---	3890	3890	---	3890	Benchmark
	Antimony-125	pCi/g	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Carbon-14	pCi/g	---	---	---	---	---	---	---	60700	4760	---	---	---	60700	---	4760	4760	---	4760	Benchmark
	Cesium-134	pCi/g	---	---	---	---	---	---	---	1090	11.3	---	---	---	1090	---	11.3	11.3	---	11.3	Benchmark
	Cesium 137	pCi/g	---	---	---	---	---	---	---	2210	20.8	---	---	---	2210	---	20.8	20.8	1.05	20.8	Benchmark
	Cobalt-60	pCi/g	---	---	---	---	---	---	---	6130	692	---	---	---	6130	---	692	692	0.00842	692	Benchmark
	Curium-244	pCi/g	---	---	---	---	---	---	---	153000	4060	---	---	---	153000	---	4060	4060	---	4060	Benchmark
	Europium-152	pCi/g	---	---	---	---	---	---	---	14700	1520	---	---	---	14700	---	1520	1520	---	1520	Benchmark
	Europium-154	pCi/g	---	---	---	---	---	---	---	12500	1290	---	---	---	12500	---	1290	1290	0.0334	1290	Benchmark
	Europium-155	pCi/g	---	---	---	---	---	---	---	153000	15800	---	---	---	153000	---	15800	15800	0.0539	15800	Benchmark
	Hydrogen-3 (tritium)	pCi/g	---	---	---	---	---	---	---	1680000	174000	---	---	---	1680000	---	174000	174000	---	174000	Benchmark
	Neptunium-237	pCi/g	---	---	---	---	---	---	---	8150	3860	---	---	---	8150	---	3860	3860	---	3860	Benchmark
	Nickel-63	pCi/g	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Plutonium-238	pCi/g	---	---	---	---	---	---	---	17500	5270	---	---	---	17500	---	5270	5270	0.00378	5270	Benchmark
	Plutonium-239/240	pCi/g	---	---	---	---	---	---	---	12700	6110	---	---	---	12700	---	6110	6110	0.0248	6110	Benchmark
	Radium-226	pCi/g	---	---	---	---	---	---	---	288	50.6	---	---	---	288	---	50.6	50.6	0.815	50.6	Benchmark
	Radium-228	pCi/g	---	---	---	---	---	---	---	245	43.9	---	---	---	245	---	43.9	43.9	---	43.9	Benchmark
	Strontium 90	pCi/g	---	---	---	---	---	---	---	3580	22.5	---	---	---	3580	---	22.5	22.5	0.178	22.5	Benchmark
	Technetium-99	pCi/g	---	---	---	---	---	---	---	21900	4490	---	---	---	21900	---	4490	4490	---	4490	Benchmark
	Thorium-232	pCi/g	---	---	---	---	---	---	---	23500	1510	---	---	---	23500	---	1510	1510	1.32	1510	Benchmark
	Uranium-234	pCi/g	---	---	---	---	---	---	---	51600	5130	---	---	---	51600	---	5130	5130	1.1	5130	Benchmark
	Uranium-235	pCi/g	---	---	---	---	---	---	---	27400	2770	---	---	---	27400	---	2770	2770	0.109	2770	Benchmark
	Uranium-238	pCi/g	---	---	---	---	---	---	---	15700	1580	---	---	---	15700	---	1580	1580	1.06	1580	Benchmark
Metals	Aluminum	mg/kg	Narrative Statement				OSWER Dir. 9285.7-60	50	---	---	---	50	---	---	50	---	---	50	11800	11800	Background
	Antimony	mg/kg	---	78	---	0.27	OSWER Dir. 9285.7-61	5	---	---	---	5	---	---	5	78	0.27	0.27	5	5	Background
	Arsenic, Total all valence states	mg/kg	18	---	43	46	OSWER Dir. 9285.7-62	10	60	---	---	---	---	---	10	60	43	10	6.47	10	Benchmark
	Arsenic (III)	mg/kg	---	---	---	---	---	---	---	---	---	---	---	7	---	---	7	7	---	7	Benchmark
	Arsenic (V)	mg/kg	---	---	---	---	---	---	---	---	---	10	60	132	10	60	132	10	---	10	Benchmark
	Barium	mg/kg	---	330	---	2000	OSWER Dir. 9285.7- 63	500	---	---	---	500	---	102	500	330	102	102	132	132	Background
	Beryllium	mg/kg	---	40	---	21	OSWER Dir. 9285.7- 64	10	---	---	---	10	---	---	10	40	21	10	1.51	10	Benchmark
	Bismuth	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Boron	mg/kg	---	---	---	---	---	0.5	---	---	---	0.5	---	---	0.5	---	---	0.5	3.62	3.62	Background
	Cadmium	mg/kg	32	140	0.77	0.36	OSWER Dir. 9285.7-65	4	20	---	---	4	20	14	4	20	0.36	0.36	0.81	0.81	Background
	Chromium (total) [c,d]	mg/kg	---	---	26	34	OSWER Dir. 9285.7- 66	1	0.4	---	---	42	42	67	1	0.4	26	0.4	18.5	18.5	Background
	Chromium (+3)	mg/kg	---	---	26	34	OSWER Dir. 9285.7- 66	1	0.4	---	---	42	42	67	1	0.4	26	0.4	---	0.4	Benchmark
	Chromium (+6)	mg/kg	---	---	---	130	OSWER Dir. 9285.7- 66	---	---	---	---	---	---	---	---	---	130	130	---	130	Benchmark
	Cobalt	mg/kg	13	---	120	230	OSWER Dir. 9285.7-67	20	---	---	---	20	---	---	13	---	120	13	15.7	15.7	Background
	Copper	mg/kg	70	80	28	49	OSWER Dir. 9285.7-68	100	50	---	---	100	50	217	70	50	28	28	22	28	Benchmark
	Lead	mg/kg	120	1700	11	56	OSWER Dir. 9285.7-70	50	500	---	---	50	500	118	50	500	11	11	10.2	11	Benchmark
	Lithium [d]	mg/kg	---	---	---	---	---	2	---	---	---	35	---	---	2	---	---	2	33.5	33.5	Background
	Manganese [d]	mg/kg	220	450	4300	4000	OSWER Dir. 9285.7-71	500	---	---	---	1100	---	1500	220	450	1500	220	512	512	Background
	Mercury	mg/kg	---	---	---	---	---	0.3	0.1	---	---	0.3	0.1	5.5	0.3	0.1	5.5	0.1	0.33	0.33	Background
	Molybdenum	mg/kg	---	---	---	---	---	2	---	---	---	2	---	7	2	---	7	2	6	6	Background
	Nickel	mg/kg	38	280	210	130	OSWER Dir. 9285.7-76	30	200	---	---	30	200	980	30	200	130	30	19.1	30	Benchmark
	Selenium	mg/kg	0.52	4.1	1.2	0.63	OSWER Dir. 9285.7-72	1	70	---	---	1	70	0.3	0.52	4.1	0.3	0.3	0.78	0.78	Background
	Silver	mg/kg	560	---	4.2	14	OSWER Dir. 9285.7-77	2	---	---	---	2	---	---	2	---	4.2	2	0.73	2	Benchmark
	Strontium	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Thallium	mg/kg	---	---	---	---	---	1	---	---	---	1	---	---	1	---	---	1	0.209	1	Benchmark
	Tin	mg/kg	---	---	---	---	---	50	---	---	---	50	---	---	50	---	---	50	---	50	Benchmark
	Uranium	mg/kg	---	---	---	---	---	5	---	---	---	5	---	---	5	---	---	5	3.21	100[f]	Benchmark
	Vanadium	mg/kg	---	---	7.8	280	OSWER Dir. 9285.7-75	2	---	---	---	2	---	---	2	---	7.8	2	85.1	85.1	Background
	Zinc [d]	mg/kg	160	120	46	79	OSWER Dir. 9285.7-73	50	200	---	---	86	200	360	50	120	46	46	67.8	67.8	Background
General Inorganics	Ammonia/Ammonium	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	9.23	9.23	Background
	Chloride	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	100	100	Background
	Cyanide	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Fluoride	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2.81	2.81	Background
	Iodine	mg/kg	---	---	---	---	---	4	---	---	---	4	---	---	4	---	---	4	---	4	Benchmark
	Nitrate/Nitrite	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	52	52	Background
	Phosphate	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.785	0.785	Background
	Sulfate/Sulfite	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	237	237	Background
	Total Organic Carbon	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Table 6-1. Summary of Generic Screening Levels in Soil

Group	Soil Constituent	Units	EPA EcoSSLs					ORNL - ES/ER/TM-85/R3, ES/ER/TM-126/R2		DOE BCGs		Washington Dept. of Ecology - MTCA (WAC 173-340, Table 749-3)			Lowest Screening Benchmark by Receptor Type				Background Soil Concentrations [a]	Literature-derived Generic Screening Level [b]	Basis
			Plants	Invertebrate	Avian	Mammalian	Reference	Plants	Invertebrate	Terrestrial Plant	Terrestrial Animal	Plant	Soil Biota	Wildlife	Plant	Inverts	Avain, Mammalian, Wildlife	Overall Lowest Screening Benchmark			
Volatile Organics	1,1-dichloroethane	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	1,1-dichloroethene	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	1,1,1-trichloroethane	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	1,1,2-trichloroethane	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	1,1,2,2-tetrachloroethane	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	1,2-dichlorobenzene	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	1,2-dichloroethane (DCA)	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	1,3-dichlorobenzene	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	2-butanone (Methyl Ethyl Ketone/MEK)	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	2-hexanone	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Benzene	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Butanol	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Carbon Tetrachloride	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Chlorobenzene	mg/kg	---	---	---	---	---	---	40	---	---	---	40	---	---	40	---	40	---	40	Benchmark
	Chloroform	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Cis-1,2-dichloroethylene	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Dichloromethane (Methylene Chloride)	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Ethyl Benzene	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Methyl Isobutyl Ketone	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	n-butyl Benzene	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Tetrachloroethylene	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Toluene	mg/kg	---	---	---	---	---	200	---	---	---	200	---	---	200	---	---	200	---	200	Benchmark
	Trans-1,2-dichloroethylene	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Trichloroethylene (TCE)	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Xylene	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/kg	---	29	---	100	OSWER Dir. 9285.7-75	20	---	---	---	20	---	---	20	29	100	20	---	20	Benchmark
	Acenaphthylene	mg/kg	---	29	---	100	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	29	100	29	---	29	Benchmark
	Anthracene	mg/kg	---	29	---	100	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	29	100	29	---	29	Benchmark
	Benzo(a)pyrene	mg/kg	---	18	---	1.1	OSWER Dir. 9285.7-75	---	---	---	---	---	---	12	---	18	1.1	1.1	---	1.1	Benchmark
	Benzo(a)anthracene	mg/kg	---	18	---	1.1	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	18	1.1	1.1	---	1.1	Benchmark
	Benzo(b)fluoranthene	mg/kg	---	18	---	1.1	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	18	1.1	1.1	---	1.1	Benchmark
	Benzo(ghi)perylene	mg/kg	---	18	---	1.1	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	18	1.1	1.1	---	1.1	Benchmark
	Benzo[k]fluoranthene	mg/kg	---	18	---	1.1	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	18	1.1	1.1	---	1.1	Benchmark
	Chrysene	mg/kg	---	18	---	1.1	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	18	1.1	1.1	---	1.1	Benchmark
	Dibenz(ah)anthracene	mg/kg	---	18	---	1.1	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	18	1.1	1.1	---	1.1	Benchmark
	Fluoranthene	mg/kg	---	18	---	1.1	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	18	1.1	1.1	---	1.1	Benchmark
	Fluorene	mg/kg	---	29	---	100	OSWER Dir. 9285.7-75	---	30	---	---	---	30	---	---	29	100	29	---	29	Benchmark
	Indeno[1,2,3-cd]pyrene	mg/kg	---	18	---	1.1	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	18	1.1	1.1	---	1.1	Benchmark
	2-Methylnaphthalene	mg/kg	---	29	---	100	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	29	100	29	---	29	Benchmark
	Naphthalene	mg/kg	---	29	---	100	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	29	100	29	---	29	Benchmark
	Phenanthrene	mg/kg	---	29	---	100	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	29	100	29	---	29	Benchmark
	Pyrene	mg/kg	---	18	---	1.1	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	18	1.1	1.1	---	1.1	Benchmark
	Total PAHs	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Low MW PAHs [e]	mg/kg	---	29	---	100	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	29	100	29	---	29	Benchmark
	High MW PAHs [f]	mg/kg	---	18	---	1.1	OSWER Dir. 9285.7-75	---	---	---	---	---	---	---	---	18	1.1	1.1	---	1.1	Benchmark
Petroleum	Gasoline Range Organics	mg/kg	---	---	---	---	---	---	---	---	---	---	100	5000	---	100	5000	100	---	100	Benchmark
	TPH - diesel	mg/kg	---	---	---	---	---	---	---	---	---	---	200	6000	---	200	6000	200	---	200	Benchmark
	TPH - kerosene	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Semivolatile Organics	Normal paraffin hydrocarbons	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Phenol	mg/kg	---	---	---	---	---	70	30	---	---	70	30		70	30	---	30	---	30	Benchmark
	2-methylphenol (ocresol)	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	4-methylphenol (pcresol)	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	2,4-dinitrotoluene	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Bis[2-ethylhexyl] phthalate [g]	mg/kg	---	---	---	---	---	100	---	---	---	100	---	---	100	---	---	100	---	100	Benchmark
	Polychlorinated Biphenyls (PCB) [h,i]	mg/kg	---	---	---	---	---	40	---	---	---	40	---	0.65	40	---	0.65	0.65	---	0.65	Benchmark
	Aroclor 1016 [h,i]	mg/kg	---	---	---	---	---	40	---	---	---	40	---	0.65	40	---	0.65	0.65	---	0.65	Benchmark
	Aroclor 1221 [h,i]	mg/kg	---	---	---	---	---	40	---	---	---	40	---	0.65	40	---	0.65	0.65	---	0.65	Benchmark
	Aroclor 1232 [h,i]	mg/kg	---	---	---	---	---	40	---	---	---	40	---	0.65	40	---	0.65	0.65	---	0.65	Benchmark
	Aroclor 1242 [h,i]	mg/kg	---	---	---	---	---	40	---	---	---	40	---	0.65	40	---	0.65	0.65	---	0.65	Benchmark
	Aroclor 1248 [h,i]	mg/kg	---	---	---	---	---	40	---	---	---	40	---	0.65	40	---	0.65	0.65	---	0.65	Benchmark
	Aroclor 1254 [h,i]	mg/kg	---	---	---	---	---	40	---	---	---	40	---	0.65	40	---	0.65	0.65	---	0.65	Benchmark

Table 6-1. Summary of Generic Screening Levels in Soil

Group	Soil Constituent	Units	EPA EcoSSLs					ORNL - ES/ER/TM-85/R3, ES/ER/TM-126/R2		DOE BCGs		Washington Dept. of Ecology - MTCA (WAC 173-340, Table 749-3)			Lowest Screening Benchmark by Receptor Type				Background Soil Concentrations [a]	Literature-derived Generic Screening Level [b]	Basis
			Plants	Invertebrate	Avian	Mammalian	Reference	Plants	Invertebrate	Terrestrial Plant	Terrestrial Animal	Plant	Soil Biota	Wildlife	Plant	Inverts	Avain, Mammalian, Wildlife	Overall Lowest Screening Benchmark			
	Aroclor 1260 [h,i]	mg/kg	---	---	---	---	---	40	---	---	---	40	---	0.65	40	---	0.65	0.65	---	0.65	Benchmark
	Aroclor-1262 [h,i, j]	mg/kg	---	---	---	---	---	40	---	---	---	40	---	0.65	40	---	0.65	0.65	---	0.65	Benchmark
Herbicide	Dichloroprop	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pesticide	Aldrin	mg/kg	---	---	---	---	---	---	---	---	---	---	---	0.1	---	---	0.1	0.1	---	0.1	Benchmark
	beta-1,2,3,4,5,6-Hexachlorocyclohexane [k, l]	mg/kg	---	---	---	---	---	---	---	---	---	---	---	6	---	---	6	6	---	6	Benchmark
	alpha-Chlordane [m]	mg/kg	---	---	---	---	---	---	---	---	---	---	1	2.7	---	1	2.7	1	---	1	Benchmark
	gamma-Chlordane [m]	mg/kg	---	---	---	---	---	---	---	---	---	---	1	2.7	---	1	2.7	1	---	1	Benchmark
	Dichlorodiphenyldichloroethylene [n, o]	mg/kg	---	---	0.093	0.021	OSWER Dir. 9285.7-57	---	---	---	---	---	---	0.75	---	---	0.021	0.021	---	0.021	Benchmark
	Dichlorodiphenyltrichloroethane [o]	mg/kg	---	---	0.093	0.021	OSWER Dir. 9285.7-57	---	---	---	---	---	---	0.75	---	---	0.021	0.021	---	0.021	Benchmark
	Dieldrin	mg/kg	---	---	0.022	0.0049	OSWER Dir. 9285.7-56	---	---	---	---	---	---	0.07	---	---	0.0049	0.0049	---	0.0049	Benchmark
	Endosulfan I	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Endosulfan II	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Endosulfan sulfate	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Endrin aldehyde [p]	mg/kg	---	---	---	---	---	---	---	---	---	---	---	0.2	---	---	0.2	0.2	---	0.2	Benchmark
	Methoxychlor	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Notes:

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Ecology Publication 94-06, 2003, Model Toxics Control Act Cleanup Regulation 173-340 WAC, as28 revised, Washington State Department of Ecology, Olympia, Washington.

a. Hanford background soil concentrations is the 90th percentile value. Statewide background (Ecology Publication 94-115) is presented for selected inorganics (antimony and cadmium).

b. The Literature-derived Generic Screening Level is the higher of either the background or the Overall Lowest Screening Benchmark.

c. When Cr (total) not available, the lower of eitherCr+3 or Cr+6 as available were used as a surrogate.

d. MTCA plant and soil biota benchmarks were replaced by Washington state natural background concentration.

e. The Low MW PAHs screening values from EPA (OSWER Directive 9285.7-78) represents the sum of the low molecular weight polyaromatic hydrocarbons (PAHs). For the purposes of this assessment, the benchmark was also applied to the individual low molecular weight PAHs.

f. The High MW PAHs screening values from EPA (OSWER Directive 9285.7-78) represents the sum of the high molecular weight polyaromatic hydrocarbons (PAHs). For the purposes of this assessment, the benchmark was also applied to the individual high molecular weight PAHs.

g. values for diethyl phthalate were used as a surrogate for bis[2-ethylhexyl] phthalate.

h. Aroclor 1254 value was used as surrogate.

i. MTCA values represent screening value for PCB mixtures.

j. MTCA Aroclor 1260 values used as surrogate for Aroclor 1262.

k. Form of HCB not identified in Efroymson et al. (ES/ER/TM-126/R2).

l. MTCA value based on benzene hexachloride, including lindane.

m. MTCA values based on chlordane.

n. DDT values used as a surrogate for DDE.

o. MTCA value based on total DDT/DDE/DDD.

p. MTCA endrin aldehyde values based on endrin.

Acronyms:

--- = Value not available

Table 6-1. Summary of Generic Screening Levels in Soil

Group	Soil Constituent	Units	EPA EcoSSLs					ORNL - ES/ER/TM-85/R3, ES/ER/TM-126/R2		DOE BCGs		Washington Dept. of Ecology - MTCA (WAC 173-340, Table 749-3)			Lowest Screening Benchmark by Receptor Type				Background Soil Concentrations [a]	Literature-derived Generic Screening Level [b]	Basis
			Plants	Invertebrate	Avian	Mammalian	Reference	Plants	Invertebrate	Terrestrial Plant	Terrestrial Animal	Plant	Soil Biota	Wildlife	Plant	Inverts	Avain, Mammalian, Wildlife	Overall Lowest Screening Benchmark			

DOE BCG = United States Department of Energy biota concentration guide. Summary of media screening values (BCGs) for radionuclides at the former McClellan Air Force Base. All values extracted from DOE/EH-0676 or DOE-STD-1153-2002.
EcoSSL = Ecological soil screening level
EPA = United States Environmental Protection Agency
High MW PAHs = High molecular weight polycyclic aromatic hydrocarbons
Low MW PAHs = Low molecular weight polycyclic aromatic hydrocarbons
mg/kg = Milligram per kilogram
MTCA = Model Toxic Control Act
ORNL = Oakridge National Laboratory
pCi/g = Pico Curie per gram
TPH = Total petroleum hydrocarbons

Table 6-2. Exposure Factors for Bird and Mammal Endpoint Species

Assessment Endpoint Functional Group	Endpoint Species	Body Weight (kg)	Notes	Source	Food Intake (kg/kg-bw/d, dw)	Notes	Source	Diet Composition: % of Diet as Mammals/Birds	Diet Composition: % Diet as Invertebrates	Diet Composition: % of Diet as Plants	Diet Composition: Major Food Items	Diet Composition: Source	Diet Composition: % of Diet as Soil	Soil Ingestion Site (kg/kg-(bw/d)[b]	Notes	Source
Granivorous bird	California Quail	**0.18**	Median from multiple studies	Robel, 1969 Roseberry and Klimstra, 1971 Guthery et al., 1988	**0.078**	Average of food ingestion rates over 4 seasons from exposure factors handbook for bobwhite (EPA, 1993). Rate based on diet of commercial game food with only 5 to 10 percent water content; therefore, assumed dry weight.	Koerth and Guthery, 1990	0	0	**100**	Primarily a granivore, but also ingests some animal matter (primarily snails) and green forage. It is assumed this species ingests 100 percent plants (seeds) for screening-level dose calculation purpose.		**6.1**	**0.00476**	Value for mourning dove assumed representative of California Quali. Median soil ingestion rate estimated for mourning dove in Table 3 of the EcoSSL guidance. The median was selected as the best measure of central tendancy that is unbiased by outliners.	OSWER Directive 9285.7 55
Omnivorous bird	Meadowlark	**0.0995**	Median from multiple studies	Wiens and Rotenberry, 1980 Maher, 1979	**0.12**	Allometric estimation for 'omnivorous birds' normalized to kg/kg-bw/d using median body weightsfrom multiple studies	Nagy, 2001[a]	0	**63**	**37**	Ground forager that consumes both plant material (primarily seeds) and invertebrates (primarily arthropods). Percentages represent averages for >1900 meadowlarks studied across North America.	Lanyon, 1994	**2.08**	**0.0025**	Data regarding soil ingestion of western meadowlarks are unavailable. For the purposes of this ERA, it was assumed that soil ingestion for meadowlarks is similar to that derived for the American robin.	Sample and Suter, 1994
Insectivorous bird	Killdeer	**0.0756**	Median from multiple studies	Purdue and Haines, 1977 Stegeman, 1955 Jackson and Jackson, 2000 Dunning, 1993	**0.192**	Allometric estimation for 'Charadriiformes' normalized to kg/kg-bw/d using median body weightsfrom multiple studies	Nagy, 2001[a]	0	**100**	0	Primarily consume terrestrial invertebrates, especially earthworms, grasshoppers, beetles, and snails. Forages in terrestrial and aquatic habitats.	Jackson and Jackson, 2000	**7.3**	**0.0140**	Data regarding soil ingestion of killdeer are unavailable. For the purposes of this ERA, it was assumed that soil ingestion for killdeer is similar to that of the least sandpiper. However, it should be noted that this value is likely somewhat higher than the actual soil ingestion for killdeer because killdeer do not probe in the soil/sediment. Jackson and Jackson (2000) reported grit to be 4.5% by volume of the esophageal contents in 15 killdeer, which suggests that a value of 7.3% may be a conservative estimate.	Beyer et al., 1994
Carnivorous bird	Red-tailed Hawk	**1.179**	Median from multiple studies	Craighead and Craighead,1956 Steenhof,1983 Springer and Osborne,1983	**0.035**	High end estimate (estimate* 1.25) presented in Table 1 of the EcoSSL guidance (EPA, 2007i). Based on empirical ingestion data from Craighead and Craighead (1956)	EPA, 2007i	**100**	0	0	Primarily eat small mammals such as mice, shrews, voles, rabbits, and squirrels, but also eat birds, lizards, snakes, and large insects, depending on availability. Assumed 100 percent small mammal diet for screening-level dose calculation purposes.	EPA,1993	**2.4**	**0.00085**	Median soil ingestion rate estimated for red-tailed hawk in Table 3 of the EcoSSL guidance. The median was selected as the best measure of central tendancy that is unbiased by outliners.	OSWER Directive 9285.7 55
Granivorous mammal	Great Basin pocket mouse	**0.0175**	Median from multiple studies	Scheffer,1938 O'Farrell et al.,1975 Schreiber,1978	**0.123**	Allometric estimation for 'granivorous mammals' normalized to kg/kg-bw/d using mean weight as reported by Scheffer, 1938, O'Farrell et al., 1975, and Schreiber, 1978	Nagy, 2001[a]	0	0	**100**	Diet consists primarily of seeds; however, insects (e.g., insect larvae reported in pocket mice from eastern Washington; Kritzman, 1974) may be consumed in the spring before seeds become available. Diet assumed to be 100 percent plants (seeds) for screening-level dose calculation purpose.	Kritzman,1974	**2**	**0.00246**	Data regarding soil ingestion of granivorous mammals are unavailable. For the purposes of this ERA, it was assumed that soil ingestion for pocket mice is similar to that of the white-footed mouse.	Beyer et al., 1994

Table 6-2. Exposure Factors for Bird and Mammal Endpoint Species

Assessment Endpoint Functional Group	Endpoint Species	Body Weight (kg)	Notes	Source	Food Intake (kg/kg-bw/d, dw)	Notes	Source	Diet Composition: % of Diet as Mammals/Birds	Diet Composition: % Diet as Invertebrates	Diet Composition: % of Diet as Plants	Diet Composition: Major Food Items	Diet Composition: Source	Diet Composition: % of Diet as Soil	Soil Ingestion Site (kg/kg-(bw/d)[b]	Notes	Source
Omnivorous mammal	Deer Mouse	**0.0194**	Median from multiple studies	O'Farrell, et al., 1975 Silva and Downing, 1995	**0.166**	Allometric estimation for 'omnivorous mammals' normalized to kg/kg-bw/d using median body weightsfrom multiple studies	Nagy, 2001[a]	0	**50**	**50**	Diet consists of plant material (primarily seeds) and terrestrial invertebrates (mainly insects). Approximation for diet of deer mice in Colorado over all seasons was 50 percent plants and 50 percent invertebrates.	EPA, 1993	**2**	**0.0033**	Assumed to be similar to the white-footed mouse because of similar dietary and foraging habits.	Beyer et al., 1994
Insectivorous mammal	Grasshopper mouse	**0.0346**	Median from multiple studies	Wied, Maximilian, Prinz zu., 1839 McKinney and Pasley, 1974 BHI-01757	**0.098**	Allometric estimation for 'insectivorous mammals' normalized to kg/kg-bw/d using median body weightsfrom multiple studies	Nagy, 2001[a]	0	**100**	0	Animal material contributed 89 percent of the total food consumed and cultivated grains represented less than 5 percent of the total in the stomach contents of field-trapped grasshopper mice from 90 locations across 13 states. Diet assumed to be 100 percent invertebrates for screening-level dose calculation purposes.	Bailey and Sperry, 1929	**0.9**	**0.00088**	Assumed to be similar to the short-tailed shrew because of similar dietary and foraging habits. Median soil ingestion rate estimated for short-tailed shrew in Table 3 of the EcoSSL guidance. The median was selected as the best measure of central tendancy that is unbiased by outliners.	OSWER Directive 9285.7 55
Carnivorous mammal	Badger	**7.6**	Median from multiple studies	Messick and Hornocker, 1981 Silva and Downing, 1995	**0.0347**	Allometric estimation for 'carnivorous mammals' normalized to kg/kg-bw/d using median body weightsfrom multiple studies	Nagy, 2001[a]	**100**	0	0	Carnivores that primarily eat small rodents (rats, mice, ground squirrels, pocket gophers), thought some reptiles, insects, birds, and carrion are consumed. Assumed 100 percent small mammal diet for screening-level dose calculation puposes.	Long, 1973	**5.2**	**0.00181**	Data regarding soil ingestion of badgers are unavailable. Because the badger is a burrowing mammal, soil ingestion may be similar to that of the prairie dog. It was assumed that the median soil ingestion of the two prairie dog species with available data (2.7 and 7.7 percent) would be representative of the badger.	Beyer et al., 1994

Notes:
Bold and underlined text indicates life-history parameters that were used in the initial screening exposure calculations.
a. Nagy (2001) regression equation format --> dry matter g/day/g body weight = *a* (grams body weight)^{b} /g body weight
b. Soil ingestion is equal to the percent soil in diet multiplied by the food ingestion rate as follows: soil ingestion = (percent soil/100* food ingestion rate)
BW = body weight
DW = dry weight
EPA = United States Environmental Protection Agency

Group	***a***	***b***
Birds		
omnivorous birds	0.670	0.627
Galliformes	0.088	0.891
Charadriiformes	0.522	0.769
Mammals		
carnivorous mammals	0.153	0.834
granivorous mammals	0.659	0.413
insectivorous mammals	0.373	0.622

Table 6-3. Body Weight Data for Selected Bird and Mammal Endpoint Species

					Summary Statistics			
Receptor Species	**Body Weight (kg)**	**Notes**	**Additional Information**	**References**	**Minimum**	**Median**	**Mean**	**Maximum**
California Quail	0.1899	A B fall		Robel, 1969	0.154	0.180	0.174	0.194
	0.1939	A B winter		Robel, 1969				
	0.19	A B spring		Robel, 1969				
	0.181	M winter		Roseberry and Klimstra, 1971				
	0.163	M summer		Roseberry and Klimstra, 1971				
	0.183	F winter		Roseberry and Klimstra, 1971				
	0.18	F summer		Roseberry and Klimstra, 1971				
	0.161	M winter		Guthery et al., 1988				
	0.154	M summer		Guthery et al., 1988				
	0.157	F winter		Guthery et al., 1988				
	0.157	F summer		Guthery et al., 1988				
Western Meadowlark	0.0894	F, N=32		Wiens and Rotenberry, 1980	0.0894	0.0995	0.100925	0.1153
	0.106	M, N=51		Wiens and Rotenberry, 1980				
	0.1153	M, N=76		Maher, 1979				
	0.093	F, N=53		Maher, 1979				
Killdeer	0.0711	N=1		Purdue and Haines, 1977	0.0711	0.0756	0.0895	0.1218
	0.1218	M, N=1		Stegeman, 1955				
	0.0756	M, N=2		Jackson and Jackson, 2000				
	0.095	M, F; weighted mean of males and females from the Great Plains		Dunning, 1993				
Red-tailed Hawk	1.224	F, N=100		Craighead and Craighead, 1956	0.957	1.179	1.13366667	1.235
	1.028	M, N=108		Craighead and Craighead, 1956				
	1.154	F		Steenhof, 1983				
	0.957	M		Steenhof, 1983				
	1.235	F		Springer and Osborne, 1983				
	1.204	M		Springer and Osborne, 1983				
Great Basin Pocket Mouse	0.0174	M, N=18	average weight of males at 500 ft elevation, Rattlesnake Mtn, WA	O'Farrell et al., 1975	0.0143	0.01745	0.0172	0.0191
	0.0183	M, N=12	average weight of males at 1,500 ft elevation, Rattlesnake Mtn, WA	O'Farrell et al., 1975				
	0.0176	M, N=11	average weight of males at 2,500 ft elevation, Rattlesnake Mtn, WA	O'Farrell et al., 1975				
	0.0191	M, N=12	average weight of males at 3,500 ft elevation, Rattlesnake Mtn, WA	O'Farrell et al., 1975				
	0.0175	M, N=10	avg measurements 10 individuals each sex, measured near Kennewick, WA	Scheffer, 1938				
	0.0143	F, N=10	avg measurements 10 individuals each sex, measured near Kennewick, WA	Scheffer, 1938				
	0.0174	M, N=4	mean of adult mean weights collected at Hanford	Schreiber, 1978 (Table 4)				
	0.016	F, N=4	mean of adult mean weights collected at Hanford	Schreiber, 1978 (Table 4)				
Deer Mouse	0.0217	M, N=2	average weight of males at 500 ft elevation, Rattlesnake Mtn, WA	O'Farrell, 1975	0.0166	0.01935	0.01936667	0.0217
	0.018	M, N=2	average weight of males at 1,500 ft elevation, Rattlesnake Mtn, WA	O'Farrell, 1975				
	0.0212	M, N=6	average weight of males at 2,500 ft elevation, Rattlesnake Mtn, WA	O'Farrell, 1975				
	0.0203	M, N=11	average weight of males at 3,500 ft elevation, Rattlesnake Mtn, WA	O'Farrell, 1975				
	0.0184	M	mean weight for species Washoe County Nevada	O'Farrell, 1978				
	0.0166	Mean of males and females from Washington		Silva and Downing, 1995				

Table 6-3. Body Weight Data for Selected Bird and Mammal Endpoint Species

					Summary Statistics			
Receptor Species	**Body Weight (kg)**	**Notes**	**Additional Information**	**References**	**Minimum**	**Median**	**Mean**	**Maximum**
Grasshopper Mouse	0.026	Low end of range		Wied, Maximilian and Prinz zu, 1841	0.026	0.0346	0.03406	0.049
	0.049	High end of range		Wied, Maximilian and Prinz zu, 1841				
	0.0347	F, N=9, 60 to 80 days	control mice receiving saline	McKinney and Pasley, 1974				
	0.0346	F, N=13, 100 to 108 days	control mice receiving saline	McKinney and Pasley, 1974				
	0.026	Mitchell, R., pers com		BHI-01757				
Badger	7.6	M, N=10		Messick and Hornocker, 1981, Appendix K	6.7	7.6	8.09888889	10.9
	8.8	M, N=61		Messick and Hornocker, 1981, Appendix K				
	9.8	M, N=64		Messick and Hornocker ,1981, Appendix K				
	10.9	M, N=1		Messick and Hornocker ,1981, Appendix K				
	6.9	F, N=20		Messick and Hornocker, 1981, Appendix K				
	6.7	F, N=60		Messick and Hornocker, 1981, Appendix K				
	7.2	F, N=47		Messick and Hornocker, 1981, Appendix K				
	7.8	F, N=9		Messick and Hornocker, 1981, Appendix K				
	7.19	Mean of males and females		Silva and Downing, 1995				

A = Adult
B = Both (Male and Female)
F = Female
M = Male
N = Number

Table 6-4. Biotransfer Factors and Regression Models Used for Refined Tier 1 PRG Calculations

Soil to Plants								
	Regression Models[a]					Bioaccumulation Factors		
Analyte	B0	B1	p-value	Source	Notes[b]	BAF	Source	Notes[b]
Americium-241						**0.00496**	Beresford et al., 2008	CR review
Antimony-125						**0.025**	Beresford et al., 2008	From Coughtrey et al. (1983) suggested value for natural vegetation (A.A. Balkema Vol. 3); Note one CR review value of CR=41
Carbon-14						**890**	Beresford et al., 2008	Specific activity model; FASSET
Cesium-134						**0.693425575**	Beresford et al., 2008	CR review
Cesium 137						**0.693425575**	Beresford et al., 2008	CR review
Cobalt-60						**0.0135**	Beresford et al., 2008	IAEA TRS364 value for grass
Curium-244						**0.000275**	Beresford et al., 2008	IAEA TRS364 value for grass
Europium-152						**0.00519802**	Beresford et al., 2008	Estimated from stable concs. in soils & angiosperms values presented Coughtrey and Thorne (1983; A.A. Balkema Vol. 1)
Europium-154						**0.00519802**	Beresford et al., 2008	Estimated from stable concs. in soils & angiosperms values presented Coughtrey and Thorne (1983; A.A. Balkema Vol. 1)
Europium-155						**0.00519802**	Beresford et al., 2008	Estimated from stable concs. in soils & angiosperms values presented Coughtrey and Thorne (1983; A.A. Balkema Vol. 1)
Hydrogen-3 (tritium)						**150**	Beresford et al., 2008	Specific activity model; FASSET
Neptunium-237						**0.01725**	Beresford et al., 2008	IAEA TRS363 value for grass
Nickel-63						**0.1875**	Beresford et al., 2008	CR review
Plutonium-238						**0.014425378**	Beresford et al., 2008	CR review; note some reviews report values in range 10-2 - 10-8 but present data in manner which cannot be used. Primary source here is Sheppard review of IUR data
Plutonium-239/240						**0.014425378**	Beresford et al., 2008	CR review; note some reviews report values in range 10-2 - 10-8 but present data in manner which cannot be used. Primary source here is Sheppard review of IUR data
Radium-226						**0.039440524**	Beresford et al., 2008	CR review
Radium-228						**0.039440524**	Beresford et al., 2008	CR review
Strontium 90						**0.206811821**	Beresford et al., 2008	CR review
Technetium-99						**20.00829611**	Beresford et al., 2008	CR review
Thorium-232						**0.043740981**	Beresford et al., 2008	CR review
Uranium-234						**0.0145507**	Beresford et al., 2008	CR review
Uranium-235						**0.0145507**	Beresford et al., 2008	CR review
Uranium-238						**0.0145507**	Beresford et al., 2008	CR review
Aluminum						**0.00287**	BJC/OR-133	Median - Table D-1 validation data
Antimony	**-3.233**	**0.938**	**0.0001**	OSWER Directive 9285.7 55	Derived from measured data in Appendix A	0.0102	BJC/OR-133	Median - Table D-1 validation data
Arsenic, Total all valence states	**-1.992**	**0.564**	**0.0001**	BJC/OR-133	Single variable regression; EcoSSLs used BAF	0.0375	BJC/OR-133	Median - Table 6; cited in OSWER Directive 9285.7 55
Arsenic (III)	**-1.992**	**0.564**	**0.0001**	BJC/OR-133	Single variable regression; EcoSSLs used BAF	0.0375	BJC/OR-133	Median - Table 6; cited in OSWER Directive 9285.7 55
Arsenic (V)	**-1.992**	**0.564**	**0.0001**	BJC/OR-133	Single variable regression; EcoSSLs used BAF	0.0375	BJC/OR-133	Median - Table 6; cited in OSWER Directive 9285.7 55
Barium						**0.156**	BJC/OR-133	Median - Table D-1 validation data; cited in OSWER Directive 9285.7 55
Beryllium	**-0.5361**	**0.7345**	**0.0001**	OSWER Directive 9285.7 55	Derived from measured data in Appendix A			
Bismuth						**0.005**	ORNL-5786	Figure 2.2
Boron						**5.714**	USACHPPM, 2004	Median - Table 4-6 leaf tissue
Cadmium	**-0.476**	**0.546**	**0.0001**	BJC/OR-133	Cited in OSWER Directive 9285.7 55 (Table 4a)	0.586	BJC/OR-133	Median - Table 6
Chromium (total)						**0.041**	BJC/OR-133	Median - Table D-1 validation data; cited in OSWER Directive 9285.7 55
Chromium (+3)						**0.041**	BJC/OR-133	Median - Table D-1 validation data; cited in OSWER Directive 9285.7 55
Chromium (+6)						**0.041**	BJC/OR-133	Median - Table D-1 validation data; cited in OSWER Directive 9285.7 55
Cobalt						**0.00745**	BJC/OR-133	Median - Table D-1 validation data; cited in OSWER Directive 9285.7 55
Copper	**0.669**	**0.394**	**0.0001**	BJC/OR-133	Cited in OSWER Directive 9285.7 55 (Table 4a)	0.124	BJC/OR-133	Median - Table 6
Lead	**-1.328**	**0.561**	**0.0001**	BJC/OR-133	Cited in OSWER Directive 9285.7 55 (Table 4a)	0.0389	BJC/OR-133	Median - Table 6
Lithium						**0.004**	ORNL-5786	Figure 2.2
Manganese						**0.0792**	BJC/OR-133	Median - Table D-1 validation data; cited in OSWER Directive 9285.7 55
Mercury	**-0.996**	**0.544**	**0.0001**	BJC/OR-133	Single variable regression	0.0652	BJC/OR-133	Median - Table 6
Molybdenum						**1.2504**	USACHPPM, 2004	Median - Table 4-6 leaf tissue
Nickel	**-2.224**	**0.748**	**0.0001**	BJC/OR-133	Cited in OSWER Directive 9285.7 55 (Table 4a)	0.018	USACHPPM, 2004	Median - Table 6

Table 6-4. Biotransfer Factors and Regression Models Used for Refined Tier 1 PRG Calculations

Soil to Plants								
	Regression Models[a]					Bioaccumulation Factors		
Analyte	B0	B1	p-value	Source	Notes[b]	BAF	Source	Notes[b]
Selenium	**-0.678**	**1.104**	**0.0001**	BJC/OR-133	Cited in OSWER Directive 9285.7 55 (Table 4a)	0.672	USACHPPM, 2004	Median - Table 6
Silver						**0.014**	BJC/OR-133	Median - Table D-1 validation data
Strontium						**0.207**	Beresford et al., 2008	CR review
Thallium						**0.004**	ORNL-5786	Figure 2.2
Tin						**1**	Default	
Uranium						**0.021**	USACHPPM, 2004	Median - Table 4-6 leaf tissue
Vanadium						**0.00485**	BJC/OR-133	Median - Table D-1 validation data
Zinc	**1.575**	**0.555**	**0.0001**	BJC/OR-133	Cited in OSWER Directive 9285.7 55 (Table 4a)	0.366	BJC/OR-133	Median - Table 6
Ammonia/Ammonium								
Chloride								
Cyanide								
Fluoride						**0.006**	ORNL-5786	Figure 2.2
Iodine						**0.05**	ORNL-5786	Figure 2.2
Nitrate/Nitrite								
Phosphate								
Sulfate/Sulfite								
Total Organic Carbon								
1,1-dichloroethane							OSWER Directive 9285.7-55	Kow (1.79) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
1,1-dichloroethene							OSWER Directive 9285.7-55	Kow (2.13) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
1,1,1-trichloroethane							OSWER Directive 9285.7-55	Kow (2.48) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
1,1,2-trichloroethane							OSWER Directive 9285.7-55	Kow (2.05) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
1,1,2,2-tetrachloroethane							OSWER Directive 9285.7-55	Kow (2.39) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
1,2-dichlorobenzene						**2.45**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 3.43 (EPA, 1995)
1,2-dichloroethane (DCA)							OSWER Directive 9285.7-55	Kow (1.47) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
1,3-dichlorobenzene						**2.23**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 3.53 (EPA, 2010)c
2-butanone (Methyl Ethyl Ketone/MEK)							OSWER Directive 9285.7-55	Kow (0.29) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
2-hexanone							OSWER Directive 9285.7-55	Kow (1.38) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
Benzene							OSWER Directive 9285.7-55	Kow (2.13) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
Butanol							OSWER Directive 9285.7-55	Kow (0.8) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
Carbon Tetrachloride							OSWER Directive 9285.7-55	Kow (2.73) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
Chlorobenzene							OSWER Directive 9285.7-55	Kow (2.86) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
Chloroform							OSWER Directive 9285.7-55	Kow (1.92) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
Cis-1,2-dichloroethylene							OSWER Directive 9285.7-55	Kow (1.86) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
Dichloromethane (Methylene Chloride)							OSWER Directive 9285.7-55	Kow (1.25) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
Ethyl Benzene						**3.21**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 3.14 (EPA, 1995)
Methyl Isobutyl Ketone							OSWER Directive 9285.7-55	Kow (1.19) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
n-butyl Benzene						**1.67**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 3.84 (EPA, 2010)c

Table 6-4. Biotransfer Factors and Regression Models Used for Refined Tier 1 PRG Calculations

Soil to Plants								
	Regression Models[a]					Bioaccumulation Factors		
Analyte	B0	B1	p-value	Source	Notes[b]	BAF	Source	Notes[b]
Tetrachloroethylene							OSWER Directive 9285.7-55	Kow (2.67) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
Toluene							OSWER Directive 9285.7-55	Kow (2.75) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
Trans-1,2-dichloroethylene							OSWER Directive 9285.7-55	Kow (2.07) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
Trichloroethylene (TCE)							OSWER Directive 9285.7-55	Kow (2.71) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
Xylene						**3.43**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 3.07 (EPA, 1995)
Acenaphthene	**-5.562**	**-0.8556**	**NR**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
Acenaphthylene	**-1.144**	**0.791**	**NR**	OSWER Directive 9285.7-55	Modeled using the rinsed PAH-specific equation			
Anthracene	**-0.9887**	**0.7784**	**NR**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
Benzo(a)pyrene	**-2.0615**	**0.975**	**NR**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
Benzo(a)anthracene	**-2.7078**	**0.5944**	**NR**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
Benzo(b)fluoranthene						**0.31**	OSWER Directive 9285.7-55	Median BAF calculated from measured data in Appendix C
Benzo(ghi)perylene	**-0.9313**	**1.1829**	**NR**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
Benzo[k]fluoranthene	**-4.6482**	**0.1668**	**NR**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
Chrysene	**-2.7078**	**0.5944**	**NR**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
Dibenz(ah)anthracene						**0.13**	OSWER Directive 9285.7-55	Median BAF calculated from measured data in Appendix C
Fluoranthene						**0.5**	OSWER Directive 9285.7-55	Median BAF calculated from measured data in Appendix C
Fluorene	**-5.562**	**-0.8556**	**NR**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
Indeno[1,2,3-cd]pyrene						**0.11**	OSWER Directive 9285.7-55	Median BAF calculated from measured data in Appendix C
2-Methylnaphthalene	**-1.3205**	**4.544**	**NR**	OSWER Directive 9285.7-55	Based on LMW PAH rinsed model in Figure 4			
Naphthalene						**12.2**	OSWER Directive 9285.7-55	Median BAF calculated from measured data in Appendix C
Phenanthrene	**-0.1665**	**0.6203**	**NR**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
Pyrene						**0.72**	OSWER Directive 9285.7-55	Median BAF calculated from measured data in Appendix C
Total PAHs	**0.083**	**0.3015**	**NR**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
Low MW PAHs	**-1.3205**	**0.4544**	**0.0001**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
High MW PAHs	**-1.7026**	**0.9469**	**0.0001**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
TPH - Diesel								
TPH - Kerosene								
Normal paraffin hydrocarbons								
Phenol							OSWER Directive 9285.7-55	Kow (1.48) outside of range of Kow-based models for plants (OSWER Directive 9285.7 55); BAF is undefined.
2-methylphenol (ocresol)							OSWER Directive 9285.7-55	Kow (1.99) outside of range of Kow-based models for plants (OSWER Directive 9285.7 55); BAF is undefined.
4-methylphenol (pcresol)							OSWER Directive 9285.7-55	Kow (1.95) outside of range of Kow-based models for plants (OSWER Directive 9285.7 55); BAF is undefined.
2,4-dinitrotoluene	1.873	-0.3768	NR	Tsao and Sample, 2005		**0.376**	Tsao and Sample, 2005	Median BAF for foliage, all plants, from Table 3.3-1
Bis[2-ethylhexyl] phthalate						**0.07**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 7.30 (EPA, 1995)[c]
Total PCBs						**0.17**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 6.29 (EPA, 2010)c
Aroclor 1016						**0.30**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 5.69 (ChemIDPlus Lite)[c]
Aroclor 1221						**0.78**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 4.65 (ChemIDPlus Lite)[c]
Aroclor 1232						**0.99**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 4.4 (ChemIDPlus Lite)[c]
Aroclor 1242						**0.16**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 6.34 (ChemIDPlus Lite)[c]
Aroclor 1248						**0.18**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 6.2 (ChemIDPlus Lite)[c]
Aroclor 1254						**0.14**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 6.5 (ChemIDPlus Lite)[c]

Table 6-4. Biotransfer Factors and Regression Models Used for Refined Tier 1 PRG Calculations

Soil to Plants								
	Regression Models[a]					Bioaccumulation Factors		
Analyte	B0	B1	p-value	Source	Notes[b]	BAF	Source	Notes[b]
Aroclor 1260						**0.05**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 7.55 (ChemIDPlus Lite)[c]
Aroclor-1262								
Dichloroprop								
Aldrin						**0.14**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 6.50 (EPA, 1995)[c]
beta-1,2,3,4,5,6-Hexachlorocyclohexane						**1.72**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 3.81 (EPA, 1995)[c]
alpha-Chlordane						**0.16**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 6.32 (EPA, 1995)[c]
gamma-Chlordane						**0.16**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 6.32 (EPA, 1995)[c]
Dichlorodiphenyldichloroethylene	**-2.5119**	**0.7524**	**NR**	OSWER Directive 9285.7-55	Regression model for total DDTs from Table 4b			
Dichlorodiphenyltrichloroethane	**-2.5119**	**0.7524**	**NR**	OSWER Directive 9285.7-55	Regression model for total DDTs from Table 4b			
Dieldrin						**0.41**	OSWER Directive 9285.7-55	Empirical BAF from Table 4b
Endosulfan I						**1.31**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 4.10 (EPA, 1995)[c]
Endosulfan II						**1.31**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 4.10 (EPA, 1995)[c]
Endosulfan sulfate						**1.98**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 4.10 (EPA, 2010)c
Endrin aldehyde						**1.44**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 4 (EPA, 1995)[c]
Methoxychlor						**0.52**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 5.08 (EPA, 1995)[c]
Soil to Terrestrial Invertebrates								
Americium-241						**0.1006**	Beresford et al., 2008	CR review
Antimony-125						**0.2525**	Beresford et al., 2008b	Same as gastropod (most conservative invertebrate CR)
Carbon-14						**430**	Beresford et al., 2008	Assume same as worm
Cesium-134						**0.1341**	Beresford et al., 2008	CR review
Cesium 137						**0.1341**	Beresford et al., 2008	CR review
Cobalt-60						**0.0035**	Beresford et al., 2008	CR review
Curium-244						**0.1374**	Beresford et al., 2008	CR review
Europium-152						**0.0008**	Beresford et al., 2008	Same as soil invertebrate
Europium-154						**0.0008**	Beresford et al., 2008	Same as soil invertebrate
Europium-155						**0.0008**	Beresford et al., 2008	Same as soil invertebrate
Hydrogen-3 (tritium)						**150**	Beresford et al., 2008	Assume same as worm
Neptunium-237						**0.1006**	Beresford et al., 2008	Same as Am gastropod
Nickel-63						**0.0086**	Beresford et al., 2008	CR review
Plutonium-238						**0.0388**	Beresford et al., 2008	CR review
Plutonium-239/240						**0.0388**	Beresford et al., 2008	CR review
Radium-226						**0.0900**	Beresford et al., 2008	CR review
Radium-228						**0.0900**	Beresford et al., 2008	CR review
Strontium 90						**0.4066**	Beresford et al., 2008	CR review
Technetium-99						**0.3700**	Beresford et al., 2008	Assume maximum available value in lack of data
Thorium-232						**0.0088**	Beresford et al., 2008	Assume U Soil invertebrate
Uranium-234						**0.0088**	Beresford et al., 2008	Same as soil invertebrate
Uranium-235						**0.0088**	Beresford et al., 2008	Same as soil invertebrate
Uranium-238						**0.0088**	Beresford et al., 2008	Same as soil invertebrate

Table 6-4. Biotransfer Factors and Regression Models Used for Refined Tier 1 PRG Calculations

Soil to Terrestrial Invertebrates								
	Regression Models[a]					Bioaccumulation Factors		
Analyte	B0	B1	p-value	Source	Notes[b]	BAF	Source	Notes[b]
Aluminum						**0.043**	ES/ER/TM-220	Median - Table C.1
Antimony						**1**	ORNL-5786 cited in EPA 2007i	Assumed earthworm conc = soil conc according to (Table 4a)
Arsenic	**-1.421**	**0.706**	**0.0001**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7-55 (Table 4a)	0.224	ES/ER/TM-220	Median - Table 11
Arsenic (III)	**-1.421**	**0.706**	**0.0001**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7-55 (Table 4a)	0.224	ES/ER/TM-220	Median - Table 11
Arsenic (V)	**-1.421**	**0.706**	**0.0001**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7-55 (Table 4a)	0.224	ES/ER/TM-220	Median - Table 11
Barium						**0.091**	ES/ER/TM-220	Median - Table 11; cited in OSWER Directive 9285.7 55
Beryllium						**0.045**	ES/ER/TM-220	Median - Table C.1; cited in OSWER Directive 9285.7 55
Bismuth						**1**	Default	
Boron						**1**	Default	
Cadmium	**2.114**	**0.795**	**0.0001**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7-55 (Table 4a)	7.708	ES/ER/TM-220	Median - Table 11
Chromium						**0.306**	ES/ER/TM-220	Median - Table 11; cited in OSWER Directive 9285.7 55
Chromium (+3)						**0.306**	ES/ER/TM-220	Median - Table 11; cited in OSWER Directive 9285.7 55
Chromium (+6)						**0.306**	ES/ER/TM-220	Median - Table 11; cited in OSWER Directive 9285.7 55
Cobalt						**0.291**	ES/ER/TM-220	Median - Table 11; cited in OSWER Directive 9285.7 55
Copper	1.675	0.264	0.0001	ES/ER/TM-220	General regression - low r^2	**0.515**	ES/ER/TM-220	Median - Table 11; cited in OSWER Directive 9285.7 55
Lead	**-0.218**	**0.807**	**0.0001**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7 55 (Table 4a)	0.266	ES/ER/TM-220	Median - Table 11
Lithium						**0.046**	ES/ER/TM-220	Median - Table C.1
Manganese	**-0.809**	**0.682**	**0.0002**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7 55 (Table 4a)	0.054	ES/ER/TM-220	Median - Table 11
Mercury	**0.0781**	**0.3369**	**0.0028**	ES/ER/TM-220	General regression, not including validation data	1.693	ES/ER/TM-220	Median - Table 11
Molybdenum						**0.953**	ES/ER/TM-220	Median - Table C.1
Nickel	3.677	-0.26	NR	ES/ER/TM-220	regression not significant	**1.059**	ES/ER/TM-220	Median - Table 11
Selenium	**-0.075**	**0.733**	**0.016**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7 55 (Table 4a)	0.985	ES/ER/TM-220	Median - Table 11
Silver						**2.045**	ES/ER/TM-220	Median - Table C.1; cited in OSWER Directive 9285.7 55
Strontium						**0.4066**	Beresford et al., 2008	CR review
Thallium						**0.0541**	USACHPPM, 2004	Median - Table 4-5 (Insecta)
Tin						**0.08**	ORNL-5786	No data available for invertebrates; assumed to be similar to uptake to small mammals (from Figure 2.25)
Uranium						**0.033**	ES/ER/TM-220	Median - Table C.1
Vanadium						**0.042**	ES/ER/TM-220	Median - Table C.1; cited in OSWER Directive 9285.7 55
Zinc	**4.449**	**0.328**	**0.0001**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7 55 (Table 4a)			
Ammonia/Ammonium								
Chloride								
Cyanide								
Fluoride								
Iodine								
Nitrate/Nitrite								
Phosphate								
Sulfate/Sulfite								
Total Organic Carbon								
1,1-dichloroethane						**1.010**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
1,1-dichloroethene						**1.011**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
1,1,1-trichloroethane						**1.013**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
1,1,2-trichloroethane						**1.010**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e

Table 6-4. Biotransfer Factors and Regression Models Used for Refined Tier 1 PRG Calculations

Soil to Terrestrial Invertebrates								
	Regression Models[a]					Bioaccumulation Factors		
Analyte	B0	B1	p-value	Source	Notes[b]	BAF	Source	Notes[b]
1,1,2,2-tetrachloroethane						**1.013**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
1,2-dichlorobenzene						**1.018**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
1,2-dichloroethane (DCA)						**0.988**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
1,3-dichlorobenzene						**1.018**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
2-butanone (Methyl Ethyl Ketone/MEK)						**0.094**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
2-hexanone						**0.207**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
Benzene						**1.011**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
Butanol						**0.478**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
Carbon Tetrachloride						**1.015**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
Chlorobenzene						**1.015**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
Chloroform						**1.011**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
Cis-1,2-dichloroethylene						**1.011**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
Dichloromethane (Methylene Chloride)						**1.007**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
Ethyl Benzene						**1.016**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
Methyl Isobutyl Ketone						**0.197**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
n-butyl Benzene						**1.022**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
Tetrachloroethylene						**1.018**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
Toluene						**1.014**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
Trans-1,2-dichloroethylene						**1.011**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
Trichloroethylene (TCE)						**1.012**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
Xylene						**1.016**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPA, 2010e
Acenaphthene						**1.470**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
Acenaphthylene						**22.9**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
Anthracene						**2.42**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
Benzo(a)pyrene						**1.33**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
Benzo(a)anthracene						**1.59**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
Benzo(b)fluoranthene						**2.6**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
Benzo(ghi)perylene						**2.94**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
Benzo[k]fluoranthene						**2.6**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
Chrysene						**2.29**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
Dibenz(ah)anthracene						**2.31**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
Fluoranthene						**3.04**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
Fluorene						**9.57**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
Indeno[1,2,3-cd]pyrene						**2.86**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
2-Methylnaphthalene						**1.020**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow
Naphthalene						**4.4**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
Phenanthrene						**1.72**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]

Table 6-4. Biotransfer Factors and Regression Models Used for Refined Tier 1 PRG Calculations

Analyte	Regression Models[a]					Bioaccumulation Factors		
	B0	B1	p-value	Source	Notes[b]	BAF	Source	Notes[b]
Soil to Terrestrial Invertebrates								
Pyrene						**1.75**	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
Total PAHs								
Low MW PAHs								
High MW PAHs								
TPH - Diesel								
TPH - Kerosene								
Normal paraffin hydrocarbons								
Phenol						**0.235**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow
2-methylphenol (ocresol)						**0.336**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow
4-methylphenol (pcresol)						**0.333**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow
2,4-dinitrotoluene						**0.184**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow
Bis[2-ethylhexyl] phthalate						**41.144**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow
Total PCBs	**1.41**	**1.36**	**0.0001**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
Aroclor 1016	**1.41**	**1.36**	**0.0001**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
Aroclor 1221	**1.41**	**1.36**	**0.0001**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
Aroclor 1232	**1.41**	**1.36**	**0.0001**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
Aroclor 1242	**1.41**	**1.36**	**0.0001**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
Aroclor 1248	**1.41**	**1.36**	**0.0001**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
Aroclor 1254	**1.41**	**1.36**	**0.0001**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
Aroclor 1260	**1.41**	**1.36**	**0.0001**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
Aroclor-1262								
Dichloroprop								
Aldrin						**1.033**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7 55 and log Koc and Kow
beta-1,2,3,4,5,6-Hexachlorocyclohexane						**1.021**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7 55 and log Koc and Kow
alpha-Chlordane						**1.031**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7 55 and log Koc and Kow
gamma-Chlordane						**1.036**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7 55 and log Koc and Kow
Dichlorodiphenyldichloroethylene	**2.4771**	**0.8804**	**0.0001**	OSWER Directive 9285.7-55	Regression derived from measured data			
Dichlorodiphenyltrichloroethane	**2.1247**	**0.8689**	**0.0001**	OSWER Directive 9285.7-55	Regression derived from measured data			
Dieldrin						**14.70**	OSWER Directive 9285.7-55	Median BAF
Endosulfan I						**1.184**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7 55 and log Koc and Kow
Endosulfan II						**1.184**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7 55 and log Koc and Kow
Endosulfan sulfate						**1.184**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7 55 and log Koc and Kow
Endrin aldehyde						**6.686**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7 55 and log Koc and Kow
Methoxychlor						**3.739**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7 55 and log Koc and Kow
Soil to Small Mammal								
Americium-241						**0.041**	Beresford et al., 2008	CR review
Antimony-125						**2.1465E-06**	Beresford et al., 2008	Constant dietary CR [assume shrub diet] Beresford et al., 2004
Carbon-14						**1340**	Beresford et al., 2008	Specific activity model; FASSET
Cesium-134						**2.87**	Beresford et al., 2008	CR review - reindeer data not included
Cesium 137						**2.87**	Beresford et al., 2008	CR review - reindeer data not included
Cobalt-60						**0.30**	Beresford et al., 2008	CR review
Curium-244						**0.041**	Beresford et al., 2008	Assume Am mammal
Europium-152						**0.002**	Beresford et al., 2008	Allometric prediction using USDoE (EPIC vole parameters, grass CR of 1E-2)
Europium-154						**0.002**	Beresford et al., 2008	Allometric prediction using USDoE (EPIC vole parameters, grass CR of 1E-2)
Europium-155						**0.002**	Beresford et al., 2008	Allometric prediction using USDoE (EPIC vole parameters, grass CR of 1E-2)
Hydrogen-3 (tritium)						**150**	Beresford et al., 2008	Specific activity model; FASSET
Neptunium-237						**0.041**	Beresford et al., 2008	Same as Am mammal
Nickel-63						**0.072**	Beresford et al., 2008	CR review but based on stable Ni concentrations in mammalian tissues and 'general' soil concentrations FWCR = 3.87e-3 (in: Coughtrey and Thorne, 1983, A.A. Balkema, Vol. 2). Note 1 study gives high conc. in bone which may increase CR circa 10x)

Table 6-4. Biotransfer Factors and Regression Models Used for Refined Tier 1 PRG Calculations

Soil to Small Mammal								
	Regression Models[a]					Bioaccumulation Factors		
Analyte	B0	B1	p-value	Source	Notes[b]	BAF	Source	Notes[b]
Plutonium-238						**0.023**	Beresford et al., 2008	CR review
Plutonium-239/240						**0.023**	Beresford et al., 2008	CR review
Radium-226						**0.027**	Beresford et al., 2008	CR review - reindeer data not included
Radium-228						**0.027**	Beresford et al., 2008	CR review - reindeer data not included
Strontium 90						**1.74**	Beresford et al., 2008	CR review - reindeer data not included
Technetium-99						**0.37**	Beresford et al., 2008	FASTer prediction
Thorium-232						**0.00012**	Beresford et al., 2008	CR review
Uranium-234						**0.00011**	Beresford et al., 2008	CR review
Uranium-235						**0.00011**	Beresford et al., 2008	CR review
Uranium-238						**0.00011**	Beresford et al., 2008	CR review
Aluminum						**0.0263**	ES/ER/TM-219	Median - Table C.1 (general)
Antimony							ORNL-5786 cited in OSWER Directive 9285.7-55	**0.001* 50 * Cdiet (from Table 4a)**
Arsenic	**-4.8471**	**0.8188**	**0.0001**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.0038	ES/ER/TM-219	Median - Table 2 (general)
Arsenic (III)	**-4.8471**	**0.8188**	**0.0001**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.0038	ES/ER/TM-219	Median - Table 2 (general)
Arsenic (V)	**-4.8471**	**0.8188**	**0.0001**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.0038	ES/ER/TM-219	Median - Table 2 (general)
Barium						**0.0168**	ES/ER/TM-219	Median - Table 2 (general); cited in OSWER Directive 9285.7 55
Beryllium							ORNL-5786 cited in OSWER Directive 9285.7-55 (table 4a)	**0.001 * 50 * Cdiet (from Table 4a)**
Bismuth						**1**	Default value	Default Value
Boron						**1**	Default value	Default Value
Cadmium	**-1.2571**	**0.4723**	**0.0001**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - herbivore	0.7568		
Chromium	**-1.4599**	**0.7338**	**0.0001**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.0605	ES/ER/TM-219	Median - Table 2 (general)
Chromium (+3)	**-1.4599**	**0.7338**	**0.0001**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.0605	ES/ER/TM-219	Median - Table 2 (general)
Chromium (+6)	**-1.4599**	**0.7338**	**0.0001**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.0605	ES/ER/TM-219	Median - Table 2 (general)
Cobalt	**-4.4669**	**1.307**	**0.01**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.1000	ES/ER/TM-219	Median - Table 2 (general)
Copper	**2.042**	**0.1444**	**0.0001**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.5999	ES/ER/TM-219	Median - Table 2 (general)
Lead	**0.0761**	**0.4422**	**0.0001**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.1233	ES/ER/TM-219	Median - Table 2 (general)
Lithium						**1**	Default value	Default Value
Manganese						**0.0205**	ES/ER/TM-219	Median - Table C.1 (general)
Mercury						**0.054**	ES/ER/TM-219	Median - Table 2 (general)
Molybdenum						**1**	Default value	
Nickel	**-0.2462**	**0.4658**	**0.0001**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.3524	ES/ER/TM-219	Median - Table 2 (general)
Selenium	**-0.4158**	**0.3764**	**0.0026**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.2107	ES/ER/TM-219	Median - Table 2 (general)
Silver						**0.0040**	ES/ER/TM-219	Median - Table C.1 (general)
Strontium						**1.74**	Beresford et al., 2008	CR review - reindeer data not included
Thallium						**0.1124**	ES/ER/TM-219	Median - Table 2 (general)
Tin						**0.08**	ORNL-5786	Figure 2.25
Uranium						**0.0002**	ORNL-5786	Figure 2.25
Vanadium						**0.0123**	ES/ER/TM-219	Median - Table C.1 (general)
Zinc	**4.3632**	**0.0706**	**0.0013**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - herbivore	0.8984	ES/ER/TM-219	Median - Table 2 (general)
Ammonia/Ammonium								
Chloride								
Cyanide								
Fluoride								
Iodine								
Nitrate/Nitrite								
Phosphate								
Sulfate/Sulfite								
Total Organic Carbon								
1,1-dichloroethane						**0.0109**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.79 (EPA, 1995)[d]
1,1-dichloroethene						**0.0186**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.13 (EPA, 1995)[d]

Table 6-4. Biotransfer Factors and Regression Models Used for Refined Tier 1 PRG Calculations

Soil to Small Mammal								
	Regression Models[a]					Bioaccumulation Factors		
Analyte	B0	B1	p-value	Source	Notes[b]	BAF	Source	Notes[b]
1,1,1-trichloroethane						**0.0305**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.48 (EPA, 1995)[d]
1,1,2-trichloroethane						**0.0165**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.05 (EPA, 1995)[d]
1,1,2,2-tetrachloroethane						**0.0270**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.39 (EPA, 1995)[d]
1,2-dichlorobenzene						**0.0882**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 3.43 (EPA, 1995)[d]
1,2-dichloroethane (DCA)						**0.0063**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.47 (EPA, 1995)[d]
1,3-dichlorobenzene						**0.0963**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 3.53 (EPA, 2010)d
2-butanone (Methyl Ethyl Ketone/MEK)						**0.0006**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 0.29 (EPA, 2010)d
2-hexanone						**0.0053**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.38 (EPA, 2010)d
Benzene						**0.0186**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.13 (EPA, 1995)[d]
Butanol						**0.0017**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 0.8 (EPA, 1995)[d]
Carbon Tetrachloride						**0.0420**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.73 (EPA, 1995)[d]
Chlorobenzene						**0.0490**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.86 (EPA, 1995)[d]
Chloroform						**0.0135**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.92 (EPA, 1995)[d]
Cis-1,2-dichloroethylene						**0.0122**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.86 (EPA, 1995)[d]
Dichloromethane (Methylene Chloride)						**0.0042**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.25 (EPA, 1995)[d]
Ethyl Benzene						**0.0666**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 3.14 (EPA, 1995)[d]
Methyl Isobutyl Ketone						**0.0037**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.19 (EPA, 1995)[d]
n-butyl Benzene						**0.1227**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 3.84 (EPA, 2010)d
Tetrachloroethylene						**0.0390**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.79 (EPA, 1995)[d]
Toluene						**0.0430**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.79 (EPA, 1995)[d]
Trans-1,2-dichloroethylene						**0.0170**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.79 (EPA, 1995)[d]
Trichloroethylene (TCE)						**0.0410**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.79 (EPA, 1995)[d]
Xylene						**0.0619**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.79 (EPA, 1995)[d]
Acenaphthene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Acenaphthylene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Anthracene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Benzo(a)pyrene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Benzo(a)anthracene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Benzo(b)fluoranthene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Benzo(ghi)perylene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Benzo[k]fluoranthene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Chrysene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Dibenz(ah)anthracene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Fluoranthene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Fluorene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Indeno[1,2,3-cd]pyrene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible

Table 6-4. Biotransfer Factors and Regression Models Used for Refined Tier 1 PRG Calculations

Soil to Small Mammal								
	Regression Models[a]					Bioaccumulation Factors		
Analyte	B0	B1	p-value	Source	Notes[b]	BAF	Source	Notes[b]
2-Methylnaphthalene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Naphthalene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Phenanthrene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Pyrene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Total PAHs						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Low MW PAHs						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
High MW PAHs						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
TPH - Diesel						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
TPH - Kerosene						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Normal paraffin hydrocarbons						**0**	OSWER Directive 9285.7-55	Assumed to be negligible
Phenol						**0.0064**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.48 (EPA, 1995)[d]
2-methylphenol (ocresol)						**0.0150**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.99 (EPA, 1995)[d]
4-methylphenol (pcresol)						**0.0141**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.95 (EPA, 1995)[d]
2,4-dinitrotoluene						**0.0155**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.01 (EPA, 1995)[d]
Bis[2-ethylhexyl] phthalate						**0.0945**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 7.3 (EPA, 1995)[d]
Total PCBs						**0.1792**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.29 (EPA, 2010)d
Aroclor 1016						**0.2104**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 5.69 (ChemIDPlus Lite)[d]
Aroclor 1221						**0.1883**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 4.65 (ChemIDPlus Lite)[d]
Aroclor 1232						**0.1704**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 4.4 (ChemIDPlus Lite)[d]
Aroclor 1242						**0.1756**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.34 (ChemIDPlus Lite)[d]
Aroclor 1248						**0.1855**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.2 (ChemIDPlus Lite)[d]
Aroclor 1254						**0.1630**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.5 (ChemIDPlus Lite)[d]
Aroclor 1260						**0.0750**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 7.55 (ChemIDPlus Lite)[d]
Aroclor-1262								
Dichloroprop								
Aldrin						**0.1630**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.5 (EPA, 1995)[d]
beta-1,2,3,4,5,6-Hexachlorocyclohexane						**0.1201**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 3.81 (EPA, 1995)[d]
alpha-Chlordane						**0.1771**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.32 (EPA, 1995)[d]
gamma-Chlordane						**0.1771**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.32 (EPA, 1995)[d]
Dichlorodiphenyldichloroethylene	**3.6401**	**0.641**	**0.0001**	OSWER Directive 9285.7-55	Regression derived from measured data [Appendix D]	0.1410	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.76 (EPA, 1995)[d]
Dichlorodiphenyltrichloroethane	**1.1788**	**0.7254**	**0.0001**	OSWER Directive 9285.7-55	Regression derived from measured data [Appendix D]	0.1606	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.53 (EPA, 1995)[d]
Dieldrin						**1.20**	OSWER Directive 9285.7-55	Median BAF

Table 6-4. Biotransfer Factors and Regression Models Used for Refined Tier 1 PRG Calculations

Soil to Small Mammal								
	Regression Models[a]					Bioaccumulation Factors		
Analyte	B0	B1	p-value	Source	Notes[b]	BAF	Source	Notes[b]
Endosulfan I						**0.1455**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 4.1 (EPA, 1995)[d]
Endosulfan II						**0.1455**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 4.1 (EPA, 1995)[d]
Endosulfan sulfate						**0.1072**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 3.66 (EPA, 2010)d
Endrin aldehyde						**0.1368**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 4 (EPA, 1995)[d]
Methoxychlor						**0.2093**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 5.08 (EPA, 1995)[d]

a. Regression models are in the form of LN(plant, invertebrate, or small mammal concentration) = B0 + B1(LN (soil concentration).

b. Notes refer to tables and appendices in the cited references, not tables or appendices of this report.

c. BAFs for uptake of organics with log Kows between 3 and 8 to plants were derived using log BAF = -0.4057*(logKow)+1.781 (rinsed plants, OSWER Directive 9285.7 55).

d. BAFs for uptake of organics to small mammals were derived using log BAF = $-0.099(\log Kow)^2 + 1.07(\log Kow) - 3.56$; this regression is for uptake to fat and represents the lipid concentration rather than whole body.

e. BAFs for uptake of organics to invertebrates were derived using BAF = (0.87*(logKow)/(Koc*foc) (OSWER Directive 9285.7 55), where foc = 0.01.

BAF = Bioaccumulation Factor

Cdiet = concentration in small mammal diet (assumed to be 50 percent plants and 50 percent invertebrates)

EPA = United States Environmental Protection Agency

NR = Not reported

PCBs = polychlorinated biphenyls

TPH = total petroleum hydrocarbons

USACHPPM = United States Army Center for Health Promotion and Preventive Medicine

Table 6-5. Avian Toxicity Reference Values

Chemical Class	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor Type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Avian NOAEL TRV (mg/kg/d)	Selected Avian LOAEL TRV (mg/kg/d)
Metals	Aluminum	aluminum sulfate	Carriere et al., 1986	ringed dove	0.155	4 month	oral in diet	reproduction				109.7	---	ES/ER/TM 86/R3		**109.7**	**---**
	Antimony															**---**	**---**
	Arsenic	arsenic oxide	Holcman and Stibilj, 1997*	chicken	1.6	19 days during reproduction	oral in diet	reproduction	progeny count	NA	NA	2.24	---	OSWER Directive 9285.7 62		**---**	**---**
	Arsenic	sodium arsenate	Stanley et al., 1994	mallard	1	>10 weeks	oral in diet	reproduction				9.3	40.3			**9.3**	**40.3**
	Barium	barium hydroxide	Johnson et al., 1960	1-day old chicks	0.121	4 weeks	oral in diet	mortality		0.1	subchronic-chronic	20.8	41.7	ES/ER/TM 86/R3		**20.8**	**41.7**
	Beryllium															**---**	**---**
	Bismuth															**---**	**---**
	Boron	boric acid	Smith and Anders, 1989	mallard	1	3 weeks pre-, during, and 3 weeks post-reproduction	oral in diet	reproduction	egg fertility, duckling growth, embryo and duckling mortality			28.8	100	ES/ER/TM 86/R3		**28.8**	**100**
	Cadmium	multiple forms	multiple studies*	multiple species								1.47	---	OSWER Directive 9285.7 65	Geometric mean of NOAELs for reproduction and growth	**1.47**	**---**
	Cadmium	cadmium sulfate	Leach et al., 1979*	chicken	1.6	12 weeks during egg laying	oral in diet	reproduction	egg production, progeny count			0.593	2.37	OSWER Directive 9285.7 65	lowest bounded reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**2.37**
	Chromium (3+)	multiple forms	multiple studies*	chicken				reproduction and growth				2.66	---	OSWER Directive 9285.7-66	Geometric mean of NOAELs for reproduction and growth	**2.66**	**---**
	Chromium (3+)	chrome alum doceahydrate	Haseltine et al., unpublished*	black duck	1.17	180-190 days	oral in diet	reproduction	reproductive success			0.569	2.78	OSWER Directive 9285.7-66	lowest bounded reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**2.78**
	Cobalt	multiple forms	multiple studies*	multiple species				growth	body weight			7.61		OSWER Directive 9285.7-67	Geometric mean of NOAELs for reproduction and growth	**7.61**	
	Cobalt	cobalt chloride	Hill, 1979*	chicken	0.328	5 weeks	oral in diet	growth	body weight			3.89	7.8	OSWER Directive 9285.7-67	lowest bounded reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**7.8**
	Copper	copper	al Ankari et al., 1998*	chicken	1.5161	84 days during egg laying	oral in diet	reproduction	eggs per nest			4.05	12.1	OSWER Directive 9285.7-68	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**4.05**	**12.1**
	Lead	lead acetate	Edens and Garlich, 1983*	chicken	1.81	4 weeks during egg laying	oral in diet	reproduction	progeny count			1.63	3.26	OSWER Directive 9285.7-70	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**1.63**	**3.26**
	Lithium															**---**	**---**
	Manganese	multiple forms	multiple studies*	multiple species				reproduction and growth				179	---	OSWER Directive 9285.7-71	Geometric mean of NOAELs for reproduction and growth	**179**	**---**
	Manganese	manganese chloride tetrahydrate	Southern and Baker, 1983*	chicken	0.316	14 days	oral in diet	growth	body weight			261	348	OSWER Directive 9285.7-71	lowest bounded growth or reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**348**
	Mercury (methyl)	methyl mercury	Heinz and Hoffman, 1998; Heinz, 1979	mallard	1	2.5 months to two generations	oral in diet	reproduction				0.068	0.37			**0.068**	**0.37**
	Mercury (inorganic)	Mercuric Chloride	Hill and Schaffner 1976	Japanese quail	0.15	1 year	oral in diet	reproduction	reduced fertility and egg hatchability			0.45	0.9	Sample et al. 1996		**0.45**	**0.9**
	Molybdenum	Sodium molybdate	Lepore and Miller, 1965	chicken	1.5	21 days through reproduction	oral in diet	reproduction	embryonic viability	0.1	LOAEL-NOAEL	3.53	35.3	ES/ER/TM 86/R3		**3.53**	**35.3**
	Nickel	multiple forms	multiple studies*	multiple species				reproduction and growth				6.71	---	OSWER Directive 9285.7-76	Geometric mean of reproduction and growth studies	**6.71**	**---**
	Nickel	nickel chloride hexahydrate	Martinez and Diaz, 1996*	chicken	1.8901	42 days	oral in diet	growth	body weight			5.76	11.5	OSWER Directive 9285.7-76	lowest bounded growth or reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**11.5**
	Selenium	sodium selenite	El-Begearmi and Combs, 1982*	chicken	0.328	2 weeks	oral in diet	survival	mortality			0.29	0.579	OSWER Directive 9285.7-72	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.29**	**0.579**
	Silver	silver acetate	Jensen et al. 1974*	turkey	0.662	5 weeks	oral in diet		growth	0.1	LOAEL-NOAEL	2.02	20.2	OSWER Directive 9285.7-77	lowest growth, reproduction, or survival LOAEL, with NOAEL estimated by application of uncertainty factor	**2.02**	**20.2**
	Strontium															**---**	**---**
	Thallium											---	---			**---**	**---**

Table 6-5. Avian Toxicity Reference Values

Chemical Class	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor Type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Avian NOAEL TRV (mg/kg/d)	Selected Avian LOAEL TRV (mg/kg/d)
	Tin	bis(Tributyltin) oxide (TBTO)	Schlatterer et al., 1993	Japanese quail	0.15	6 weeks during reproduction	oral in diet	reproduction	egg weight and hatchability	NA	NA	6.8	16.9	ES/ER/TM 86/R3		**6.8**	**16.9**
	Uranium	depleted metallic	Haseltine and Sileo, 1983	black duck	1.25	6 weeks	oral in diet	growth, mortality, organ pathology	mortality, body weight, blood chemistry, liver or kidney effects	0.1	subchronic-chronic	16	---	ES/ER/TM 86/R3		**16**	**---**
	Vanadium	sodium metavanadate	Hill, 1979*	chicken	1.042	5 weeks	oral in diet	growth	body weight			0.344	0.688	OSWER Directive 9285.7-75	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.344**	**0.688**
	Zinc	multiple forms	multiple studies*	multiple species				reproduction and growth				66.1	---	OSWER Directive 9285.7-73	Geometric mean of reproduction and growth studies	**66.1**	**---**
	Zinc	zinc acetate	Gibson et al., 1986*	chicken	2	10 weeks	oral in diet	reproduction	progeny count			57.3	66.5	OSWER Directive 9285.7-73	lowest bounded growth or reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**66.5**
General Inorganics	Ammonia/Ammonium															**---**	**---**
	Chloride															**---**	**---**
	Cyanide															**---**	**---**
	Fluoride		Pattee et al., 1988	screech owl	0.18	1 month	oral in diet	reproduction	hatching success	NA	NA	7.8	32	ES/ER/TM 86/R3		7.8	32
	Iodine															**---**	**---**
	Nitrate/Nitrite															**---**	**---**
	Phosphate															**---**	**---**
	Sulfate/Sulfite															**---**	**---**
	Total Organic Carbon															**---**	**---**
Volatile Organics	1,1-dichloroethane	1,2-dichloroethane (DCA)	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**
	1,1-dichloroethene	1,2-dichloroethane (DCA)	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**
	1,1,1-trichloroethane	1,2-dichloroethane (DCA)	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**
	1,1,2-trichloroethane	1,2-dichloroethane (DCA)	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**
	1,1,2,2-tetrachloroethane	1,2-dichloroethane (DCA)	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**
	1,2-dichlorobenzene	1,2-dichloroethane (DCA)	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**
	1,2-dichloroethane (DCA)	NA	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**
	1,3-dichlorobenzene	1,2-dichloroethane (DCA)	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**
	2-butanone (Methyl Ethyl Ketone/MEK)	2-hexanone	Abou-Donia et al., 1982	chicken	1.7	90 days	oral gavage	survival, pathology, neurotoxicity	weight loss and ataxia	0.1	LOAEL-NOAEL	10	100			**10**	**100**
	2-hexanone	NA	Abou-Donia et al., 1982	chicken	1.7	90 days	oral gavage	survival, pathology, neurotoxicity	weight loss and ataxia	0.1	LOAEL-NOAEL	10	100			**10**	**100**
	Benzene	xylene	Hill and Camardese, 1986	Japanese quail		5 days	oral in diet	growth and mortality		0.01	subacute-chronic	40.7	---		5 day dietary exposure to 4066 mg/kg/d had no effect	**40.7**	**---**
	Butanol															**---**	**---**
	Carbon Tetrachloride	1,2-dichloroethane (DCA)	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**
	Chlorobenzene	1,2-dichloroethane (DCA)	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**
	Chloroform	1,2-dichloroethane (DCA)	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**
	Cis-1,2-dichloroethylene	1,2-dichloroethane (DCA)	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**

Table 6-5. Avian Toxicity Reference Values

Chemical Class	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor Type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Avian NOAEL TRV (mg/kg/d)	Selected Avian LOAEL TRV (mg/kg/d)
	Dichloromethane (Methylene Chloride)	1,2-dichloroethane (DCA)	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**
	Ethyl Benzene	xylene	Hill and Camardese, 1986	Japanese quail		5 days	oral in diet	growth and mortality		0.01	subacute-chronic	40.7	---		5 day dietary exposure to 4066 mg/kg/d had no effect	**40.7**	**---**
	Methyl Isobutyl Ketone	2-hexanone	Abou-Donia et al., 1982	chicken	1.7	90 days	oral gavage	survival, pathology, neurotoxicity	weight loss and ataxia	0.1	LOAEL-NOAEL	10	100			**10**	**100**
	n-butyl Benzene	xylene	Hill and Camardese, 1986	Japanese quail		5 days	oral in diet	growth and mortality		0.01	subacute-chronic	40.7	---		5 day dietary exposure to 4066 mg/kg/d had no effect	**40.7**	**---**
	Tetrachloroethylene	1,2-dichloroethane (DCA)	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**
	Toluene	xylene	Hill and Camardese, 1986	Japanese quail		5 days	oral in diet	growth and mortality		0.01	subacute-chronic	33.3	---		5 day dietary exposure to 4066 mg/kg/d had no effect	**40.7**	**---**
	Trans-1,2-dichloroethylene	1,2-dichloroethane (DCA)	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**
	Trichloroethylene (TCE)	1,2-dichloroethane (DCA)	Alumot et al., 1976b	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM 86/R3		**17.2**	**34.4**
	Xylene	NA	Hill and Camardese, 1986	Japanese quail		5 days	oral in diet	growth and mortality		0.01	subacute-chronic	40.7	---		5 day dietary exposure to 4066 mg/kg/d had no effect	**40.7**	**---**
Polycyclic Aromatic Hydrocarbons	Acenaphthene	aromatic hydrocarbon mixture	Patton and Dieter, 1980	mallard	1.23	7 mo	oral in diet	growth	liver weight			32.5	325		*Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	Acenaphthylene	aromatic hydrocarbon mixture	Patton and Dieter, 1980	mallard	1.23	7 mo	oral in diet	growth	liver weight			32.5	325		* Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	Anthracene	aromatic hydrocarbon mixture	Patton and Dieter 1980	mallard	1.23	7 mo	oral in diet	growth	liver weight			32.5	325		* Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	Benzo(a)pyrene	benzo(a)anthracene	Beall 2007	bobwhite quail		60 days	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Benzo(a)anthracene	NA	Beall 2007	bobwhite quail		60 days	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Benzo(b)fluoranthene	benzo(a)anthracene	Beall 2007	bobwhite quail		60 days	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Benzo(ghi)perylene	benzo(a)anthracene	Beall 2007	bobwhite quail		60 days	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Benzo(k)fluoranthene	benzo(a)anthracene	Beall 2007	bobwhite quail		60 days	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Chrysene	benzo(a)anthracene	Beall 2007	bobwhite quail		60 days	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Dibenz(ah)anthracene	benzo(a)anthracene	Beall 2007	bobwhite quail		60 days	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Fluoranthene	benzo(a)anthracene	Beall 2007	bobwhite quail		60 days	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Fluorene	aromatic hydrocarbon mixture	Patton and Dieter 1980	mallard	1.23	7 months	oral in diet	growth	liver weight			32.5	325		* Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	Indeno[1,2,3-cd]pyrene	benzo(a)anthracene	Beall 2007	bobwhite quail		60 days	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**

Table 6-5. Avian Toxicity Reference Values

Chemical Class	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor Type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Avian NOAEL TRV (mg/kg/d)	Selected Avian LOAEL TRV (mg/kg/d)
	2-Methylnaphthalene	aromatic hydrocarbon mixture	Patton and Dieter 1980	mallard	1.23	7 mo	oral in diet	growth	liver weight			32.5	325		* Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	Naphthalene	aromatic hydrocarbon mixture	Patton and Dieter 1980	mallard	1.23	7 months	oral in diet	growth	liver weight			32.5	325		* Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	Phenanthrene	aromatic hydrocarbon mixture	Patton and Dieter 1980	mallard	1.23	7 months	oral in diet	growth	liver weight			32.5	325		* Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	Pyrene	Benzo(a)anthracene	Beall 2007	bobwhite quail		60 days	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Low Molecular Weight PAHs	aromatic hydrocarbon mixture	Patton and Dieter 1980	mallard	1.23	7 months	oral in diet	growth	liver weight			32.5	325		* Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	High Molecular Weight PAHs	benzo(a)anthracene	Beall 2007	bobwhite quail		60 days	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
Petroleum	Gasoline Range Organics	No. 2 Fuel	Szaro et al. 1981	mallard	1	18 weeks	oral in diet	mortality and growth	reduced growth			500	5000			**500**	**5000**
	TPH - Diesel	No. 2 Fuel	Szaro et al. 1981	mallard	1	18 weeks	oral in diet	mortality and growth	reduced growth			500	5000			**500**	**5000**
	TPH - Kerosene	No. 2 Fuel	Szaro et al. 1981	mallard	1	18 weeks	oral in diet	mortality and growth	reduced growth			500	5000			**500**	**5000**
Semivolatile Organics	Normal paraffin hydrocarbons	aliphatic hydrocarbon mixture	Patton and Dieter 1980	mallard	1.23	7 months	oral in diet	growth				813	---		* Mixture of n-paraffins (tridecane, pentadecane, hexadecane, heptadecane, octadecane, and nonadecane), iso-paraffins (2,2,4,6,6-pentamethylheptane, 2,2,4,4,6,8,8-heptamethylnonane, and 2,6,10,14-tetramethylpentadecane), and 2-ring cyclo-paraffins (decahydronaphthalene)	**813**	**---**
	Phenol															**---**	**---**
	2-methylphenol (o-cresol)															**---**	**---**
	4-methylphenol (p-cresol)															**---**	**---**
	2,4-dinitrotoluene	NA	Johnson et al., 2005	bobwhite quail		60 days	oral gavage	hematoxicity and mortality	hematoxicity and mortality	0.01(for NOAEL) 0.25 (for LOAEL)	subchronic-chronic, inter-species differences	0.01	1.3	39 EJ 1138 01D	study and value selected based on an extensive review of available literature - documented in USACHPPM	**0.01**	**1.3**
	Bis[2-ethylhexyl] phthalate	NA	Peakall, 1974	ringed dove	0.155	4 weeks (during reproduction)	oral in diet	reproduction		NA		1.1		ES/ER/TM 86/R3		**1.1**	**---**
	Total PCBs	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM 86/R3		**0.18**	**1.8**
	Aroclor 1016	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM 86/R3		**0.18**	**1.8**
	Aroclor 1221	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM 86/R3		**0.18**	**1.8**
	Aroclor 1232	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM 86/R3		**0.18**	**1.8**
	Aroclor 1242	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM 86/R3		**0.18**	**1.8**

Table 6-5. Avian Toxicity Reference Values

Chemical Class	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor Type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Avian NOAEL TRV (mg/kg/d)	Selected Avian LOAEL TRV (mg/kg/d)
	Aroclor 1248	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM 86/R3		**0.18**	**1.8**
	Aroclor 1254	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM 86/R3		**0.18**	**1.8**
	Aroclor 1260	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM 86/R3		**0.18**	**1.8**
	Aroclor 1262	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM 86/R3		**0.18**	**1.8**
Herbicide	Dichloroprop															**---**	**---**
Pesticide	Aldrin	NA	Hall et al., 1971	ring-necked pheasant		6 weeks	oral via gelatin capsule	growth		0.1 (for NOAEL) 0.25 (for LOAEL)	subchronic-chronic	0.007	0.035	39 EJ 1138 01J	study and value selected based on an extensive review of available literature - documented in USACHPPM	**0.007**	**0.035**
	beta-1,2,3,4,5,6-Hexachlorocyclohexane	gamma hexachlorobenzene (lindane)	Chakravarty and Lahiri, 1986; Chakravarty et al., 1986	mallard	1	8 weeks	oral intubation	reproduction	eggshell thickness, egg number, etc.	0.1	for interspecies uncertainty	0.571	0.857	87 MA02T6 05C	study and value selected based on an extensive review of available literature - documented in USACHPPM	**0.571**	**0.857**
	alpha-Chlordane	chlordane	Stickel et al., 1983	red-winged blackbird	0.064	84 days	oral in diet	mortality				2.14	10.7	ES/ER/TM 86/R3		**2.14**	**10.7**
	gamma-Chlordane	chlordane	Stickel et al., 1983	red-winged blackbird	0.064	84 days	oral in diet	mortality				2.14	10.7	ES/ER/TM 86/R3		**2.14**	**10.7**
	Dichlorodiphenyldichloroethylene	DDT	Cecil et al., 1978	chicken		30 days	oral in diet	growth	body weight			0.227	2.27	OSWER Directive 9285.7 57	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.227**	**---**
	Dichlorodiphenyldichloroethylene	DDT	Heath et al., 1969	mallard		1 year	oral in diet	reproduction	reproductive success			0.563	1.892	OSWER Directive 9285.7 57	value is lowest reproductive LOAEL above the NOAEL used for the EcoSSL; NOAEL is from same study	**---**	**1.892**
	Dichlorodiphenyltrichloroethane	NA	Cecil et al., 1978	chicken		30 days	oral in diet	growth	body weight			0.227	2.27	OSWER Directive 9285.7 57	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.227**	**---**
	Dichlorodiphenyltrichloroethane	NA	Heath et al., 1969	mallard		1 year	oral in diet	reproduction	reproductive success			0.563	1.892	OSWER Directive 9285.7 57	value is lowest reproductive LOAEL above the NOAEL used for the EcoSSL; NOAEL is from same study	**---**	**1.892**
	Dieldrin	NA	Nebeker et al., 1992	mallard		24 days	oral in diet	growth	body weight			0.0709	3.78	OSWER Directive 9285.7 56	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.0709**	**---**
	Dieldrin	NA	Wiese et al., 1968	crowned guinea fowl		21 months	oral in diet	reproduction	number of progeny			0.0671	0.223	OSWER Directive 9285.7 56	value is lowest reproductive LOAEL above the NOAEL used for the EcoSSL; NOAEL is from same study	**---**	**0.223**
	Endosulfan I	endosulfan	Abiola, 1992	gray partridge	0.4	4 weeks (during reproduction)	oral in diet	reproduction				10	---	ES/ER/TM 86/R3		**10**	**---**
	Endosulfan II	endosulfan	Abiola, 1992	gray partridge	0.4	4 weeks (during reproduction)	oral in diet	reproduction				10	---	ES/ER/TM 86/R3		**10**	**---**
	Endosulfan sulfate	endosulfan	Abiola, 1992	gray partridge	0.4	4 weeks (during reproduction)	oral in diet	reproduction				10	---	ES/ER/TM 86/R3		**10**	**---**
	Endrin aldehyde	endrin	Spann et al., 1986	mallard	1.15	>200 days	oral in diet	reproduction				0.3	---	ES/ER/TM 86/R3		**0.3**	**---**
	Methoxychlor															**---**	**---**

Notes:

Uncertainty factors were used to adjust all measured effect concentrations to chronic NOAELS and chronic LOAELs as follows:

LOAEL to NOAEL = 0.1

Subchronic to chronic = 0.1

where:

chronic = >12 weeks or during critical lifestage

subchronic = 4 to 12 weeks

These uncertainty factors are consistent with methods used in development of the EcoSSLs (EPA, 2007a) and are more conservative than uncertainty factors. recommended in EPA 540-R-97-006.

*Study information and calculated NOAELs and LOAELs for these sources were taken directly from the cited EcoSSL report developed by the EPA. All other primary sources were obtained and reviewed, and TRVs were extracted or developed from the study.

EcoSSL = Ecological Soil Screening Level

EPA = United States Environmental Protection Agency

LOAEL = lowest observable adverse effect level

mg/kg/d = milligrams per kilogram per day

Table 6-5. Avian Toxicity Reference Values

Chemical Class	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor Type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Avian NOAEL TRV (mg/kg/d)	Selected Avian LOAEL TRV (mg/kg/d)

NA = not applicable
NOAEL = no observable adverse effect level
PAH = polynuclear aromatic hydrocarbon
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbon
TRV = toxicity reference value
USACHPPM = United States Army Center for Health Promotion and Preventive Medicine
Bold values were selected as the avian TRVs.

Table 6-6. Mammalian Toxicity Reference Values

Chemical Class	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Mammalian NOAEL TRV (mg/kg/d)	Selected Mammalian LOAEL TRV (mg/kg/d)
Metals	Aluminum	aluminum chloride	Ondreicka et al., 1966	mouse	0.03	3 generations	oral in water	reproduction	offspring growth	0.1	LOAEL-NOAEL	1.93	19.3	ES/ER/TM-86/R3	Note that soil pH must be <5.5 (EPA, 2003) for Al to be bioavailable.	**1.93**	**19.3**
	Antimony	antimony trichloride	*Rossi et al., 1987	rat	0.33	31 days	oral in water	reproduction	progeny body weight			0.059	0.59	OSWER Directive 9285.7-61	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.059**	**0.59**
	Arsenic	sodium arsenite	*Neiger and Osweiler, 1989	dog	10.1	8 weeks	oral in diet	growth	reduced body weight			1.04	1.66	OSWER Directive 9285.7-62	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**1.04**	**1.66**
	Barium	multiple forms	*multiple studies	multiple species								51.8		OSWER Directive 9285.7-63	geometric mean of NOAELs for reproduction and growth	**---**	**---**
	Barium	barium chloride	NTP, 1994	rat	0.35	105 weeks	oral in water	nephrotoxicity	increased kidney weight			45	75		study selected because NOAEL is similar to EcoSSL, study is of long duration, and a LOAEL was identified.	**45**	**75**
	Beryllium	beryllium sulfate	*Schroeder and Mitchener, 1975	rat	0.486	lifetime	oral in water	longevity				0.532		OSWER Directive 9285.7-64	Same study as ES/E/TM-86/R3, but used different body weight in calculation of NOAEL	**0.532**	**---**
	Bismuth															**---**	**---**
	Boron	boric acid or Borax	Weir and Fischer, 1972	rat	0.35	three generations	oral in diet	reproduction	sterility			28	93.6	ES/ER/TM-86/R3		**28**	**93.6**
	Cadmium	cadmium acetate	*Yuhas et al., 1979	rat	0.43	2 weeks	oral in water	growth	body weight			0.77	7.7	OSWER Directive 9285.7-65	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**---**	**---**
	Cadmium	cadmium chloride	Sutou et al., 1980a and 1980b	rat	0.303	6 weeks during reproduction	oral gavage	reproduction	reduced fetal survival			1	10	ES/ER/TM-86/R3	The ORNL TRV for cadmium was selected as it represents reproductive effects, is a longer study, and is comparable to the TRV used for EcoSSLs	**1**	**10**
	Chromium (6+)	multiple forms	*multiple studies	multiple species				reproduction and growth				9.24		OSWER Directive 9285.7-66	geometric mean of NOAELs for reproduction and growth	**9.24**	**---**
	Chromium (6+)	sodium dichromate	Chowdhury and Mitra, 1995	rat	0.3084	90 days	oral gavage	reproduction	testes weight			20	40	OSWER Directive 9285.7-66	lowest bounded reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**40**
	Chromium (3+)	multiple forms	*multiple studies	multiple species				reproduction and growth				2.4		OSWER Directive 9285.7-66	geometric mean of NOAELs for reproduction and growth	**2.4**	**---**
	Chromium (3+)	chromium sulfate	*Zahid et al., 1990	mouse	0.0249	35 days	oral in diet	reproduction	sperm cell counts	0.1	LOAEL-NOAEL	0.962	9.62	OSWER Directive 9285.7-66	lowest reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**9.62**
	Cobalt	multiple forms	*multiple studies	multiple species				reproduction and growth				7.33		OSWER Directive 9285.7-67	geometric mean of NOAELs for reproduction and growth	**7.33**	**---**
	Cobalt	cobalt chloride	*Domingo et al., 1985	rat	0.3	28 days	gavage	reproduction	progeny body weight			5.45	10.9	OSWER Directive 9285.7-67	lowest bounded reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**10.9**
	Copper	copper sulfate pentahydrate	*Allcroft et al., 1961	pig	100	4 weeks	oral in diet	growth	body weight			5.6	9.34	OSWER Directive 9285.7-68	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**5.6**	**9.34**
	Lead	lead acetate	*Kimmel et al., 1980	rat	0.3	7 weeks during gestation	oral in water	growth	body weight			4.7	8.9	OSWER Directive 9285.7-68	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**4.7**	**8.9**
	Lithium	lithium carbonate	Marathe and Thomas, 1986	rat	0.35	days 6-15 of gestation	oral in diet	reproduction	reduced number of offspring			9.4	18.8	ES/ER/TM-86/R3		**9.4**	**18.8**
	Manganese	multiple forms	*multiple studies	multiple species				reproduction and growth				51.5		OSWER Directive 9285.7-71	geometric mean of NOAELs for reproduction and growth	**51.5**	**---**
	Manganese	manganese oxide	*Rehnberg et al., 1980	rat	0.0566	20 days	gavage	reproduction, growth	reproductive organ histology, body weight			21	71	OSWER Directive 9285.7-71	lowest bounded growth or reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**71**
	Mercury (methyl)	methylmercury chloride	Verschuuren et al., 1976a	rat	0.35	three generations	oral in diet	reproduction	pup viability			0.032	0.16	ES/ER/TM-86/R3		**0.032**	**0.16**
	mercury (inorganic)	mercuric chloride	Atkinson, 2001	rat		multiple generations	gavage	reproduction	reproduction and fertility - sex ratio, live birth index, fertility index			---	0.37		study selected based on detailed review of available values for an EPA Region IV lead chlor-alkali Superfund Site	**---**	**0.37**
	Molybdenum	molybdate (MoO4)	Schroeder and Mitchener, 1971	mouse	0.03	three generations	oral in water	reproduction	reproductive success, number of runts	0.1	LOAEL-NOAEL	0.26	2.6	ES/ER/TM-86/R3		**0.26**	**2.6**
	Nickel	nickelous chloride	*Pandey and Srivastava, 2000	mouse	0.025	35 days	oral (other)	reproduction	sperm cell counts			1.7	3.4	OSWER Directive 9285.7-76	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**1.7**	**3.4**
	Selenium	sodium selenite	*Mahan and Moxon, 1984	pig	17.8	37 days	oral in diet	growth	body weight			0.143	0.215	OSWER Directive 9285.7-72	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.143**	**0.215**
	Silver	silver acetate	*Van Vleet, 1976	pig	8.86	40 days	oral in diet	growth	body weight	0.1	LOAEL-NOAEL	6.02	60.2	OSWER Directive 9285.7-77	lowest growth, reproduction, or survival LOAEL, with NOAEL estimated by application of uncertainty factor	**6.02**	**60.2**
	Strontium	strontium chloride	Skoryna, 1981	rat	0.35	3 yrs	oral in water	growth	body weight			263		ES/ER/TM-86/R3		**263**	**---**
	Thallium	thallium sulfate	Formigli et al., 1986	rat	0.365	60 days	drinking water	reproduction	sperm motility	0.05 and 0.25	subchronic LOAEL-chronic NOAEL; subchronic LOAEL-chronic LOAEL	0.015	0.075	ES/ER/TM-86/R3; 37 EJ1138 01O	study and value selected based on an extensive review of available literature - documented in USACHPPM	**0.015**	**0.075**
	Tin	bis(tibutyltin) oxide (TBTO)	Davis et al., 1987	mouse	0.03	days 6-15 of gestation	oral intubation	reproduction	reduced fetal weight and fetal survival			23.4	35	ES/ER/TM-86/R3		**23.4**	**35**
	Uranium	uranyl acetate	Domingo et al., 1989a	mouse	0.028	gestational days 6-15	drinking water	reproduction	pup survival and body weight	0.1	LOAEL-NOAEL	0.28	2.8		Statistically significant 25.5% fetal growth reduction at a dose of 2.8 mg U/kg/d.	0.28	2.8
	Vanadium	sodium orthovanadate	*Sanchez et al., 1991	mouse	0.047	12 days during gestation	gavage	reproduction	ODVP			4.16	8.31	OSWER Directive 9285.7-75	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**4.16**	**8.31**

Table 6-6. Mammalian Toxicity Reference Values

Chemical Class	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Mammalian NOAEL TRV (mg/kg/d)	Selected Mammalian LOAEL TRV (mg/kg/d)
	Zinc	various forms	*multiple studies	multiple species				reproduction and growth				75.4		OSWER Directive 9285.7-73	geometric mean of NOAELs for reproduction and growth	**75.4**	**---**
	Zinc	zinc sulfate	*Miller et al., 1989	cattle	580	14 weeks	oral in diet	reproduction	progeny body weight			37.9	75.9	OSWER Directive 9285.7-73	lowest bounded growth or reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**75.9**
General Inorganics	Ammonia/Ammonium															**---**	**---**
	Chloride															**---**	**---**
	Cyanide	potassium cyanide	Tewe and Maner, 1981	rat	0.273	gestation and lactation	oral in diet	reproduction	juvenile growth			68.7	---	ES/ER/TM-86/R3		**68.7**	**---**
	Fluoride	sodium fluoride	Aulerich et al., 1987	mink	1	382 days	oral in diet	reproduction	kit survival			31.37	52.75	ES/ER/TM-86/R3		**31.37**	**52.75**
	Iodine	potassium iodide	Aulerich et al., 1978	mink	1	breeding through lactation	oral in diet	reproduction	kit survival			1.37	13.7			**1.37**	**13.7**
	Nitrate/Nitrite	potassium nitrate	Sleight and Atallah, 1968	guinea pig	0.86	143-204 days	oral in water	reproduction	number of live births			507	1130	ES/ER/TM-86/R3		**507**	**1130**
	Phosphate															**---**	**---**
	Sulfate/Sulfite															**---**	**---**
	Total Organic Carbon															**---**	**---**
Volatile Organics	1,1-dichloroethane	1,2-dichloroethane (DCA)	Lane et al., 1982	mouse	0.035	2 generations	oral in water	reproduction				50	---	ES/ER/TM-86/R3		**50**	**---**
	1,1-dichloroethene	NA	Quast et al., 1983	rat	0.35	2 years	oral in water	mortality, body weight				30	---	ES/ER/TM-86/R3		**30**	**---**
	1,1,1-trichloroethane	NA	Lane et al., 1982	mouse	0.035	2 generations	oral in water	reproduction				1000	---	ES/ER/TM-86/R3		**1000**	**---**
	1,1,2-trichloroethane	1,1,1-trichloroethane	Lane et al., 1982	mouse	0.035	2 generations	oral in water	reproduction				1000	---	ES/ER/TM-86/R3		**1000**	**---**
	1,1,2,2-tetrachloroethane	1,1,1,2-tetrachloroethane	NTP, 1983	rat		103 wks	oral gavage	nephrotoxicity		0.1	LOAEL-NOAEL	8.93	89.3	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0265.htm) Dec 11, 2009	**8.93**	**89.3**
	1,2-dichlorobenzene	NA	NTP, 1985	rat		2 yrs	oral gavage	survival and pathology				85.7	---	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0408.htm) Dec 11, 2009	**85.7**	**---**
	1,2-dichloroethane (DCA)	NA	Lane et al., 1982	mouse	0.035	2 generations	oral in water	reproduction				50	---	ES/ER/TM-86/R3		**50**	**---**
	1,3-dichlorobenzene	1,2-dichlorobenzene	NTP, 1985	rat		2 yrs	oral gavage	survival and pathology				85.7	---	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0408.htm) Dec 11, 2009	**85.7**	**---**
	2-butanone (Methyl Ethyl Ketone/MEK)	NA	Cox et al., 1975	rat	0.35	2 generations	oral in water	reproduction	reduced litter size and pup survival			1771	4571	ES/ER/TM-86/R3		**1771**	**4571**
	2-hexanone	NA	O'Donoghue et al., 1978	rat		13 months	oral in water	neurotoxicity				5	36.1	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/1019.htm) Dec 11, 2009; NOAEL is BMDL10 value; LOAEL is BMD10 value	**5**	**36.1**
	Benzene	NA	Wolf et al., 1956	rat	0.175-0.250	187 days	oral gavage	survival and pathology	hemotoxicity			0.7	7			**0.7**	**7**
	Butanol	NA	EPA, 1986	rat		13 weeks	oral gavage	hypoactivity/ataxia				125	500	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0140.htm) Dec 11, 2009	**125**	**500**
	Carbon Tetrachloride	NA	Alumot et al., 1976a	rat	0.35	2 yrs	oral in diet	reproduction				16	---	ES/ER/TM-86/R3		**16**	**---**
	Chlorobenzene	NA	Monsanto Co., 1967	dog		13 weeks	oral in capsules	liver pathology				19.5	38.7	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0399.htm) Dec 11, 2009	**19.5**	**38.7**
	Chloroform	NA	Palmer et al., 1979	rat	0.35	13 wk	oral intubation	liver, kidney, gonad condition	gonadal atrophy	0.1	subchronic-chronic	15	41	ES/ER/TM-86/R3		**15**	**41**
	Cis-1,2-dichloroethylene	1,2-dichloroethylene	Palmer et al., 1979	mouse	0.03	90 days	oral in water	body and organ weights				45.2	---	ES/ER/TM-86/R3		**45.2**	**---**
	Dichloromethane (Methylene Chloride)	NA	NCA, 1982	rat	0.35	2 yrs	oral in water	liver histology				5.85	50	ES/ER/TM-86/R3		**5.85**	**50**
	Ethyl Benzene	NA	Wolf et al., 1956	rat	0.175-0.250	182 days	oral gavage	survival and pathology	liver and kidney histopathology			136	408			**97.1**	**291**
	Methyl Isobutyl Ketone	2-butanone (Methyl Ethyl Ketone/MEK)	Cox et al., 1975	rat	0.35	2 generations	oral in water	reproduction	reduced litter size and pup survival			1771	4571	ES/ER/TM-86/R3		**1771**	**4571**
	n-butyl Benzene	isopropyl benzene	Wolf et al., 1956	rat	0.175-0.250	194 days	oral gavage	survival and pathology	increased kidney weight			110	330			**110**	**330**
	Tetrachloroethylene	1,1,2,2-tetrachloroethylene	Buben and O'Flaherty, 1985	mouse	0.03	6 weeks	oral gavage	hepatotoxicity		0.1	LOAEL-NOAEL	1.4	7	ES/ER/TM-86/R3		**1.4**	**7**
	Toluene	NA	Gospe et al,. 1994	rat	0.2	gestation days 6-19	oral gavage	reproduction	maternal weight loss			52	520			**52**	**520**
	Trans-1,2-dichloroethylene	1,2-dichloroethylene	Palmer et al., 1979	mouse	0.03	90 days	oral in water	body and organ weights				45.2	---	ES/ER/TM-86/R3		**45.2**	**---**
	Trichloroethylene (TCE)	NA	Buben and O'Flaherty, 1985	mouse	0.03	6 weeks	oral gavage	hepatotoxicity		0.01	LOAEL-NOAEL subchronic-chronic	0.7	7	ES/ER/TM-86/R3		**0.7**	**7**
	Xylene	xylene mixture	NTP, 1986	rat		103 wks	oral gavage	behavior growth mortality				179	350			**179**	**350**
Polycyclic Aromatic Hydrocarbons	Acenaphthene	NA	EPA, 1989a	mouse	0.03	90 days	oral gavage	hepatotoxicity	liver weight changes and cellular hypertrophy			175	350	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0442.htm) Dec 9, 2009	**175**	**350**
	Acenaphthylene	acenaphthene	EPA, 1989a	mouse	0.03	90 days	oral gavage	hepatotoxicity	liver weight changes and cellular hypertrophy			175	350	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0442.htm) Dec 9, 2009	**175**	**350**
	Anthracene	NA	EPA, 1989b	mouse	0.03	90 days	oral gavage	survival and pathology	reduced body weight			1000	---	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0434.htm) Dec 9, 2009	**1000**	**---**
	Benzo(a)pyrene	NA	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39 EJ 1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**
	Benzo(a)anthracene	benzo(a)pyrene	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39 EJ 1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**
	Benzo(b)fluoranthene	benzo(a)pyrene	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39 EJ 1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**
	Benzo(ghi)perylene	benzo(a)pyrene	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39 EJ 1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**
	Benzo(k)fluoranthene	benzo(a)pyrene	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39 EJ 1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**
	Chrysene	benzo(a)pyrene	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39 EJ 1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**

Table 6-6. Mammalian Toxicity Reference Values

Chemical Class	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Mammalian NOAEL TRV (mg/kg/d)	Selected Mammalian LOAEL TRV (mg/kg/d)
	Dibenz(ah)anthracene	benzo(a)pyrene	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39 EJ 1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**
	Fluoranthene	NA	EPA, 1988b	mouse	0.03	13 weeks	oral gavage	nephropathy	increased liver wt and pathology			125	250	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0444.htm) Dec 9, 2009	**125**	**250**
	Fluorene	NA	EPA, 1989c	mouse	0.03	13 weeks	oral gavage	hemotoxicity				125	250	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0435.htm) Dec 9, 2009	**125**	**250**
	Indeno[1,2,3-cd]pyrene	benzo(a)pyrene	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39 EJ 1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**
	2-Methylnaphthalene	NA	Murata et al., 1997	mouse	0.0425	81 wks	oral in diet	survival and pathology	pulmonary pathology			50.3	113.8			**50.3**	**113.8**
	Naphthalene	NA	NTP, 1991	rat	0.24	days 6-15 of gestation	oral gavage	reproduction	maternal weight loss			50	150			**50**	**150**
	Phenanthrene	anthracene	EPA, 1989b	rat	0.03	90 days	oral gavage	survival and pathology	reduced body weight			1000	---	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0434.htm) Dec 9, 2009	**1000**	**---**
	Pyrene	NA	EPA, 1989d	mouse	0.03	13 weeks	oral gavage	nephropathy				75	125	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0445.htm) Dec 9, 2009	**75**	**125**
	Low Molecular Weight PAHs	1-naphthaleneacetic acid	*Verschuuren et al., 1976b	rat	0.247	6 weeks	oral in diet	growth	reduced body weight			65.6	328	OSWER Directive 9285.7-78	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**65.6**	**328**
	High Molecular Weight PAHs	benzo(a)pyrene	*Culp et al., 1998	mouse	0.038	55 weeks	oral in diet	survival	reduced survival			0.615	3.07	OSWER Directive 9285.7-78	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.615**	**3.07**
Petroleum	Gasoline Range Organics	JP-8 jet fuel	Cooper and Mattie, 1996	rat	0.35	gestation days 6-15	oral gavage	reproduction	adult and fetal weight; fetal mortality			1000	1500			**1000**	**1500**
	TPH - Diesel	JP-8 jet fuel	Cooper and Mattie, 1996	rat	0.35	gestation days 6-15	oral gavage	reproduction	adult and fetal weight; fetal mortality			1000	1500			**1000**	**1500**
	TPH - Kerosene	JP-8 jet fuel	Cooper and Mattie, 1996	rat	0.35	gestation days 6-15	oral gavage	reproduction	adult and fetal weight; fetal mortality			1000	1500			**1000**	**1500**
Semivolatile Organics	Normal paraffin hydrocarbons	JP-8 jet fuel	Cooper and Mattie, 1996	rat	0.35	gestation days 6-15	oral gavage	reproduction	adult and fetal weight; fetal mortality			1000	1500			**1000**	**1500**
	Phenol	NA	EPAOTS0573686	rat		gestation days 6-15	oral gavage	reproduction	reduced fetal weight	0.1	for interspecies uncertainty	12	36	87 MA02T6 05E	study and value selected based on an extensive review of available literature - documented in USACHPPM	**12**	**36**
	2-methylphenol (o-cresol)	NA	Hornshaw et al., 1986	mink	0.958	6 month	oral in diet	reproduction		NA		313	---	ES/ER/TM-86/R3	calculations have been updated to use body weight and ingestion data from primary source	**313**	**---**
	4-methylphenol (p-cresol)	2-methylphenol (o-cresol)	Hornshaw et al., 1986	mink	0.958	6 month	oral in diet	reproduction		NA		313	---	ES/ER/TM-86/R3	calculations have been updated to use body weight and ingestion data from primary source	**313**	**---**
	2,4-dinitrotoluene	NA	Ellis et al., 1979	dog		24 months	oral in capsules	hemotoxicity and mortality	hemotoxicity and mortality	NA		0.67	1.4	39 EJ 1138 01D	NOAEL and LOAEL are LED10 and ED10 values, respectively calcualted using EPA benchmark dose software. Study for benchmark calculation selected based on an extensive review of available literature - documented in USACHPPM	**0.67**	**1.4**
	Bis[2-ethylhexyl] phthalate	NA	Lamb et al., 1987	mouse	0.03	105 days (during reproduction)	oral in diet	reproduction		NA		18.3	183	ES/ER/TM-86/R3		**18.3**	**183**
	Total PCBs	aroclor 1254	McCoy et al., 1995	Oldfield mouse	0.014	12 months	oral in diet	reproduction	reduced number of litters, pup body weight, and pup survival	0.1	LOAEL-NOAEL	0.068	0.68	ES/ER/TM-86/R3		**0.068**	**0.68**
	Aroclor 1016	aroclor 1016	EPA/600/3¬80/033	mink	1	18 months	oral in diet	reproduction	reduced kit growth			1.37	3.43	ES/ER/TM-86/R3		**1.37**	**3.43**
	Aroclor 1221	aroclor 1254	McCoy et al., 1995	Oldfield mouse	0.014	12 months	oral in diet	reproduction	reduced number of litters, pup body weight, and pup survival	0.1	LOAEL-NOAEL	0.068	0.68	ES/ER/TM-86/R3		**0.068**	**0.68**
	Aroclor 1232	aroclor 1254	McCoy et al., 1995	Oldfield mouse	0.014	12 months	oral in diet	reproduction	reduced number of litters, pup body weight, and pup survival	0.1	LOAEL-NOAEL	0.068	0.68	ES/ER/TM-86/R3		**0.068**	**0.68**
	Aroclor 1242	aroclor 1242	Bleavins et al., 1980	mink	1	7 months	oral in diet	reproduction	total reproductive failure	0.1	LOAEL-NOAEL	0.069	0.69	ES/ER/TM-86/R3		**0.069**	**0.69**
	Aroclor 1248	aroclor 1248	Barsotti et al., 1976	Rhesus monkey	5	14 months	oral in diet	reproduction	reduced pregnancy and live birth rates	0.1	LOAEL-NOAEL	0.0087	0.087	ES/ER/TM-86/R3	recalculated: study reports PCB consumption of 0.43 mg PCB/day	**0.0087**	**0.087**
	Aroclor 1254	aroclor 1254	McCoy et al., 1995	Oldfield mouse	0.014	12 months	oral in diet	reproduction	reduced number of litters, pup body weight, and pup survival	0.1	LOAEL-NOAEL	0.068	0.68	ES/ER/TM-86/R3		**0.068**	**0.68**
	Aroclor 1260	aroclor 1254	McCoy et al., 1995	Oldfield mouse	0.014	12 months	oral in diet	reproduction	reduced number of litters, pup body weight, and pup survival	0.1	LOAEL-NOAEL	0.068	0.68	ES/ER/TM-86/R3		**0.068**	**0.68**
	Aroclor 1262	aroclor 1254	McCoy et al., 1995	Oldfield mouse	0.014	12 months	oral in diet	reproduction	reduced number of litters, pup body weight, and pup survival	0.1	LOAEL-NOAEL	0.068	0.68	ES/ER/TM-86/R3		**0.068**	**0.68**
Herbicide	Dichloroprop															**---**	**---**
Pesticide	Aldrin	NA	Treon and Cleveland, 1955	rat	0.35	3 generations	oral in diet	reproduction	number of litters and offspring mortality	NA	---	0.2	1	ES/ER/TM-86/R3		**0.2**	**1**
	beta-1,2,3,4,5,6-Hexachlorocyclohexane	NA	Van Velsen et al., 1986	rat	0.35	13 weeks	oral in diet	growth, blood chemistry, organ histology	gonadal atrophy in male and female rats	0.1	chronic-subchronic	0.4	2	ES/ER/TM-86/R3		**0.4**	**2**
	alpha-Chlordane	chlordane	Narotsky and Kavlock, 1995	rat		6 to 19 gestational days	oral gavage	reproduction	post natal pup viability	0.1	LOAEL-NOAEL	2.1	21	87 MA02T6 05A	study and value selected based on an extensive review of available literature - documented in USACHPPM	**2.1**	**21**
	gamma-Chlordane	chlordane	Narotsky and Kavlock, 1995	rat		6 to 19 gestational days	oral gavage	reproduction	post natal pup viability	0.1	LOAEL-NOAEL	2.1	21	87 MA02T6 05A	study and value selected based on an extensive review of available literature - documented in USACHPPM	**2.1**	**21**
	Dichlorodiphenyldichloroethylene (DDE)	DDT	Wrenn et al., 1970	rat		15 days (during gestation)	oral gavage	reproduction				0.147	0.735	EPA, 2007a	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.147**	**0.735**

Table 6-6. Mammalian Toxicity Reference Values

Chemical Class	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Mammalian NOAEL TRV (mg/kg/d)	Selected Mammalian LOAEL TRV (mg/kg/d)
	Dichlorodiphenyltrichloroethane (DDT)	NA	Wrenn et al., 1970	rat		15 days (during gestation)	oral gavage	reproduction				0.147	0.735	EPA, 2007a	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.147**	**0.735**
	Dieldrin	NA	Harr et al., 1970	rat		750 days	oral in diet	reproduction		NA	---	0.015	0.03	EPA, 2007b	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.015**	**0.03**
	Endosulfan I	endosulfan	Dikshith et al., 1984	rat	0.35	30 days (not during reproduction)	oral intubation	reproduction and blood chemistry		0.1	chronic-subchronic	0.15	---	ES/ER/TM-86/R3	no effects observed at highest dose	**0.15**	**---**
	Endosulfan II	endosulfan	Dikshith et al., 1984	rat	0.35	30 days (not during reproduction)	oral intubation	reproduction and blood chemistry		0.1	chronic-subchronic	0.15	---	ES/ER/TM-86/R3	no effects observed at highest dose	**0.15**	**---**
	Endosulfan sulfate	endosulfan	Dikshith et al., 1984	rat	0.35	30 days (not during reproduction)	oral intubation	reproduction and blood chemistry		0.1	chronic-subchronic	0.15	---	ES/ER/TM-86/R3	no effects observed at highest dose	**0.15**	**---**
	Endrin aldehyde	endrin	Good and Ware, 1969	mouse	0.03	120 days (during reproduction)	oral in diet	reproduction	reduced parental survival, litter size, and no. yng/d	0.1	LOAEL-NOAEL	0.092	0.92	ES/ER/TM-86/R3		**0.092**	**0.92**
	Methoxychlor	NA	Gray et al., 1988	rat	0.35	11 months (during reproduction)	oral in diet	reproduction	fertility and litter size reduced	NA	---	4	8	ES/ER/TM-86/R3		**4**	**8**

Notes:
Uncertainty factors were used to adjust all measured effect concentrations to chronic NOAELS and chronic LOAELs as follows:
LOAEL to NOAEL = 0.1
Subchronic to chronic = 0.1
where:
chronic = >12 weeks or during critical lifestage
subchronic = 4 to 12 weeks
These uncertainty factors are consistent with methods used in development of the EcoSSLs (EPA, 2007a) and are more conservative than uncertainty factors recommended in EPA 540-R-97-006.
*Study information and calculated NOAELs and LOAELs for these sources were taken directly from the cited EcoSSL report developed by the EPA. All other primary sources were obtained and reviewed, and TRVs were extracted or developed from the study.
Terms:
BMD = benchmark dose
BMDL = benchmark dose limit
EcoSSl = ecological soil screening level
ED = effective dose
EPA = United States Environmental Protection Agency
LED = lethal dose
LOAEL = lowest observable adverse effect level
NA = not applicable
NOAEL = no observable adverse effect level
mg/kg/d = milligrams per kilogram per day
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
TPH = total petroleum hydrocarbon
TRV = toxicity reference value
USACHPPM = United States Army Center for Health Promotion and Preventive Medicine
Bold values were selected as the mammalian TRVs.

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Aluminum	Al2(SO4)3	White Clover	5			Seedling Establish	LOEC		50						Mackay et al., 1990			ES/ER/TM 85/R3
Aluminum																		OSWER Directive 9285.7 60
Antimony						Phytotoxic	LOEC		5						Kabata-Pendias and Pendias, 1984			ES/ER/TM 85/R3
Arsenic		Blueberry	4.6	0.17-98.0		Growth	MATC		55		0	13	Y	N	Anastasia and Kender, 1973	11144	a	OSWER Directive 9285.7 62
Arsenic		Ryegrass	4.9	5.3		Growth	MATC		22		0	11	Y	N	Jiang and Singh, 1994	4441	b	OSWER Directive 9285.7 62
Arsenic		Ryegrass	4.9	5.3		Growth	MATC		22		0	11	N	N	Jiang and Singh, 1994	4441	d	OSWER Directive 9285.7 62
Arsenic		Barley	4.9	5.3		Growth	MATC		22		0	11	Y	N	Jiang and Singh, 1994	4441	f	OSWER Directive 9285.7 62
Arsenic		Barley	4.9	5.3		Growth	MATC		22		0	11	N	N	Jiang and Singh, 1994	4441	h	OSWER Directive 9285.7 62
Arsenic	NaAsO2	Barley	5	6	365	Grain Yield	LOEC		50						Jiang and Singh, 1994			ES/ER/TM 85/R3
Arsenic	NaAsO2	Ryegrass	5	6	365	Grain Yield	LOEC		250						Jiang and Singh, 1994			ES/ER/TM 85/R3
Arsenic	Na HAsO4	Ryegrass	5	6	365	Grain Yield	LOEC		250						Jiang and Singh, 1994			ES/ER/TM 85/R3
Arsenic	Na HAsO4	Barley	5	6	365	Grain Yield	LOEC		250						Jiang and Singh, 1994			ES/ER/TM 85/R3
Arsenic		Radish	5.1	1.5		Population	MATC		6		1	13	N	N	Woolson and Isensee, 1981	56454	a	OSWER Directive 9285.7 62
Arsenic		Soybean	5.1	1.5		Population	MATC		6		1	13	N	N	Woolson and Isensee, 1981	56454	b	OSWER Directive 9285.7 62
Arsenic		Corn	5.5	1.2		Growth	MATC		40		1	12	Y	N	Jacobs et al., 1970	5577	b	OSWER Directive 9285.7 62
Arsenic		Snap Bean	5.5	1.2		Growth	MATC		22		1	12	Y	N	Jacobs et al., 1970	5577	c	OSWER Directive 9285.7 62
Arsenic		Pea	5.5	1.2		Growth	MATC		40		1	12	Y	N	Jacobs et al., 1970	5577	e	OSWER Directive 9285.7 62
Arsenic		Potato	5.5	1.2		Growth	MATC		97		1	11	Y	N	Jacobs et al., 1970	5577	a	OSWER Directive 9285.7 62
Arsenic		Ryegrass	5.6	0.7		Growth	MATC		22		2	13	Y	Y	Jiang and Singh, 1994	4441	a	OSWER Directive 9285.7 62
Arsenic		Barley	5.6	0.7		Growth	LOAEC		2		2	13	N	N	Jiang and Singh, 1994	4441	e	OSWER Directive 9285.7 62
Arsenic		Barley	5.6	0.7		Growth	LOAEC		2		2	13	N	N	Jiang and Singh, 1994	4441	g	OSWER Directive 9285.7 62
Arsenic		Ryegrass	5.6	0.7		Growth	MATC		22		2	13	N	N	Jiang and Singh, 1994	4441	c	OSWER Directive 9285.7 62
Arsenic	NaAsO2	Barley	6	1	365	Grain Yield	LOEC		2						Jiang and Singh, 1994			ES/ER/TM 85/R3
Arsenic	NaAsO2	Ryegrass	6	1	365	Grain Yield	LOEC		50						Jiang and Singh, 1994			ES/ER/TM 85/R3
Arsenic	NaHAsO4	Barley	6	1	365	Grain Yield	LOEC		50						Jiang and Singh, 1994			ES/ER/TM 85/R3

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Arsenic	Na HAsO4	Ryegrass	6	1	365	Grain Yield	LOEC		250						Jiang and Singh, 1994			ES/ER/TM 85/R3
Arsenic	As2O3	Cotton			42	Shoot Weight	LOEC		11.2						Deuel and Swoboda,1972			ES/ER/TM 85/R3
Arsenic	As2O3	Soybean			42	Shoot Weight	LOEC		11.2						Deuel and Swoboda,1972			ES/ER/TM 85/R3
Arsenic	As2O3	Soybean			42	Shoot Weight	LOEC		22.4						Deuel and Swoboda,1972			ES/ER/TM 85/R3
Arsenic	As2O3	Cotton			42	Shoot Weight	LOEC		89.6						Deuel and Swoboda,1972			ES/ER/TM 85/R3
Arsenic	As2O3	Spruce			335	Height	LOEC		1000						Rosehart and Lee, 1973			ES/ER/TM 85/R3
Arsenic	NaH2AsO4	Corn	7		28	Fresh Weight	LOEC		100						Woolson et al., 1971			ES/ER/TM 85/R3
Arsenic	Al(H2AsO4)3	Corn	7		28	Fresh Weight	LOEC		100						Woolson et al., 1971			ES/ER/TM 85/R3
Arsenic	Ca(H2AsO4)2	Corn	7		28	Fresh Weight	LOEC		100						Woolson et al., 1971			ES/ER/TM 85/R3
Arsenic		Cotton	7.9	1.1		Growth	MATC		69		2	16	Y	Y	Schweizer, 1967	9659	a	OSWER Directive 9285.7 62
Arsenic		Rice	7.9	1.1		Growth	MATC		4		2	15	Y	Y	Schweizer, 1967	9659	b	OSWER Directive 9285.7 62
Barium		Bush bean	7.1 - 8.4	1.0 - 2.4		Growth	MATC		1,414		0	11	Y	N	Chaudhry et al., 1977			OSWER Directive 9285.7 63
Barium	Ba(NO3)2	Barley			14	Plant Weight	LOEC		500						Chaudhry et al., 1977			ES/ER/TM 85/R3
Barium	Ba(NO3)2	Bush Beans			14	Plant Weight	LOEC		1000						Chaudhry et al., 1977			ES/ER/TM 85/R3
Barium	Ba(NO3)2	Bush Beans			14	Plant Weight	LOEC		2000						Chaudhry et al., 1977			ES/ER/TM 85/R3
Beryllium	$BeSO_4$	Soybean	4.9	1.9	14	Shoot Weight	LCT	LCT	25		2	12	N	N	Sajwan et al., 1996		a	ES/ER/TM 85/R3 and OSWER Directive 9285.7 64
Beryllium	$BeSO_4$	Soybean	5.5	3.2	14	Shoot Weight	LCT	LCT	25		2	12	N	N	Sajwan et al., 1996		c	ES/ER/TM 85/R3 and OSWER Directive 9285.7 64
Beryllium						Phytotoxic	LOEC		10						Kabata-Pendias and Pendias, 1984			ES/ER/TM 85/R3
Beryllium		Soybean	6.5	1.9		Growth	LOAEC		25		2	12	N	N	Sajwan et al., 1996		b	OSWER Directive 9285.7 64
Beryllium		Soybean	6.0	3.2		Growth	LOAEC		25		1	12	N	N	Sajwan et al., 1996		d	OSWER Directive 9285.7 64
Beryllium		Kale	6.5	1.9		Growth	MATC		56.8		2	16	Y	N	Kaplan et al. 1990		a	OSWER Directive 9285.7 64

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Boron	H3BO3	Corn	5	56	49	Shoot Weight	LOEC		50						John et al., 1977			ES/ER/TM 85/R3
Boron	H3BO3	Corn	6	6	49	Shoot Weight	LOEC		0.5						John et al., 1977			ES/ER/TM 85/R3
Boron	H3BO3	Corn	6	3	49	Shoot Weight	LOEC		50						John et al., 1977			ES/ER/TM 85/R3
Cadmium		Oats	6.1	1.3		Growth	EC50		239		2	12	N	N	Gunther and Pestemer, 1990		a	OSWER Directive 9285.7 65
Cadmium		Turnip	6.1	1.3		Growth	EC50		69		2	12	N	N	Gunther and Pestemer, 1990		b	OSWER Directive 9285.7 65
Cadmium		Strawberry	5.1	0.5		Growth	cnbd		could not be determined (cnbd)		2	14	N	N	Cieslinski et al., 1996		a	OSWER Directive 9285.7 65
Cadmium		Black-eyed Susan	4.7-6.9	0.138-3.47		Growth	EC25		10		1	11	Y	N	Miles and Parker, 1980			OSWER Directive 9285.7 65
Cadmium		Wild bergamot	4.7-6.9	0.138-3.47		Growth	EC25		6		1	11	Y	N	Miles and Parker, 1980			OSWER Directive 9285.7 65
Cadmium		Little bluestem	4.7-6.9	0.138-3.47		Growth	EC25		12		1	11	Y	N	Miles and Parker, 1980			OSWER Directive 9285.7 65
Cadmium	CdCl2	Soybean	6		28	Shoot Weight	LOEC		1						Miller et al., 1976			ES/ER/TM 85/R3
Cadmium	CdCl2	Soybean	6		42	Plant Weight	LOEC		1.25						Strickland et al.,1979			ES/ER/TM 85/R3
Cadmium	CdCl2	Spruce			98	Root and Shoot Weights	LOEC		2						Burton et al., 1984			ES/ER/TM 85/R3
Cadmium	CdCl2	Soybean	6	0.5	42	Plant Weight	LOEC		2.5						Strickland et al., 1979			ES/ER/TM 85/R3
Cadmium	CdCl2	Radish	7	4	26	Root Weight	LOEC		2.5						Haghiri, 1973			ES/ER/TM 85/R3
Cadmium	CdCl2	Lettuce	7	4	37	Plant Weight	LOEC		2.5						Haghiri, 1973			ES/ER/TM 85/R3
Cadmium		Corn	6		28	Shoot Weight	LOEC		2.5						Miller et al., 1977			ES/ER/TM 85/R3
Cadmium		Spinach	8	1		Plant Weight	LOEC		4						Sadana and Singh, 1987b			ES/ER/TM 85/R3
Cadmium	CdSO4	Spinach	8			Leaf Weight	LOEC		4						Bingham et al., 1975			ES/ER/TM 85/R3
Cadmium	CdSO4	Soybean	8			bean weight	LOEC		5						Bingham et al., 1975			ES/ER/TM 85/R3
Cadmium	CdCl2	Sycamore			90	Leaf Weight	LOEC		5						Carlson and Bazzaz, 1977			ES/ER/TM 85/R3
Cadmium	CdCl2	Wheat	7	4	35	Shoot Weight	LOEC		5						Haghiri, 1973			ES/ER/TM 85/R3
Cadmium	Cd(NO3)2	Beech	5			annual ring width	LOEC		none provided						Hagemeyer et al., 1993			ES/ER/TM 85/R3
Cadmium	CdSO4	Curley Cress	8			Leaf Weight	LOEC		8						Bingham et al., 1975			ES/ER/TM 85/R3

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Cadmium	CdCl2	Black-eyed Susan	5	2	42	germination; Root and Shoot Weights	LOEC		10						Miles and Parker, 1979a			ES/ER/TM 85/R3
Cadmium	CdCl2	Blazing Star	5	2	42	Root and Shoot Weights	LOEC		10						Miles and Parker, 1979a			ES/ER/TM 85/R3
Cadmium	CdCl2	Thimbleweed	5	2	42	Shoot Weight	LOEC		10						Miles and Parker, 1979a			ES/ER/TM 85/R3
Cadmium	CdCl2	Bergamot	5	2	42	Root Weight	LOEC		10						Miles and Parker, 1979a			ES/ER/TM 85/R3
Cadmium	CdCl2	Soybean	5		28	Shoot Weight	LOEC		10						Miller et al., 1976			ES/ER/TM 85/R3
Cadmium	CdCl2	Soybean	6		28	Shoot Weight	LOEC		10						Miller et al., 1976			ES/ER/TM 85/R3
Cadmium	CdCl2	Soybean	7		28	Shoot Weight	LOEC		10						Miller et al., 1976			ES/ER/TM 85/R3
Cadmium	CdCl2	Soybean	6		28	Shoot Weight	LOEC		10						Miller et al., 1976			ES/ER/TM 85/R3
Cadmium	CdCl2	Radish	5		42	Root and Shoot Weights	LOEC		10						Khan and Frankland, 1983			ES/ER/TM 85/R3
Cadmium	CdCl2	Oats	5		42	Root Weight	LOEC		10						Khan and Frankland, 1984			ES/ER/TM 85/R3
Cadmium	loamy	Wheat	8	0.9		Grain Yield	LOEC		10						Sadana and Singh, 1987a			ES/ER/TM 85/R3
Cadmium	CdCl2	Bluestem	8	2.5	84	Root and Shoot Weights	LOEC		10						Miles and Parker, 1979a			ES/ER/TM 85/R3
Cadmium	CdCl2	Soybean	7	4	35	Shoot Weight	LOEC		10						Haghiri, 1973			ES/ER/TM 85/R3
Cadmium	CdCl2	Soybean				Seeds/Plant	LOEC		10						Aery and Sakar, 1991			ES/ER/TM 85/R3
Cadmium	CdCl2	Soybeans	6	1	42	Plant Weight	LOEC		10						Strickland et al., 1979			ES/ER/TM 85/R3
Cadmium	CdSO4	Lettuce	8			head weight	LOEC		13						Bingham et al., 1975			ES/ER/TM 85/R3
Cadmium	C4H6CdO4	Wheat	6	1.7	28	Shoot Weight	LOEC		14.1						Reber, 1989			ES/ER/TM 85/R3
Cadmium	CdCl2	Tomato	5	3.7	14	Fresh Shoot Weight	LOEC		16						Adema and Henzen, 1989			ES/ER/TM 85/R3
Cadmium	CdSO4	Corn	8			Grain Yield	LOEC		18						Bingham et al., 1975			ES/ER/TM 85/R3
Cadmium	CdSO4	Carrot	8			tuber weight	LOEC		20						Bingham et al., 1975			ES/ER/TM 85/R3
Cadmium	CdCl2	Red Oak	6	1.5	112	Plant Weight	LOEC		20						Dixon, 1988			ES/ER/TM 85/R3
Cadmium	CdCl2	Wheat	8	1		Grain and straw yields	LOEC		20						Singh et al., 1991			ES/ER/TM 85/R3
Cadmium	CdCl2	Soybeans	6	2	42	Plant Weight	LOEC		20						Strickland et al., 1979			ES/ER/TM 85/R3
Cadmium	CdCl2	Corn	7	2.1	7	Root length	LOEC		25						Hassett et al., 1976			ES/ER/TM 85/R3

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Cadmium	CdCl2	Corn	5	2.2	35	Plant Weight	LOEC		28						Traynor and Knezek, 1973			ES/ER/TM 85/R3
Cadmium	CdSO4	turnip	8			Tuber weight	LOEC		28						Bingham et al., 1975			ES/ER/TM 85/R3
Cadmium	CdCl2	Ky bluegrass	5	2	42	Root and Shoot Weights	LOEC		30						Miles and Parker, 1979a			ES/ER/TM 85/R3
Cadmium	CdCl2	Bluestem	5	2	42	Root and Shoot Weights	LOEC		30						Miles and Parker, 1979a			ES/ER/TM 85/R3
Cadmium	CdCl2	Poison-ivy	5	2	42	Root and Shoot Weights	LOEC		30						Miles and Parker, 1979a			ES/ER/TM 85/R3
Cadmium	CdO	Wheat	6		161	Grain Yield	LOEC		30						Muramoto et al., 1990			ES/ER/TM 85/R3
Cadmium	CdCl2	Lettuce	8	1.4	14	Fresh Shoot Weight	LOEC		33						Adema and Henzen, 1989			ES/ER/TM 85/R3
Cadmium	CdCl2	Spinach	5	11.8		Root and Leaf Weights	LOEC		40						John, 1973			ES/ER/TM 85/R3
Cadmium	CdCl2	Peas	5	11.8		Seed, pod, vine weights	LOEC		40						John, 1973			ES/ER/TM 85/R3
Cadmium	CdCl2	Oats	5	11.8		Grain Yield	LOEC		40						John, 1973			ES/ER/TM 85/R3
Cadmium	CdCl2	Radish	5	11.8		tuber and Top Weights	LOEC		40						John, 1973			ES/ER/TM 85/R3
Cadmium	CdSO4	Field bean	8			Bean weight	LOEC		40						Bingham et al., 1975			ES/ER/TM 85/R3
Cadmium	CdCl2	Wheat	5		42	Root Weight	LOEC		50						Khan and Frankland, 1984			ES/ER/TM 85/R3
Cadmium	CdSO4	Wheat	8			Grain Yield	LOEC		50						Bingham et al., 1975			ES/ER/TM 85/R3
Cadmium	CdCl2+CdO	Radish	5		42	Root Weight	LOEC		50						Khan and Frankland, 1984			ES/ER/TM 85/R3
Cadmium	CdSO4	Radish	8			Tuber weight	LOEC		96						Bingham et al., 1975			ES/ER/TM 85/R3
Cadmium	CdCl2	Oats	5	3.7	14	Fresh Shoot Weight	LOEC		97						Adema and Henzen, 1989			ES/ER/TM 85/R3
Cadmium	CdCl2	Rye	6			Shoot Weight	LOEC		100						Carlson and Rolfe,1979			ES/ER/TM 85/R3
Cadmium	CdCl2	Radish	6	12.9	21	Top and Root Weights	LOEC		100						John et al., 1972			ES/ER/TM 85/R3
Cadmium	CdO	Rice	6			Root and Shoot Weights	LOEC		100						Muramoto et al., 1990			ES/ER/TM 85/R3
Cadmium	CdO	Wheat	5		42	Root Weight	LOEC		100						Khan and Frankland, 1984			ES/ER/TM 85/R3

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Cadmium	CdO	Radish	5		42	Root and Shoot Weights	LOEC		100						Khan and Frankland, 1983			ES/ER/TM 85/R3
Cadmium	CdCl2	Soybean	7		28	Shoot Weight	LOEC		100						Miller et al., 1976			ES/ER/TM 85/R3
Cadmium	C4H6CdO4	Wheat	7	2.2	28	Shoot Weight	LOEC		113						Reber, 1989			ES/ER/TM 85/R3
Cadmium	CdCl2	Lettuce	5	3.7	14	Fresh Shoot Weight	LOEC		136						Adema and Henzen, 1989			ES/ER/TM 85/R3
Cadmium	CdCl2	Oats	8	1.4	14	Leaf Weight	LOEC		159						Adema and Henzen, 1989			ES/ER/TM 85/R3
Cadmium	CdSO4	Tomato	8			Fruit weight	LOEC		160						Bingham et al., 1975			ES/ER/TM 85/R3
Cadmium	CdSO4	Zucchini	8			Fruit weight	LOEC		160						Bingham et al., 1975			ES/ER/TM 85/R3
Cadmium	CdSO4	Cabbage	8			Head weight	LOEC		170						Bingham et al., 1975			ES/ER/TM 85/R3
Cadmium	CdCl2	Tomato	8	1.4	14	Fresh Shoot Weight	LOEC		171						Adema and Henzen, 1989			ES/ER/TM 85/R3
Cadmium	CdCl2	Lettuce	5	11.8		Root and Leaf Weights	LOEC		200						John, 1973			ES/ER/TM 85/R3
Cadmium	CdCl2	Broccoli	5	11.8		Leaf Weight	LOEC		200						John, 1973			ES/ER/TM 85/R3
Cadmium	CdCl2	Cauliflower	5	11.8		Root and Leaf Weights	LOEC		200						John, 1973			ES/ER/TM 85/R3
Cadmium	CdCl2	Carrot	5	11.8		Root, tuber,Top Weight	LOEC		200						John, 1973			ES/ER/TM 85/R3
Cadmium		Cotton	7		35	Leaf and stem weights	LOEC		300						Rehab and Wallace, 1978a,c			ES/ER/TM 85/R3
Cadmium		Cotton	7		35	Leaf and stem weights	LOEC		300						Rehab and Wallace, 1978a,c			ES/ER/TM 85/R3
Cadmium		Ryegrass	6.0	0.1		Growth	MATC		22		2	14	Y	Y	Singh and Jeng, 1993			OSWER Directive 9285.7 65
Cadmium		Lettuce	5.1	3.7		Growth	MATC		57		2	16	Y	Y	Adema and Henzen, 1989		a	OSWER Directive 9285.7 65
Cadmium		Tomato	5.1	3.7		Growth	MATC		57		2	16	Y	Y	Adema and Henzen, 1989		b	OSWER Directive 9285.7 65
Cadmium		Oats	5.1	3.7		Growth	MATC		18		2	16	Y	Y	Adema and Henzen, 1989		c	OSWER Directive 9285.7 65
Cadmium		Corn	4.2	4.43		Growth	MATC		71		2	14	Y	Y	Lehoczky et al., 1996		b	OSWER Directive 9285.7 65
Cadmium		Garlic	4.2	4.43		Growth	MATC		22		2	14	Y	Y	Lehoczky et al., 1996		c	OSWER Directive 9285.7 65

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Cadmium		Barley	6.9	1.9		Growth	MATC		9		2	12	Y	Y	Monette,1978			OSWER Directive 9285.7 65
Cadmium		White Pine	4.8	1.9		Growth	MATC		39		2	12	Y	Y	Kelly et al., 1979		a	OSWER Directive 9285.7 65
Cadmium		Yellow Birch	4.8	1.9		Growth	MATC		39		2	12	Y	Y	Kelly et al., 1979		b	OSWER Directive 9285.7 65
Cadmium		Choke Cherry	4.8	1.9		Growth	MATC		39		2	12	Y	Y	Kelly et al., 1979		c	OSWER Directive 9285.7 65
Cadmium		Loblolly pine	4.8	1.9		Growth	MATC		39		2	12	Y	Y	Kelly et al., 1979		d	OSWER Directive 9285.7 65
Cadmium		Red Oak	6.0	1.5		Growth	MATC		14		2	16	Y	Y	Dixon, 1988		b	OSWER Directive 9285.7 65
Cadmium		Alfalfa	6.4	1.0		Growth	MATC		79		2	11	Y	Y	Taylor, 1974			OSWER Directive 9285.7 65
Cadmium		Lettuce	4.3	4.4		Growth	LOAEC		10		2	15	N	N	Lehoczky et al., 1998		b	OSWER Directive 9285.7 65
Cadmium		Red Oak	6.0	1.5		Growth	MATC		32		2	16	N	N	Dixon, 1988		a	OSWER Directive 9285.7 65
Cadmium		corn	5.5	2.58		Growth	LOAEC		5		2	12	N	N	Mahler et al., 1987			OSWER Directive 9285.7 65
Cadmium		spinach	4.2	4.43		Growth	LOAEC		10		2	14	N	N	Lehoczky et al., 1996		d	OSWER Directive 9285.7 65
Cadmium		Radish	6.9	1.0		Growth	LOAEC		100		2	11	N	N	Zaman and Zereen, 1998		a	OSWER Directive 9285.7 65
Cadmium		Radish	6.9	1.0		Growth	LOAEC		50		2	11	N	N	Zaman and Zereen, 1998		b	OSWER Directive 9285.7 65
Cadmium		Radish	6.9	1.0		Physiology	LOAEC		50		2	11	N	N	Zaman and Zereen, 1998		b	OSWER Directive 9285.7 65
Cadmium		Cotton	6.8	1.3		Growth	LOAEC		300		2	12	N	N	Rehab and Wallace, 1978a,c		b	OSWER Directive 9285.7 65
Cadmium		Cowpea	8	0.3		Growth	MATC		2		1	14	Y	N	Singh and Nayyar, 1994		b	OSWER Directive 9285.7 65
Cadmium		Egyptian clover	8	0.3		Growth	MATC		2		1	14	Y	N	Singh and Nayyar, 1994		c	OSWER Directive 9285.7 65
Cadmium		Indiana clover	8	0.3		Growth	MATC		2		1	14	Y	N	Singh and Nayyar, 1994		d	OSWER Directive 9285.7 65

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Cadmium		Maize	8	0.3		Growth	MATC		35		1	14	Y	N	Singh and Nayyar, 1994		e	OSWER Directive 9285.7 65
Cadmium		Oats	8	0.3		Growth	MATC		4		1	14	Y	N	Singh and Nayyar, 1994		f	OSWER Directive 9285.7 65
Cadmium		Pearl millet	8	0.3		Growth	MATC		2		1	14	Y	N	Singh and Nayyar, 1994		g	OSWER Directive 9285.7 65
Cadmium		Alfalfa	8	0.3		Growth	LOAEC		1		1	14	N	N	Singh and Nayyar, 1994		a	OSWER Directive 9285.7 65
Cadmium		Teosinte	8	0.3		Growth	LOAEC		1		1	14	N	N	Singh and Nayyar, 1994		h	OSWER Directive 9285.7 65
Cadmium		Lettuce	7.5	1.4		Growth	MATC		6		1	15	N	N	Adema and Henzen, 1989		d	OSWER Directive 9285.7 65
Cadmium		Tomato	7.5	1.4		Growth	LOAEC		3		1	15	N	N	Adema and Henzen, 1989		e	OSWER Directive 9285.7 65
Cadmium		Oats	7.5	1.4		Growth	MATC		18		1	15	N	N	Adema and Henzen, 1989		f	OSWER Directive 9285.7 65
Cadmium		garlic	6.8	5.7		Growth	MATC		71		1	13	Y	N	Lehoczky et al., 1996		a	OSWER Directive 9285.7 65
Cadmium		Wheat (var LW 711)	8.1	0.3		Growth	MATC		18		1	11	Y	N	Singh et al., 1989		a	OSWER Directive 9285.7 65
Cadmium		Wheat (var LW 711)	8.1	0.3		Growth	MATC		35		1	11	Y	N	Singh et al., 1989		b	OSWER Directive 9285.7 65
Cadmium		onion	8.3	0.5		Growth	LOAEC		50		1	11	N	N	Dang et al., 1990		C	OSWER Directive 9285.7 65
Cadmium		fenugreek	8.3	0.5		Growth	LOAEC		50		1	11	N	N	Dang et al., 1990		F	OSWER Directive 9285.7 65
Cadmium		corn	6-6.4	2.58-4.64		Growth	LOAEC		5		1	11	N	N	Mahler et al., 1987			OSWER Directive 9285.7 65
Cadmium		Alfalfa	6.9	4.8		Growth	MATC		177		1	14	N	N	Taylor and Allinson, 1981		d	OSWER Directive 9285.7 65
Cadmium		Wheat	8.40	0.45		Growth	LOAEC		10		1	11	N	N	Sadana and Singh, 1987a		d	OSWER Directive 9285.7 65
Chromium	K2Cr2O7	Lettuce	5	3.7	14	Fresh Shoot Weight	LOEC		>11						Adema and Henzen, 1989			ES/ER/TM 85/R3
Chromium	K2Cr2O7	Tomato	5	3.7	14	Fresh Shoot Weight	LOEC		21						Adema and Henzen, 1989			ES/ER/TM 85/R3
Chromium	K2Cr2O7	Oats	5	3.7	14	Fresh Shoot Weight	LOEC		31						Adema and Henzen, 1989			ES/ER/TM 85/R3

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Chromium		Lettuce	5.1	3.7		Growth	could not be determined		could not be determined		2	13	N	N	Adema and Henzen, 1989	2125	c	OSWER Directive 9285.7 66
Chromium		Oat	6.1	2.2		Growth	EC50		9		1	14	N	N	Gunther and Pestemer, 1990	7099	a	OSWER Directive 9285.7 66
Chromium		Turnip	6.1	2.2		Growth	EC50		3		1	14	N	N	Gunther and Pestemer, 1990	7099	b	OSWER Directive 9285.7 66
Chromium	K2Cr2O7	Soybean			3	Fresh Shoot Weight	LOEC		30						Turner and Rust, 1971			ES/ER/TM 85/R3
Chromium		Carrot	7	1		Growth	LOAEC		15		1	11	N	N	Kadar and Morvai, 1998	12988	a	OSWER Directive 9285.7 66
Chromium	K2Cr2O7	Lettuce	8	1.4	14	Fresh Shoot Weight	LOEC		1.8						Adema and Henzen, 1989			ES/ER/TM 85/R3
Chromium	K2Cr2O7	Tomato	8	1.4	14	Fresh Shoot Weight	LOEC		6.8						Adema and Henzen, 1989			ES/ER/TM 85/R3
Chromium	K2Cr2O7	Oats	8	1.4	14	Fresh Shoot Weight	LOEC		7.4						Adema and Henzen, 1989			ES/ER/TM 85/R3
Cobalt						Phytotoxic	LOEC		25						Kabata-Pendias and Pendias, 1984			ES/ER/TM 85/R3
Cobalt		Alfalfa	5.0	5.0		Growth	EC20		0.60		2	18	Y	Y	TN & Associates, Inc., 2000		a	OSWER Directive 9285.7 67
Cobalt		Barley	5.0	5.0		Growth	EC20		29.8		2	18	Y	Y	TN & Associates, Inc., 2000		b	OSWER Directive 9285.7 67
Cobalt		Radish	5.0	5.0		Growth	EC20		14.5		2	18	Y	Y	TN & Associates, Inc., 2000		c	OSWER Directive 9285.7 67
Cobalt		Alfalfa	6.3	0.1		Growth	EC20		13.4		2	18	Y	Y	TN & Associates, Inc., 2000		d	OSWER Directive 9285.7 67
Cobalt		Barley	6.3	0.1		Growth	EC20		36.4		2	18	Y	Y	TN & Associates, Inc., 2000		e	OSWER Directive 9285.7 67
Cobalt		Radish	6.3	0.1		Growth	EC20		45.2		2	18	Y	Y	TN & Associates, Inc., 2000		f	OSWER Directive 9285.7 67
Cobalt		Cotton	6.6	2.4		Growth	LOAEC		100		1	12	Y	N	Rehab and Wallace, 1978		f	OSWER Directive 9285.7 67
Copper		Common oat	4.6	2.5		Growth	LOAEC		150		2	14	N	N	Tikhomirov et al, 1988	4757	d	OSWER Directive 9285.7 68
Copper	CuSO4	Bluestem	5	1.9	84	Root and Shoot Weights	LOEC		100						Miles and Parker, 1979b			ES/ER/TM 85/R3
Copper		Alfalfa	5.4	1.1		Growth	EC10		32		2	13	Y	Y	Gonzalez, 1991	4609	g	OSWER Directive 9285.7 68

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Copper		citrus cultivar	5.4	1		Growth	LOAEC		5		2	11	N	N	Spencer, 1966	15004	--	OSWER Directive 9285.7 68
Copper		Alfalfa	5.5	2.8		Growth	EC10		58		2	13	Y	Y	Gonzalez, 1991	4609	e	OSWER Directive 9285.7 68
Copper		Common oat	5.5	2		Growth	EC50		535		2	14	N	N	Mitchell et al., 1988	15861	a	OSWER Directive 9285.7 68
Copper		Cucumber	5.5	2		Growth	EC50		540		2	14	N	N	Mitchell et al., 1988	15861	b	OSWER Directive 9285.7 68
Copper		Soybean	5.5	2		Growth	EC50		550		2	14	N	N	Mitchell et al., 1988	15861	c	OSWER Directive 9285.7 68
Copper		Heath-leaf banksia	5.5	2		Growth	EC50		610		2	14	N	N	Mitchell et al., 1988	15861	d	OSWER Directive 9285.7 68
Copper		She-oak	5.5	2		Growth	EC50		205		2	14	N	N	Mitchell et al., 1988	15861	e	OSWER Directive 9285.7 68
Copper		Yellow bloodwood	5.5	2		Growth	EC50		560		2	14	N	N	Mitchell et al., 1988	15861	f	OSWER Directive 9285.7 68
Copper		Common oat	5.5	2		Growth	LC50		1765		2	13	N	N	Mitchell et al., 1988	15861	g	OSWER Directive 9285.7 68
Copper		Cucumber	5.5	2		Growth	LC50		1725		2	13	N	N	Mitchell et al., 1988	15861	h	OSWER Directive 9285.7 68
Copper		Soybean	5.5	2		Growth	LC50		1140		2	13	N	N	Mitchell et al., 1988	15861	I	OSWER Directive 9285.7 68
Copper		Heath-leaf banksia	5.5	2		Growth	LC50		1520		2	13	N	N	Mitchell et al., 1988	15861	j	OSWER Directive 9285.7 68
Copper		She-oak	5.5	2		Growth	LC50		580		2	13	N	N	Mitchell et al., 1988	15861	k	OSWER Directive 9285.7 68
Copper		Yellow bloodwood	5.5	2		Growth	LC50		1845		2	13	N	N	Mitchell et al., 1988	15861	l	OSWER Directive 9285.7 68
Copper		Common oat	5.6	1.6		Reproduction	MATC		283		2	11	N	N	De Haan, 1985	5048	a	OSWER Directive 9285.7 68
Copper		Common oat	5.9	2.9		Growth	LOAEC		400		1	13	N	N	Tikhomirov et al, 1988	4757	c	OSWER Directive 9285.7 68
Copper		Citrus cultivar	6	0.98		Growth	MATC		141		2	13	Y	Y	Mozaffari et al, 1996	4176	b	OSWER Directive 9285.7 68
Copper		Barley	6.1	9		Growth	EC20		143		0	12	Y	N	Aquaterra, 2000	22616	c	OSWER Directive 9285.7 68

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Copper		Northern Wheatgrass	6.1	9		Growth	EC20		151.7		0	12	Y	N	Aquaterra, 2000	22616	l	OSWER Directive 9285.7 68
Copper		Alfalfa	6.3	1.3		Growth	EC10		115		2	13	Y	Y	Gonzalez, 1991	4609	d	OSWER Directive 9285.7 68
Copper		Black bindweed	6.4	1.7		Reproduction	MATC		251		2	14	Y	Y	Kjaer and Elmegaard, 1996	4231	c	OSWER Directive 9285.7 68
Copper		Black bindweed	6.4	1.7		Growth	EC50		272		2	14	N	N	Kjaer and Elmegaard, 1996	4231	a	OSWER Directive 9285.7 68
Copper		Black bindweed	6.4	1.7		Mortality	EC50		219		2	14	N	N	Kjaer and Elmegaard, 1996	4231	d	OSWER Directive 9285.7 68
Copper		Perennial ryegrass	4.4 - 5.4	1		Growth	MATC		16		2	12	Y	Y	Torres and De Varennes, 1998	13958	--	OSWER Directive 9285.7 68
Copper		Cotton	6.6	2.4		Growth	MATC		141.4		1	14	Y	N	Rehab and Wallace, 1978b	46710	--	OSWER Directive 9285.7 68
Copper		Citrus cultivar	7	0.98		Growth	LOAEC		200		1	12	N	N	Mozaffari et al, 1996	4176	c	OSWER Directive 9285.7 68
Copper		Alfalfa	7.3	0.5		Growth	EC10		41		1	12	Y	N	Gonzalez, 1991	4609	f	OSWER Directive 9285.7 68
Copper		Alfalfa	7.5	1.1		Growth	EC10		821		1	12	Y	N	Gonzalez, 1991	4609	c	OSWER Directive 9285.7 68
Copper		Barley, cultivated	7.6	3.8	14	Emergence	LOEC		322						Ali et al. 2004			LA UR 08 6673
Copper		Barley, cultivated	7.6	3.8	14	Root Biomass	LOEC		28.2						Ali et al. 2004			LA UR 08 6673
Copper		Wheat	7.8	0.2		Growth	MATC		28		1	13	Y	N	Chhibba et al, 1994	12325	a	OSWER Directive 9285.7 68
Copper		Alfalfa	7.8	1.8		Growth	EC10		1253		1	12	Y	N	Gonzalez, 1991	4609	b	OSWER Directive 9285.7 68
Copper		Alfalfa	7.8	2.9		Growth	EC20		326.4		0	12	Y	N	Aquaterra, 2000	22616	a	OSWER Directive 9285.7 68
Copper		Barley	7.8	2.9		Growth	EC20		0.74		0	12	Y	N	Aquaterra, 2000	22616	d	OSWER Directive 9285.7 68
Copper		Carrot	7.8	2.9		Growth	EC20		659		0	12	Y	N	Aquaterra, 2000	22616	f	OSWER Directive 9285.7 68
Copper		Corn	7.8	2.9		Growth	EC20		407.6		0	12	Y	N	Aquaterra, 2000	22616	g	OSWER Directive 9285.7 68

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Copper		Cucumber	7.8	2.9		Growth	EC20		506		0	12	Y	N	Aquaterra, 2000	22616	i	OSWER Directive 9285.7 68
Copper		Grama grass	7.8	2.9		Growth	EC20		471.3		0	12	Y	N	Aquaterra, 2000	22616	k	OSWER Directive 9285.7 68
Copper		Northern Wheatgrass	7.8	2.9		Growth	EC20		391.3		0	12	Y	N	Aquaterra, 2000	22616	m	OSWER Directive 9285.7 68
Copper		Radish	7.8	2.9		Growth	EC20		347.3		0	12	Y	N	Aquaterra, 2000	22616	o	OSWER Directive 9285.7 68
Copper		Barley, cultivated	7.8	0.27	14	Emergence	LOEC		31						Ali et al., 2004			LA UR 08 6673
Copper		Barley, cultivated	7.8	0.27	14	Shoot Biomass	LOEC		31						Ali et al., 2004			LA UR 08 6673
Copper		Barley, cultivated	7.8	0.27	14	Root Biomass	LOEC		3						Ali et al., 2004			LA UR 08 6673
Copper	CuSO4	Bluestem	8	2.5	84	Root and Shoot Weights	LOEC		100						Miles and Parker, 1979b			ES/ER/TM 85/R3
Copper		Alfalfa	8.1	3.5		Growth	EC20		674		0	12	Y	N	Aquaterra, 2000	22616	b	OSWER Directive 9285.7 68
Copper		Barley	8.1	3.5		Growth	EC20		234.8		0	12	Y	N	Aquaterra, 2000	22616	e	OSWER Directive 9285.7 68
Copper		Corn	8.1	3.5		Growth	EC20		776.2		0	12	Y	N	Aquaterra, 2000	22616	h	OSWER Directive 9285.7 68
Copper		Cucumber	8.1	3.5		Growth	EC20		804.9		0	12	Y	N	Aquaterra, 2000	22616	j	OSWER Directive 9285.7 68
Copper		Northern wheatgrass	8.1	3.5		Growth	EC20		801.6		0	12	Y	N	Aquaterra, 2000	22616	n	OSWER Directive 9285.7 68
Copper		Radish	8.1	3.5		Growth	EC20		322.7		0	12	Y	N	Aquaterra, 2000	22616	p	OSWER Directive 9285.7 68
Copper	CuSO4	Bush Beans			17	Leaf Weight	LOEC		200						Wallace et al., 1977b			ES/ER/TM 85/R3
Copper		Black bindweed	6.0-6.7	4.5		Growth	EC50		284		1	16	N	N	Pedersen et al., 2000a	56463	a	OSWER Directive 9285.7 68
Copper		Black bindweed	6.0-6.7	4.5		Growth	EC50		258		1	16	N	N	Pedersen et al., 2000a	56463	b	OSWER Directive 9285.7 68
Copper		Black bindweed	6.0-6.7	4.5		Growth	EC50		259		1	16	N	N	Pedersen et al., 2000a	56463	c	OSWER Directive 9285.7 68
Copper		Black bindweed	6.0-6.7	4.5		Growth	EC50		329		1	16	N	N	Pedersen et al., 2000a	56463	d	OSWER Directive 9285.7 68

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Copper		Black bindweed	6.0-6.7	4.5		Growth	EC50		260		1	16	N	N	Pedersen et al., 2000a	56463	e	OSWER Directive 9285.7 68
Copper		Black bindweed	6.0-6.7	4.5		Growth	EC50		291		1	16	N	N	Pedersen et al., 2000a	56463	f	OSWER Directive 9285.7 68
Iron																		OSWER Directive 9285.7 69
Lead	PbCl2	Spruce	3	45.3	98	Root and Shoot Weights	LOEC		100						Burton et al.. 1984			ES/ER/TM 85/R3
Lead	PbCl2	Lettuce	4	17	30	Leaf Weight	LOEC		1000						John and Van Laerhoven, 1972			ES/ER/TM 85/R3
Lead	Pb(NO3)2	Lettuce	4	17	30	Leaf Weight	LOEC		1000						John and Van Laerhoven, 1972			ES/ER/TM 85/R3
Lead		Loblolly pine	4	2.5		Growth	MATC		144		2	12	Y	Y	Davis and Barnes, 1973		a	OSWER Directive 9285.7 70
Lead		Red maple	4	2.5		Growth	MATC		144		2	12	Y	Y	Davis and Barnes, 1973		b	OSWER Directive 9285.7 70
Lead	PbCl2	Bluestem	5	1.93	84	Root Weight	LOEC		450						Miles and Parker, 1979b			ES/ER/TM 85/R3
Lead	PbCl2	Oat	5		42	Root Weight	LOEC		500						Khan and Frankland, 1984			ES/ER/TM 85/R3
Lead	PbCl2	Radish	5		42	Root Weight	LOEC		500						Khan and Frankland, 1983			ES/ER/TM 85/R3
Lead	PbCl2	Wheat	5		42	Root Weight	LOEC		1000						Khan and Frankland, 1984			ES/ER/TM 85/R3
Lead	PbO	Radish	5		42	Root Weight	LOEC		1000						Khan and Frankland, 1983			ES/ER/TM 85/R3
Lead		Ryegrass	5.6	0.1		Growth	MATC		22		2	14	Y	Y	Singh and Jeng, 1993			OSWER Directive 9285.7 70
Lead	PbCl2	Red Oak	6	1.5	112	Plant Weight	LOEC		50						Dixon, 1988			ES/ER/TM 85/R3
Lead		Corn	6		31	Plant Weight	LOEC		250						Miller et al., 1977			ES/ER/TM 85/R3
Lead	PbO	Wheat	6			Root and Shoot Weights	LOEC		1000						Muramoto et al., 1990			ES/ER/TM 85/R3
Lead	PbCl2	Rye	6			Shoot Weight	LOEC		5000						Carlson and Rolfe, 1979			ES/ER/TM 85/R3

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Lead	PbCl2	Fescue	6			Shoot Weight	LOEC		5000						Carlson and Rolfe. 1979			ES/ER/TM 85/R3
Lead		Red Oak	6	1.5		Growth	LOAEC		100		2	19	N	N	Dixon, 1988			OSWER Directive 9285.7 70
Lead		Berseem clover	6.3	0.94		Growth	MATC		316		2	14	Y	Y	Marques Dos Santos et al., 1993		b	OSWER Directive 9285.7 70
Lead		Corn	6.5	2.1		Growth	MATC		158		1	15	Y	N	Hassett et al., 1976			OSWER Directive 9285.7 70
Lead	PbCl2	sycamore			90	Leaf Weight	LOEC		50						Carlson and Bazzaz, 1977			ES/ER/TM 85/R3
Lead	PbCl2	autumn olive			49	Transpiration	LOEC		160						Rolfe and Bazzaz, 1975			ES/ER/TM 85/R3
Lead		*cassia occidentalis L.*			Up to 6 months in the field	Percentage of seed germination	LOEC		46	38					Krishnayya and Bedi, 1986			LA UR 08 6673
Lead		Berseem clover	6.7	3.11		Growth	MATC		141		1	13	Y	N	Marques Dos Santos et al., 1993		a	OSWER Directive 9285.7 70
Lead		Spinach	6.7	3		Growth	MATC		424		1	13	Y	N	Gaweda, 1991		b	OSWER Directive 9285.7 70
Lead		Radish	6.9	1		Growth, Biomass	LOAEC		500		2	14	N	N	Zaman and Zereen, 1998		a	OSWER Directive 9285.7 70
Lead		Radish	6.9	1		Growth	LOAEC		100		2	14	N	N	Zaman and Zereen, 1998		b	OSWER Directive 9285.7 70
Lead		Radish	6.9	1		Growth	LOAEC		100		2	14	N	N	Zaman and Zereen, 1998		c	OSWER Directive 9285.7 70
Lead	PbCl2	Corn	7	2.1	7	root length	LOEC		500						Hassett et al., 1976			ES/ER/TM 85/R3
Lead		Sow thistle	7.23	1.6		Growth	MATC		2263		1	14	Y	N	Xiong, 1997			OSWER Directive 9285.7 70
Lead		Tomato	7.45	2.06		Reproduction	MATC		35		0	14	N	N	Balba et al., 1991		a	OSWER Directive 9285.7 70
Lead		Tomato	7.73	1.7		Reproduction	MATC		71		1	15	Y	N	Balba et al., 1991		b	OSWER Directive 9285.7 70
Lead	PbCl2	Bluestem	8	2.5	84	Root and Shoot Weights	LOEC		450						Miles and Parker, 1979b			ES/ER/TM 85/R3
Lead		Tomato	8.2	0.86		Reproduction	MATC		71		1	15	Y	N	Balba et al., 1991		c	OSWER Directive 9285.7 70
Lead		Fenugreek	8.3	0.5		Growth	MATC		283		1	11	Y	N	Dang et al., 1990		g	OSWER Directive 9285.7 70

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Lead		Onion	8.3	0.5		Growth	LOAEC		50		1	11	N	N	Dang et al., 1990		d	OSWER Directive 9285.7 70
Lithium	LiSO4	Orange			180	Phytotoxic	LOEC		2						Aldrich et al., 1951			ES/ER/TM 85/R3
Lithium	LiCl	Bush Beans	6		10	Leaf Weight	LOEC		25						Wallace et al., 1977c			ES/ER/TM 85/R3
Lithium	LiNO3	Cotton	6		16	Leaf and stem weights	LOEC		50						Wallace et al., 1977c			ES/ER/TM 85/R3
Lithium	Li2C2O4	Barley	6		10	Shoot Weight	LOEC		500						Wallace, 1979			ES/ER/TM 85/R3
Manganese		Barley	4.6	0.78		Growth	MATC		71		2	16	Y	Y	Reid, 1965	55992		OSWER Directive 9285.7 71
Manganese		Common bean	5.4	1.9		Reproduction	LOAEC		80		2	15	N	N	Gonzalez and Lynch, 1999	18987		OSWER Directive 9285.7 71
Manganese		Nile grass	4.62-5.16	0.017 - 4.24		Growth	MATC		707		1	11	Y	Y	Foy et al., 1998	11629		OSWER Directive 9285.7 71
Manganese	MnSO4	Bush Beans			17	Stem Weight	LOEC		500						Wallace et al., 1977b			ES/ER/TM 85/R3
Manganese		Cotton	6.6	2.4		Growth	MATC		707		1	14	Y	Y	Rehab and Wallace, 1978b	46710		OSWER Directive 9285.7 71
Manganese		Barley	7.3	0.78		Growth	MATC		71		1	15	Y	Y	Reid, 1965	55992		OSWER Directive 9285.7 71
Mercury	chloralkali waste	Barley	7.4	0.7	7	Seedling height	LOEC		64						Panda et al., 1992			ES/ER/TM 85/R3
Mercury						Phytotoxic	LOEC		0.3						Kabata-Pendias and Pendias, 1984			ES/ER/TM 85/R3
Molydbenum						Phytotoxic	LOEC		2						Kabata-Pendias and Pendias, 1984			ES/ER/TM 85/R3
Nickel	NiSO4	Barley	6		14	Shoot Weight	LOEC		25						Wallace et al., 1977a			ES/ER/TM 85/R3
Nickel	NiCl2	Red Oak	6	1.5	112	Plant Weight	LOEC		50						Dixon, 1988			ES/ER/TM 85/R3
Nickel	NiCl2	Oats	6	1.4	110	Grain and straw weights	LOEC		50						Halstead et al., 1969			ES/ER/TM 85/R3
Nickel	NiSO4	Bush Beans	6		14	Leaf Weight	LOEC		100						Wallace et al., 1977a			ES/ER/TM 85/R3
Nickel	NiSO4	Bush Beans	6		14	Shoot Weight	LOEC		100						Wallace et al., 1977a			ES/ER/TM 85/R3
Nickel	NiCl2	Oats	6	4.1	110	Straw weight	LOEC		100						Halstead et al., 1969			ES/ER/TM 85/R3
Nickel	NiSO4	Ryegrass	5		28	Shoot Weight	LOEC		180						Khalid and Tinsley, 1980			ES/ER/TM 85/R3
Nickel	NiSO4	Corn	4		14	Shoot Weight	LOEC		250						Wallace et al., 1977a			ES/ER/TM 85/R3

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Nickel	NiSO4	Bush Beans	8		14	Shoot Weight	LOEC		250						Wallace et al., 1977a			ES/ER/TM 85/R3
Nickel	NiSO4	Corn	6		14	Shoot Weight	LOEC		250						Wallace et al., 1977a			ES/ER/TM 85/R3
Nickel	NiSO4	Corn	8		14	Shoot Weight	LOEC		250						Wallace et al., 1977a			ES/ER/TM 85/R3
Nickel	NiCl2	Corn	5	2.2	35	Plant Weight	LOEC		294						Traynor and Knezek, 1973			ES/ER/TM 85/R3
Nickel		Alfalfa	5.0	5.0		Growth	EC20		17		2	18	Y	Y	TN & Associates, Inc., 2000	56444	G	OSWER Directive 9285.7 76
Nickel		Barley	5.0	5.0		Growth	EC20		7		2	18	Y	Y	TN & Associates, Inc., 2000	56444	H	OSWER Directive 9285.7 76
Nickel		brassica	5.0	5.0		Growth	EC20		10		2	18	Y	Y	TN & Associates, Inc., 2000	56444	I	OSWER Directive 9285.7 76
Nickel		Alfalfa	6.3	0.1		Growth	EC20		25		2	18	Y	Y	TN & Associates, Inc., 2000	56444	J	OSWER Directive 9285.7 76
Nickel		Barley	6.3	0.1		Growth	EC20		65		2	18	Y	Y	TN & Associates, Inc., 2000	56444	K	OSWER Directive 9285.7 76
Nickel		brassica	6.3	0.1		Growth	EC20		32		2	18	Y	Y	TN & Associates, Inc., 2000	56444	L	OSWER Directive 9285.7 76
Nickel		Red Oak	6.0	1.5		Growth	MATC		32		2	16	Y	Y	Dixon, 1988	7450	--	OSWER Directive 9285.7 76
Nickel		Alfalfa	6.9	1.7		Growth	MATC		177		2	15	Y	Y	Taylor and Allinson, 1981	2790	B	OSWER Directive 9285.7 76
Nickel		Ryegrass	4.7	4.5		Growth	MATC		52		2	15	Y	Y	Khalid and Tinsley, 1980	7481	--	OSWER Directive 9285.7 76
Nickel		Alfalfa	6.4	1.0		Growth	MATC		177		2	11	Y	Y	Taylor, 1974	9645	--	OSWER Directive 9285.7 76
Nickel		oat	6.1	1.4		Reproduction	MATC		71		2	13	Y	Y	Halstead et al., 1969	7465	B	OSWER Directive 9285.7 76
Nickel		Corn	8.0	0.3		Growth	MATC		141		1	15	Y	N	Narwal et al., 1996	11707	A	OSWER Directive 9285.7 76
Nickel		Corn	7.8	0.2		Growth	MATC		71		1	15	Y	N	Narwal et al., 1996	11707	B	OSWER Directive 9285.7 76
Nickel		Corn	7.7	1.2		Growth	MATC		71		1	15	Y	N	Narwal et al., 1996	11707	C	OSWER Directive 9285.7 76
Nickel		Alfalfa	6.9	4.8		Growth	MATC		177		1	14	Y	N	Taylor and Allinson, 1981	2790	A	OSWER Directive 9285.7 76

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Nickel		Oat	5.7	4.1		Reproduction	MATC		224		1	12	Y	N	Halstead et al., 1969	7465	C	OSWER Directive 9285.7 76
Nickel		Alfalfa	5.7	4.1		Growth	MATC		32		1	12	Y	N	Halstead et al., 1969	7465	F	OSWER Directive 9285.7 76
Nickel		Alfalfa	7.8	4.0		Growth	MATC		224		0	11	Y	N	Halstead et al., 1969	7465	D	OSWER Directive 9285.7 76
Nickel		Oat	4.6	2.5		Growth	LOAEC		100		2	14	N	N	Tikhomirov et al., 1988	4757	B	OSWER Directive 9285.7 76
Nickel		Alfalfa	6.1	1.4		Growth	LOAEC		20		2	13	N	N	Halstead et al., 1969	7465	E	OSWER Directive 9285.7 76
Nickel		Cotton	6.8	2.2	35	Leaf and stem weights	LOAEC		100		1	12	N	N	Rehab and Wallace, 1978a,c	7523	A	ES/ER/TM 85/R3 and OSWER Directive 9285.7 76
Nickel		Corn	8.2	1.2		Growth	MATC		57		1	11	N	N	Metwally and Rabie, 1989	1536	D	OSWER Directive 9285.7 76
Nickel		Bush Beans	5.8	2.8		Growth	LOAEC		100		1	11	N	N	Wallace et al., 1977a	57304	B	OSWER Directive 9285.7 76
Nickel		Oat	5.9	2.9		Growth	LOAEC		400		1	13	N	N	Tikhomirov et al., 1988	4757	A	OSWER Directive 9285.7 76
Nickel		onion	8.3	0.5		Growth	LOAEC		50		1	11	N	N	Dang et al., 1990	12906	A	OSWER Directive 9285.7 76
Nickel		fenugreek	8.3	0.5		Growth	LOAEC		50		1	11	N	N	Dang et al., 1990	12906	B	OSWER Directive 9285.7 76
Nickel		Barley	5.8	2.8		Growth	MATC		50		1	11	N	N	Wallace et al., 1977a	57304	C	OSWER Directive 9285.7 76
Nickel		chickpea	8.0	2.0		Growth	MATC		6		0	11	N	N	Gupta et al., 1996	13146	A	OSWER Directive 9285.7 76
Nickel		lentil	8.0	2.0		Growth	MATC		4		0	11	N	N	Gupta et al., 1996	13146	B	OSWER Directive 9285.7 76
Nickel		Mustard	8.0	2.0		Growth	MATC		14		0	11	N	N	Gupta et al., 1996	13146	C	OSWER Directive 9285.7 76
Selenium	Na2SeO4	sorgrass	5	11	42	Shoot Weight	LOEC		1						Carlson et al., 1991			ES/ER/TM 85/R3
Selenium	Na2SeO3	sorgrass	5	11	42	Shoot Weight	LOEC		2						Carlson et al., 1991			ES/ER/TM 85/R3
Selenium		Alfalfa	5	5.0		Growth	EC20		1		0	16	Y	N	TN & Associates, 2000	56444	S	OSWER Directive 9285.7 72

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Selenium		Barley	5	5.0		Growth	EC20		3		0	16	Y	N	TN & Associates, 2000	56444	T	OSWER Directive 9285.7 72
Selenium		Brassica	5	5.0		Growth	EC20		1		0	16	Y	N	TN & Associates, 2000	56444	U	OSWER Directive 9285.7 72
Selenium		Alfalfa	5.6	1.3		Growth	MATC		0.9		2	12	Y	Y	Wan et al., 1988	7562	g	OSWER Directive 9285.7 72
Selenium	Na2SeO4	sorgrass	6	18.5	42	Shoot Weight	LOEC		1						Carlson et al., 1991			ES/ER/TM 85/R3
Selenium	Na2SeO4	sorgrass	6	18.5	42	Shoot Weight	LOEC		1						Carlson et al., 1991			ES/ER/TM 85/R3
Selenium	Na2SeO4	Alfalfa	6	15		Shoot Weight	LOEC		1.5						Wan et al., 1988			ES/ER/TM 85/R3
Selenium		Alfalfa	6.3	0.1		Growth	EC20		0.1		2	18	Y	Y	TN & Associates, 2000	56444	V	OSWER Directive 9285.7 72
Selenium		Barley	6.3	0.1		Growth	EC20		0.2		2	18	Y	Y	TN & Associates, 2000	56444	W	OSWER Directive 9285.7 72
Selenium		Brassica	6.3	0.1		Growth	EC20		0.2		2	18	Y	Y	TN & Associates, 2000	56444	X	OSWER Directive 9285.7 72
Selenium		Alfalfa	6.7	1.1		Growth	LOAEC		0.5		2	12	N	N	Wan et al., 1988	7562	e	OSWER Directive 9285.7 72
Selenium		Alfalfa	6.9	1.1		Growth	MATC		0.9		2	12	Y	Y	Wan et al., 1988	7562	h	OSWER Directive 9285.7 72
Selenium	Na2SeO4	sorgrass	7	11	42	Shoot Weight	LOEC		1						Carlson et al., 1991			ES/ER/TM 85/R3
Selenium	Na2SeO4	Alfalfa	7	13		Shoot Weight	LOEC		1.5						Wan et al., 1988			ES/ER/TM 85/R3
Selenium	Na2SeO4	Alfalfa	7	13		Shoot Weight	LOEC		1.5						Wan et al., 1988			ES/ER/TM 85/R3
Selenium	Na2SeO4	Alfalfa	7	6.5		Shoot Weight	LOEC		2						Soltanpour and Workman, 1980			ES/ER/TM 85/R3
Selenium	Na2SeO4	Alfalfa	7	6.3		Shoot Weight	LOEC		4						Soltanpour and Workman, 1980			ES/ER/TM 85/R3
Selenium	Na2SeO3	Wheat	7.9	0.2	50	weight	LOEC	LCT	2.5						Singh and Singh, 1978			ES/ER/TM 85/R3
Selenium		Raya	7.9	0.17		Growth	MATC		1.4		2	13	Y	Y	Singh et al., 1980b	21715		OSWER Directive 9285.7 72
Selenium	Na2SeO4	Alfalfa	8	5		Shoot Weight	LOEC		2						Soltanpour and Workman, 1980			ES/ER/TM 85/R3
Selenium	Na2SeO4	Alfalfa	8	3.7		Shoot Weight	LOEC		2						Soltanpour and Workman, 1980			ES/ER/TM 85/R3

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Selenium	Na2SeO4	Alfalfa	8	3.1		Shoot Weight	LOEC		2						Soltanpour and Workman, 1980			ES/ER/TM 85/R3
Selenium		Berseem	8	0.14		Growth	MATC		1.6		2	12	Y	Y	Singh et al., 1980a	21716		OSWER Directive 9285.7 72
Selenium		Cowpea	8	0.1		Growth	MATC		0.8		2	11	Y	Y	Singh and Singh, 1979	21714		OSWER Directive 9285.7 72
Silver							LOEC		2						Kabata-Pendias and Pendias, 1984			ES/ER/TM 85/R3
Silver		Soybeans	7.4	0.17-2.8		Growth	MATC		3162		0	11	Y	Y	Weaver and Klarich, 1973	20195	c	OSWER Directive 9285.7 77
Silver		Wheat	7.4	0.17-2.8		Growth	MATC		316		0	11	Y	Y	Weaver and Klarich, 1973	20195	e	OSWER Directive 9285.7 77
Silver		Corn	7.4	0.17-2.8		Growth	MATC		316		0	11	Y	Y	Weaver and Klarich, 1973	20195	f	OSWER Directive 9285.7 77
Silver		Sunflower	7.4	0.17-2.8		Growth	MATC		316		0	11	Y	Y	Weaver and Klarich, 1973	20195	g	OSWER Directive 9285.7 77
Thallium						Phytotoxic			1						Kabata-Pendias and Pendias, 1984			ES/ER/TM 85/R3
Tin	SnCl2	Bush Bean	6		17	Shoot Weight	LOEC		500						Romney et al., 1975			ES/ER/TM 85/R3
Tin						Phytotoxic	LOEC		50						Kabata-Pendias and Pendias, 1984			ES/ER/TM 85/R3
Uranium		Wheat				Seeds per Spike	EC25		0.5						Aery and Jain 1998			Sheppard et al. 2005
Uranium		Corn, Sorghum, Cotton, Sugar beet				Yield	EC25		5						Schevchenko et al. 1987			Sheppard et al. 2005
Uranium		Wheat, Tomato				Yield	EC25		6						Gulati et al. 1980			Sheppard et al. 2005
Uranium		Native Range Grasses				Biomass	LOEC		50						Meyer et al. 1998			Sheppard et al. 2005
Uranium		Wheat				Yield	EC11		50						Zhukov and Zudilkin 1971			Sheppard et al. 2005
Uranium		Rice				Survival	EC25		250						Bufatin et al. 1986			Sheppard et al. 2005
Uranium		Beans				Pod Yield	EC25		300						Sheppard et al. 1992			Sheppard et al. 2005
Uranium		Swiss Chard	6.4		40	Yield	LOEC		25						Sheppard et al. 1983			
Vanadium		Broccoli	6.5	1.1		Growth	LOAEC		100		2	15	Y	N	Kaplan et al., 1990	3295	a	OSWER Directive 9285.7 75

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Vanadium						Phytotoxic	LOEC		2.5						EPA 450/2-81-078			ES/ER/TM 85/R3
Vanadium						Phytotoxic	LOEC		50						Kabata-Pendias and Pendias, 1984			ES/ER/TM 85/R3
Zinc		Oats	4.2	0.7		Growth	LOAEC		95		2	17	N	N	Roszyk et al., 1988	13624	a	OSWER Directive 9285.7 73
Zinc		Mustard	4.2	0.7		Growth	LOAEC		95		2	17	N	N	Roszyk et al., 1988	13624	n	OSWER Directive 9285.7 73
Zinc		Oats	4.3	0.8		Growth	MATC		143		2	18	Y	Y	Roszyk et al., 1988	13624	p	OSWER Directive 9285.7 73
Zinc	ZnSO4	Beech	5			annual ring width	LOEC		3.3						Hagemeyer et al., 1993			ES/ER/TM 85/R3
Zinc		Oats	5.3	2.6		Growth	MATC		155		2	18	Y	Y	Roszyk et al., 1988	13624	b	OSWER Directive 9285.7 73
Zinc		Mustard	5.3	2.6		Growth	LOAEC		105		2	18	N	N	Roszyk et al., 1988	13624	l	OSWER Directive 9285.7 73
Zinc		Oats	5.4	7		Growth	MATC		283		1	11	N	N	De Haan et al., 1985	5048	e	OSWER Directive 9285.7 73
Zinc		Soybean	5.5	1.2		Growth	LOAEC		131		2	12	N	N	White et al., 1979b	57096	a	OSWER Directive 9285.7 73
Zinc		Oats	5.6	2.3		Growth	MATC		361		1	17	Y	N	Roszyk et al., 1988	13624	d	OSWER Directive 9285.7 73
Zinc		Mustard	5.6	2.3		Growth	MATC		177		1	17	Y	N	Roszyk et al., 1988	13624	g	OSWER Directive 9285.7 73
Zinc		Seradela	5.6	5.2		Growth	LOAEC		102		1	17	N	N	Roszyk et al., 1988	13624	zb	OSWER Directive 9285.7 73
Zinc		Oats	5.7	1.3		Growth	MATC		159		2	18	Y	Y	Roszyk et al., 1988	13624	u	OSWER Directive 9285.7 73
Zinc		Oats	5.7	5.7		Growth	MATC		319		1	18	Y	N	Roszyk et al., 1988	13624	zc	OSWER Directive 9285.7 73
Zinc		Seradela	5.7	5.7		Growth	LOAEC		95		1	17	N	N	Roszyk et al., 1988	13624	ze	OSWER Directive 9285.7 73
Zinc		Oats	5.9	2.3		Growth	MATC		169		1	17	Y	N	Roszyk et al., 1988	13624	z	OSWER Directive 9285.7 73
Zinc	ZnSO4	Soybean	6			Leaf Weight	LOEC		131						White et al., 1979a			ES/ER/TM 85/R3
Zinc	ZnO	Wheat	6			Plant Weight and grain yeild	LOEC		1000						Muramoto et al., 1990			ES/ER/TM 85/R3

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Zinc	ZnO	Rice	6			Root Weight	LOEC		1000						Muramoto et al., 1990			ES/ER/TM 85/R3
Zinc		Lettuce	6.3	<1		Growth	MATC		173		2	12	Y	Y	Sheppard et al., 1993	4146	b	OSWER Directive 9285.7 73
Zinc		Soybean	6.5	1.2		Growth	MATC		185		2	13	Y	Y	White et al., 1979b	57096	d	OSWER Directive 9285.7 73
Zinc	ZnSO4	Soybean				Seeds/Plant	LOEC		25						Aery and Sakar, 1991			ES/ER/TM 85/R3
Zinc	ZnSO4	coriander			60	Root and Shoot Weights	LOEC		87						Lata and Veer, 1990			ES/ER/TM 85/R3
Zinc	ZnSO4	spinach			60	Root and Shoot Weights	LOEC		87						Lata and Veer, 1990			ES/ER/TM 85/R3
Zinc	ZnSO4	cowpea			30	Shoot Weight	LOEC		316						Gall and Barnette, 1940			ES/ER/TM 85/R3
Zinc	ZnSO4	Corn			30	Shoot Weight	LOEC		632						Gall and Barnette, 1940			ES/ER/TM 85/R3
Zinc	ZnSO4	Cowpea			30	Shoot Weight	LOEC		222						Gall and Barnette, 1940			ES/ER/TM 85/R3
Zinc	ZnSO4	Corn			30	Shoot Weight	LOEC		334						Gall and Barnette, 1940			ES/ER/TM 85/R3
Zinc	ZnSO4	Corn			30	Shoot Weight	LOEC		404						Gall and Barnette, 1940			ES/ER/TM 85/R3
Zinc	ZnSO4	cowpea			30	Shoot Weight	LOEC		141						Gall and Barnette, 1940			ES/ER/TM 85/R3
Zinc		Cotton	6.6	2.4		Growth	MATC		283		1	14	Y	N	Rehab and Wallace, 1978b	46710	b	OSWER Directive 9285.7 73
Zinc		Cotton	6.6	2.4		Growth	MATC		283		1	14	Y	N	Rehab and Wallace, 1978b	46710	a	OSWER Directive 9285.7 73
Zinc	ZnSO4	Soybean	7			Leaf Weight	LOEC		393						White et al., 1979a			ES/ER/TM 85/R3
Zinc		Carrot	7.0	1.032		Growth	MATC		57		1	17	Y	N	Kadar and Morvai, 1998	12988	a	OSWER Directive 9285.7 73
Zinc		Garden Pea	7.0	1.032		Growth	MATC		34		1	17	Y	N	Kadar and Morvai, 1998	12988	b	OSWER Directive 9285.7 73
Zinc		Red Clover	7.0	3.00		Growth	MATC		90		1	11	Y	N	Biro et al., 1998	12986	b	OSWER Directive 9285.7 73
Zinc		Oats	7.0	3.3		Growth	MATC		162		0	16	Y	N	Roszyk et al., 1988	13624	t	OSWER Directive 9285.7 73
Zinc		Common Bean	7.1	0.32		Growth	MATC		330		1	13	Y	N	Kucharski and Niklewska, 1992	13292		OSWER Directive 9285.7 73
Zinc		Mustard	7.1	3.7		Growth	MATC		157		0	16	Y	N	Roszyk et al., 1988	13624	zm	OSWER Directive 9285.7 73

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Zinc		Mustard	7.9	2.70		Growth	MATC		424		0	12	Y	N	Sheppard et al., 1993	4146	c	OSWER Directive 9285.7 73
Zinc		Wheat	8.2	0.086		Growth	MATC		113		1	13	Y	N	Singh et al., 1991	12701		OSWER Directive 9285.7 73
Zinc		Onion	8.3	0.5		Growth	MATC		141		1	11	Y	N	Dang et al., 1990	12906	E	OSWER Directive 9285.7 73
Zinc		Fenugreek	8.3	0.5		Growth	MATC		283		1	11	Y	N	Dang et al., 1990	12906	H	OSWER Directive 9285.7 73
Fluorine						Phytotoxic	LOEC		200						Kabata-Pendias and Pendias, 1984			ES/ER/TM 85/R3
Iodine	KI	Tomato	7		97	Top Weight	LOEC		4						Newton and Toth 1952			ES/ER/TM 85/R3
Iodine	KI	Tomato	7		97	Top Weight	LOEC		4						Newton and Toth, 1952			ES/ER/TM 85/R3
Iodine	KI	Tomato	7		97	Top Weight	LOEC		4						Newton and Toth, 1952			ES/ER/TM 85/R3
Iodine	KI	Tomato	7		97	Top Weight	LOEC		4						Newton and Toth, 1952			ES/ER/TM 85/R3
Toluene		Soybean	5		21	Fresh Shoot Weight	LOEC		20,000						Overcash et al., 1982			ES/ER/TM 85/R3
Toluene		Corn	5		21	Fresh Shoot Weight	LOEC		200						Overcash et al., 1982			ES/ER/TM 85/R3
Toluene		Corn	4			% germination	LOEC		20,000						Overcash et al., 1982			ES/ER/TM 85/R3
Toluene		Corn	6		21	Fresh Shoot Weight	LOEC		20,000						Overcash et al., 1982			ES/ER/TM 85/R3
Toluene		Fescue	6		21	Fresh Shoot Weight	LOEC		20,000						Overcash et al., 1982			ES/ER/TM 85/R3
Toluene		Soybean	6		21	Fresh Shoot Weight	LOEC		200						Overcash et al., 1982			ES/ER/TM 85/R3
Toluene		Soybean	4			% germination	LOEC		2000						Overcash et al., 1982			ES/ER/TM 85/R3
Acenaphthene		Lettuce	8	2	14	Fresh Weight Shoot	LOEC		25						Hulzebos et al., 1993			ES/ER/TM 85/R3
Anthracene		Oats	5.5	2.0		Growth	EC50		30		2	15	N	N	Mitchell et al., 1988	15861	g	OSWER Directive 9285.7 78
Anthracene		Cucumber	5.5	2.0		Growth	EC50		720		2	15	N	N	Mitchell et al., 1988	15861	h	OSWER Directive 9285.7 78
Anthracene		Oats	5.5	2.0		Mortality	LC50		525		2	14	N	N	Mitchell et al., 1988	15861	a	OSWER Directive 9285.7 78
Anthracene		Cucumber	5.5	2.0		Mortality	LC50		>1000		2	12	N	N	Mitchell et al., 1988	15861	b	OSWER Directive 9285.7 78

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Anthracene		Soybean	5.5	2.0		Mortality	LC50		>1000		2	12	N	N	Mitchell et al., 1988	15861	c	OSWER Directive 9285.7 78
Anthracene		Heath Banksia	5.5	2.0		Mortality	LC50		>1000		2	12	N	N	Mitchell et al., 1988	15861	d	OSWER Directive 9285.7 78
Anthracene		She-oak	5.5	2.0		Mortality	LC50		>1000		2	12	N	N	Mitchell et al., 1988	15861	e	OSWER Directive 9285.7 78
Anthracene		Yellow Bloodwood	5.5	2.0		Mortality	LC50		>1000		2	12	N	N	Mitchell et al., 1988	15861	f	OSWER Directive 9285.7 78
Anthracene		Soybean	5.5	2.0		Growth	EC50		>1000		2	15	N	N	Mitchell et al., 1988	15861	i	OSWER Directive 9285.7 78
Anthracene		HHath Banksia	5.5	2.0		Growth	EC50		>1000		2	15	N	N	Mitchell et al., 1988	15861	j	OSWER Directive 9285.7 78
Anthracene		She-oak	5.5	2.0		Growth	EC50		>1000		2	15	N	N	Mitchell et al., 1988	15861	k	OSWER Directive 9285.7 78
Anthracene		Yellow Bloodwood	5.5	2.0		Growth	EC50		>1000		2	15	N	N	Mitchell et al., 1988	15861	l	OSWER Directive 9285.7 78
TPH Diesel							EC50	10th percentile of LOEC	1105						Marwood et al., 1998			Efroymson et al., 2004
TPH Diesel							EC50	10th percentile of LOEC	1039						Marwood et al., 1998			Efroymson et al., 2004
TPH Diesel							LOAEC	10th percentile of LOEC	10000						Miller et al., 1980			Efroymson et al., 2004
TPH Diesel							EC>20	10th percentile of LOEC	25000						Adam and Duncan, 1999; Hou et al., 1999			Efroymson et al., 2004
TPH Diesel							EC>20	10th percentile of LOEC	14000						Wang and Bartha, 1990			Efroymson et al., 2004
TPH Diesel							EC50	10th percentile of LOEC	94						Marwood et al., 1998			Efroymson et al., 2004
Bis[2-ethylhexyl] phthalate	diethylphthalate	Lettuce	8	2	14	Fresh Weight Shoot	LOEC		134						Hulzebos et al., 1993			ES/ER/TM 85/R3
Bis[2-ethylhexyl] phthalate	Di-n-butylphthalate	Corn	6		21	Shoot Weight (fresh)	LOEC		200						Overcash et al., 1982			ES/ER/TM 85/R3
Bis[2-ethylhexyl] phthalate	Di-n-butylphthalate	Corn	4		21	Root and Shoot Weights (fresh)	LOEC		200						Overcash et al., 1982			ES/ER/TM 85/R3

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Bis[2-ethylhexyl] phthalate	Di-n-butylphthalate	Corn	5		21	Shoot Weight (fresh)	LOEC		200						Overcash et al., 1982			ES/ER/TM 85/R3
Bis[2-ethylhexyl] phthalate	Di-n-butylphthalate	Fescue	5		21	Shoot Weight (fresh)	LOEC		2000						Overcash et al., 1982			ES/ER/TM 85/R3
Bis[2-ethylhexyl] phthalate	Di-n-butylphthalate	Fescue	6		21	Shoot Weight (fresh)	LOEC		2000						Overcash et al., 1982			ES/ER/TM 85/R3
Bis[2-ethylhexyl] phthalate	Di-n-butylphthalate	Soybean	6		21	Shoot Weight (fresh)	LOEC		200						Overcash et al., 1982			ES/ER/TM 85/R3
Bis[2-ethylhexyl] phthalate	Di-n-butylphthalate	Soybean	4		21	% seed germination	LOEC		200						Overcash et al., 1982			ES/ER/TM 85/R3
phenol		Lettuce	8	2	14	Fresh Weight Shoot	LOEC		79						Hulzebos et al., 1993			ES/ER/TM 85/R3
phenol		Lettuce	8	2	14	Fresh Weight Shoot	LOEC		168						Hulzebos et al., 1993			ES/ER/TM 85/R3
PCB - Aroclor 1254		Pigweed	4	1.4	28	Plant height	LOEC		100						Strek and Weber, 1982			ES/ER/TM 85/R3
PCB - Aroclor 1254		Soybean	5	1	26	Fresh Weight Shoot	LOEC		100						Weber and Mrozek, 1979			ES/ER/TM 85/R3
PCB - Aroclor 1254		Soybean	5	1	16	Fresh Weight Shoot	LOEC		1000						Strek and Weber, 1980			ES/ER/TM 85/R3
PCB - Aroclor 1254		Pigweed	5	1		Fresh weight leaves and plant height	LOEC		100						Strek and Weber, 1980			ES/ER/TM 85/R3
PCB - Aroclor 1254		Soybean	5	1	16	Fresh Weight Shoot	LOEC		1000						Strek and Weber, 1980			ES/ER/TM 85/R3
PCB - Aroclor 1254		Pigweed	5	1		Fresh weight leaves and plant height	LOEC		40						Strek and Weber, 1980			ES/ER/TM 85/R3
PCB - Aroclor 1254		Soybean	5	1	16	Fresh weight leaves and plant height	LOEC		1000						Strek and Weber, 1980			ES/ER/TM 85/R3
PCB - Aroclor 1254		Beet	5	1		Fresh weight leaves and plant height	LOEC		1000						Strek and Weber, 1980			ES/ER/TM 85/R3
DDT		Common bean	7.8	0.9		Growth	MATC		7.1		0	12	Y	N	Pareek and Gaur, 1970	17330	a	OSWER Directive 9285.7 57

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Dieldrin		Cotton	6.6	0.85		Growth	MATC	Medium vigor seeds. Seedling height.	34.6		1	14	N	N	Rajanna and de la Cruz, 1977		a	OSWER Directive 9285.7 56
Dieldrin		Soybean	6.6	0.85		Growth	MATC	Medium vigor seeds. Seedling height.	14.1		1	14	N	N	Rajanna and de la Cruz, 1977		b	OSWER Directive 9285.7 56
Dieldrin		Corn	6.6	0.85		Growth	MATC	Medium vigor seeds. Seedling height.	24.5		1	14	N	N	Rajanna and de la Cruz, 1977		c	OSWER Directive 9285.7 56
Dieldrin		Wheat	6.6	0.85		Growth	MATC	Medium vigor seeds. Seedling height.	34.6		1	14	N	N	Rajanna and de la Cruz, 1977		d	OSWER Directive 9285.7 56
Dieldrin		Cotton	6.6	0.85		Growth	MATC	Medium vigor seeds. Seedling dry weight.	44.7		1	14	N	N	Rajanna and de la Cruz, 1977		e	OSWER Directive 9285.7 56
Dieldrin		Soybean	6.6	0.85		Growth	MATC	Medium vigor seeds. Seedling dry weight.	34.6		1	14	N	N	Rajanna and de la Cruz, 1977		f	OSWER Directive 9285.7 56
Dieldrin		Corn	6.6	0.85		Growth	MATC	Medium vigor seeds. Seedling dry weight.	24.5		1	14	N	N	Rajanna and de la Cruz, 1977		g	OSWER Directive 9285.7 56
Dieldrin		Wheat	6.6	0.85		Growth	MATC	Medium vigor seeds. Seedling dry weight.	7.1		1	14	N	N	Rajanna and de la Cruz, 1977		h	OSWER Directive 9285.7 56
Dieldrin		Cotton	6.6	0.85		Growth	MATC	Low vigor seeds. Seedling height.	34.6		1	14	N	N	Rajanna and de la Cruz, 1977		i	OSWER Directive 9285.7 56
Dieldrin		Soybean	6.6	0.85		Growth	MATC	Low vigor seeds. Seedling height.	24.5		1	14	N	N	Rajanna and de la Cruz, 1977		j	OSWER Directive 9285.7 56
Dieldrin		Corn	6.6	0.85		Growth	MATC	Low vigor seeds. Seedling height.	34.6		1	14	N	N	Rajanna and de la Cruz, 1977		k	OSWER Directive 9285.7 56

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Dieldrin		Wheat	6.6	0.85		Growth	MATC	Low vigor seeds. Seedling height.	7.1		1	14	N	N	Rajanna and de la Cruz, 1977		l	OSWER Directive 9285.7 56
Dieldrin		Cotton	6.6	0.85		Growth	MATC	Low vigor seeds. Seedling dry weight.	7.1		1	14	N	N	Rajanna and de la Cruz, 1977		m	OSWER Directive 9285.7 56
Dieldrin		Soybean	6.6	0.85		Growth	MATC	Low vigor seeds. Seedling dry weight.	14.1		1	14	N	N	Rajanna and de la Cruz, 1977		n	OSWER Directive 9285.7 56
Dieldrin		Corn	6.6	0.85		Growth	MATC	Low vigor seeds. Seedling dry weight.	7.1		1	14	N	N	Rajanna and de la Cruz, 1977		o	OSWER Directive 9285.7 56
Dieldrin		Wheat	6.6	0.85		Growth	MATC	Low vigor seeds. Seedling dry weight.	7.1		1	14	N	N	Rajanna and de la Cruz, 1977		p	OSWER Directive 9285.7 56
Dieldrin		Corn, Reids yellow			14	Growth	LOEC	Decreased plant size	1.149						Cole et al. 1976			LA UR 08 6673
Dieldrin		Cabbage			35	Growth	LOEC	Decreased in plant size, root fresh mass, and shoot fresh mass	0.114	22					Kabir and Kahn 1972			LA UR 08 6673
Ammonia	no data																	
Bismuth	no data																	
Calcium	no data																	
Chloride	no data																	
Cyanide	no data																	
Hexavalent Chromium	Only LANL data																	
Hydrazine	no data																	
Magnesium	no data																	
Nitrate	no data																	
Nitrite	no data																	
Nitrogen in Nitrite and Nitrate	no data																	
Phosphate	no data																	
Potassium	no data																	
Silicon	no data																	
Sodium	no data																	
Strontium	no data																	
Sulfate	no data																	
Sulfide	no data																	
Thorium	no data																	
Titanium	no data																	
Zirconium	no data																	
1,1,1-Trichloroethane	no data																	
2-Butanone	no data																	

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
4,4'-DDD (Dichlorodiphenyldichloroethane)	no data																	
Acetone	no data																	
Aroclor-1260	no data																	
Benzene	no data																	
Benzo(a)anthracene	no data																	
Benzo(a)pyrene	no data																	
Benzo(b)fluoranthene	no data																	
Benzo(ghi)perylene	no data																	
Benzo(k)fluoranthene	no data																	
Bis(2-ethylhexyl) phthalate	no data																	
Butylbenzylphthalate	no data																	
Carbazole	no data																	
Carbon disulfide	no data																	
Chloroform	no data																	
Chloromethane	no data																	
Chrysene	no data																	
Diacetone alcohol	no data																	
Dibenz[a,h]anthracene	no data																	
Fluoranthene	no data																	
High boiling hydrocarbons	no data																	
Indeno(1,2,3-cd)pyrene	no data																	
Methylene chloride	no data																	
Phenanthrene	no data																	
Pyrene	no data																	
Tetrachloroethene	no data																	
Total organic carbon	NA																	
Total petroleum hydrocarbons - motor oil (high boiling)	no data																	
Xylenes (total)	Only LANL data																	
Alkalinity	NA																	
pH Measurement (range)	NA																	
Europium-154	no data, but there is data for E-152																	
Europium-155	no data, but there is data for E-153																	
Neptunium-237	no data																	
Nickel-63	no data																	
Plutonium-238	no data																	
Plutonium-239/240	no data																	
Potassium-40	no data and not listed														CPEE (DOE-RL-2001-54 Rev 0, App C3)			
Radium-226	no data																	
Radium-228	no data																	

Table 6-7. Terrestrial Plant Effect Data

Chemical		Test Organism				Toxicity Value					Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concen. (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Selenium-79	no data and Excluded - Constituent generated at less than 5.0 E-05 times cesium-137 activity. Based on ORIGEN2 modeling of Hanford reactor production.														CPEE (DOE-RL-2001-54 Rev 0, App C3)			
Strontium-90	no data																	
Technetium-99	no data																	
Thorium-230	no data and not listed														CPEE (DOE-RL-2001-54 Rev 0, App C3)			
Thorium-232	no data																	
Tritium	no data and Not listed and is on target list for 100-BC OUs														CPEE (DOE-RL-2001-54 Rev 0, App C3)			
Uranium-233/234	no data																	
Uranium-234	no data																	
Uranium-235	no data																	
Uranium-238	no data																	
Gross alpha	NA																	
Gross beta	NA																	
Total beta radiostrontium	NA																	

Notes:

Geometric means were derived using LOECs, LOAECs, EC20s, EC10s, and MATCs. ILLs, LC50s, and EC50s were not evaluated except for TPH diesel for which all endpoints were listed as 10th percentiles of the LOEC.

EC25s, EC50s, and LC50s were only considered for analytes for which no other effects data were available. A geometric mean was derived from these effect levels and then the geometric mean was multiplied by uncertainty factor of 0.1.

Values for diethyl phthalate and di-n-butyl phthalate were used as a surrogate for bis[2-ethylhexyl] phthalate.

Acronyms:

EC10 = concentration at which an effect is observed in 10% of exposed organisms
EC20 = concentration at which an effect is observed in 20% of exposed organisms
EC50 = concentration at which an effect is observed in 50% of exposed organisms
ILL = Incipient lethal level
LC50 = concentration lethal to 50% of exposed organisms
LCT = Lowest Concentration Tested
LOAEC = lowest observed adverse effect concentration
LOEC = lowest adverse effect concentration
MATC = maximum acceptable toxicant concentration (calculated as a geometric mean of the NOEC and LOEC)
NOEC = no observed effect concentration

Table 6-8. Summary of Terrestrial Invertebrate Effects Data

Chemical		Test Organism		Soil			Toxicity Value						Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	Species	Type	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concentration (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Aluminum																				OSWER Directive 9285.7 60
Antimony		Enchytraeid	Enchytraeus crypticus		4.08-5.29	1.2		Reproduction	EC20		194		2	16	Y	Y	Kuperman et al., 2002			OSWER Directive 9285.7 61
Antimony		Springtail	Folsomia candida		4.57-5.29	1.2		Reproduction	EC20		81		2	17	Y	Y	Phillips et al., 2002			OSWER Directive 9285.7 61
Antimony		Earthworm	Eisenia fetida		4.39-5.29	1.2		Reproduction	EC20		30		2	15	Y	Y	Simini et al., 2002			OSWER Directive 9285.7 61
Arsenic	KH2AsO4	Earthworm	Eisenia fetida	Peaty Marshland Soil and Manure			56	Cocoons/Worm	LOEC	Lowest Concentration Tested (LCT)	68	56					Fischer and Koszorus, 1992			ES/ER/TM-126/R2
Barium		Potworm	Enchytraeus crypticus		4.36-5.29	1.2		Reproduction	EC20		585		2	17	Y	Y	Kuperman et al., 2002			OSWER Directive 9285.7 63
Barium		Springtail	Folsomia candida		4.47-5.29	1.2		Reproduction	EC20		165		2	18	Y	Y	Phillips et al., 2002			OSWER Directive 9285.7 63
Barium		Earthworm	Eisenia fetida		4.26-5.29	1.2		Reproduction	EC20		370		2	17	Y	Y	Simini et al., 2002			OSWER Directive 9285.7 63
Beryllium		Potworm	*Enchytraeus crypticus*		4.29-5.29	1.2		Reproduction	EC20		45		2	17	Y	Y	Kuperman et al., 2002	62344		ES/ER/TM 85/R3 and OSWER Directive 9285.7 64
Beryllium		Springtail	*Folsomia candida*		4.29-5.29	1.2		Reproduction	EC20		28		2	18	Y	Y	Phillips et al., 2002	62345		ES/ER/TM 85/R3 and OSWER Directive 9285.7 64
Beryllium		Earthworm	*Eisenia fetida*		3.83-5.29	1.2		Reproduction	EC20		52		2	16	Y	Y	Simini et al., 2002	62343		ES/ER/TM 85/R3 and OSWER Directive 9285.7 64
Cadmium	C4H6CdO4	Earthworm	*Eisenia fetida*	Horse Manure			56	Cocoon Production	LOEC	LCT	25	52					Malecki et al., 1982			ES/ER/TM-126/R2
Cadmium	C4H6CdO4	Earthworm	*Eisenia fetida*	Horse Manure			140	Cocoon Production	LOEC	LCT	50	24					Malecki et al., 1982			ES/ER/TM-126/R2
Cadmium	Soluble Forms	Earthworm	*Eisenia fetida*	Horse Manure			42	Growth;Cocoon Production	LOEC	LCT	100	25,100					Neuhauser et al., 1984			ES/ER/TM-126/R2
Cadmium		Nematode	*Caenorhabditis elegans*		4	4.2		Mortality	LC50		7		2	13	N	N	Donkin and Dusenbery, 1994			OSWER Directive 9285.7 65
Cadmium		Nematode	*Caenorhabditis elegans*		4	1.14		Mortality	LC50		268		2	13	N	N	Peredney and Williams, 2000b		a	OSWER Directive 9285.7 65
Cadmium		Nematode	*Caenorhabditis elegans*		4	1.14		Mortality	LC50		371		2	13	N	N	Peredney and Williams, 2000b		b	OSWER Directive 9285.7 65
Cadmium		Nematode	*Caenorhabditis elegans*		4	4.2		Mortality	LC50		937		2	13	N	N	Peredney and Williams, 2000b		c	OSWER Directive 9285.7 65
Cadmium		Nematode	*Caenorhabditis elegans*		4	4.2		Mortality	LC50		1215		2	13	N	N	Peredney and Williams, 2000b		d	OSWER Directive 9285.7 65
Cadmium		Earthworm	*Eisenia fetida*		4.1	1.7		Mortality	LC50		>1000		2	14	N	N	Van Gestel and Van Dis, 1988		a	OSWER Directive 9285.7 65

Table 6-8. Summary of Terrestrial Invertebrate Effects Data

Chemical		Test Organism		Soil			Toxicity Value						Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	Species	Type	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concentration (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Cadmium		Springtail	*Folsomia candida*		5.2	2.4		Reproduction	EC50		125		2	18	N	N	Vonk et al., 1996		c	OSWER Directive 9285.7 65
Cadmium		Springtail	*Folsomia candida*		4.9	3.8		Reproduction	EC50		49		2	18	N	N	Vonk et al., 1996		e	OSWER Directive 9285.7 65
Cadmium		Earthworm	*Eisenia fetida*		5.4	2.4		Growth	EC50		393		2	17	N	N	Vonk et al., 1996		h	OSWER Directive 9285.7 65
Cadmium		Earthworm	*Eisenia fetida*		4.9	3.8		Growth	EC50		332		2	17	N	N	Vonk et al., 1996		j	OSWER Directive 9285.7 65
Cadmium		Earthworm	*Eisenia andrei*		6.5	10.0		Mortality	ILL	Incipient Lethal Level	112		1	16	N	N	Conder and Lanno, 2000			OSWER Directive 9285.7 65
Cadmium		Springtail	*Folsomia candida*		6.2	10.0		Reproduction	EC50		123		1	15	N	N	Crommentuijn et al., 1995			OSWER Directive 9285.7 65
Cadmium		Earthworm	*Eisenia fetida*		6.5	10.0		Mortality	LC50		298		1	13	N	N	Fitzpatrick et al., 1996			OSWER Directive 9285.7 65
Cadmium		Earthworm	*Eisenia fetida*		6.0	10.0		Mortality	LC50		876		1	14	N	N	Neuhauser et al., 1986a, 1985			OSWER Directive 9285.7 65
Cadmium		Nematode	*Caenorhabditis elegans*		4	10.0		Mortality	LC50		1,641		1	12	N	N	Peredney and Williams, 2000a			OSWER Directive 9285.7 65
Cadmium		Nematode	*Caenorhabditis elegans*		4	10.0		Mortality	LC50		1642		1	12	N	N	Peredney and Williams, 2000b		e	OSWER Directive 9285.7 65
Cadmium		Nematode	*Caenorhabditis elegans*		4	10.0		Mortality	LC50		1852		1	12	N	N	Peredney and Williams, 2000b		f	OSWER Directive 9285.7 65
Cadmium		Earthworm	*Eisenia fetida*		6.1	10.0		Growth	EC50		215		1	15	N	N	Spurgeon and Hopkin, 1995			OSWER Directive 9285.7 65
Cadmium		Earthworm	*Eisenia fetida*		6.3	10.0		Reproduction	EC50		46		1	15	N	N	Spurgeon et al., 1994			OSWER Directive 9285.7 65
Cadmium		Springtail	*Folsomia candida*		6.0	10.0		Reproduction	EC50		40		1	15	N	N	Van Gestel and Hensbergen, 1997			OSWER Directive 9285.7 65
Cadmium		Springtail	*Folsomia candida*		5.0	10.0		Reproduction	EC50		101		1	17	N	N	Vonk et al., 1996		a	OSWER Directive 9285.7 65
Cadmium		Springtail	*Folsomia candida*		6.5	10.0		Reproduction	EC50		223		1	17	N	N	Vonk et al., 1996		b	OSWER Directive 9285.7 65
Cadmium		Springtail	*Folsomia candida*		6.5	2.4		Reproduction	EC50		112		1	17	N	N	Vonk et al., 1996		d	OSWER Directive 9285.7 65
Cadmium		Earthworm	*Eisenia fetida*		5.4	10.0		Growth	EC50		410		1	16	N	N	Vonk et al., 1996		f	OSWER Directive 9285.7 65
Cadmium		Earthworm	*Eisenia fetida*		6.9	10.0		Growth	EC50		358		1	16	N	N	Vonk et al., 1996		g	OSWER Directive 9285.7 65
Cadmium		Earthworm	*Eisenia fetida*		6.9	2.4		Growth	EC50		343		1	16	N	N	Vonk et al., 1996		I	OSWER Directive 9285.7 65
Cadmium		Earthworm	*Eisenia fetida*		7.0	7.7		Mortality	LC50		>1000		0	12	N	N	Van Gestel and Van Dis, 1988		b	OSWER Directive 9285.7 65

Table 6-8. Summary of Terrestrial Invertebrate Effects Data

Chemical		Test Organism		Soil			Toxicity Value						Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	Species	Type	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concentration (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Cadmium	CdCl2	Earthworm	*Eisenia andrei*	OECD Soil	6	5	84	Sexual Development EC50	LOEC		27	50					Van Gestel et al., 1991b			ES/ER/TM-126/R2
Cadmium	Cd(NO3)2	Earthworm	*Eisenia fetida*	OECD Soil	6		56	Cocoon Production EC50	LOEC		46.3	50					Spurgeon et al., 1994			ES/ER/TM-126/R2
Cadmium	CdCl2	Earthworm	*Eisenia andrei*	OECD Soil	6	5	84	Sexual Development EC50	LOEC		108	50					Van Gestel et al., 1991a			ES/ER/TM-126/R2
Cadmium	CdCl2	Earthworm	*Eisenia fetida*	Sandy Soil	4	0.9	14	Survival LC50	LOEC		440	50					Van Gestel and Van Dis 1988			ES/ER/TM-126/R2
Cadmium	CdNO3	Earthworm	*Eisenia fetida*	OECD Soil	6	5	14	Survival LC50	LOEC		1843	50					Neuhauser et al., 1985b			ES/ER/TM-126/R2
Cadmium		Springtail	*Folsomia candida*		5.6	10.0		Population	EC10		6		1	16	Y	Y	Van Gestel and Van Diepen, 1997			OSWER Directive 9285.7 65
Cadmium	CdSO4	Earthworm	*Aporrectodea caliginosa*	Egyptian	7.05	10.8	56	Cocoon Production	LOEC		10	25					Khalil et al., 1996			ES/ER/TM-126/R2
Cadmium	CdCl2	Earthworm	*Eisenia andrei*	OECD Soil	6	5	21	Cocoons/Worm; Juveniles/Worm	LOEC		18	23,22					Van Gestel et al., 1992			ES/ER/TM-126/R2
Cadmium	CdCl2	Earthworm	*Eisenia andrei*	OECD Soil	6	5	84	Growth	LOEC		32	40					Van Gestel et al., 1991a			ES/ER/TM-126/R2
Cadmium	CdCl2	Earthworm	*Eisenia andrei*	OECD Soil	6	5	84	Growth	LOEC		100	44					Van Gestel et al., 1991a			ES/ER/TM-126/R2
Cadmium		Earthworm	*Dendrobaena rubida*	Soil and Dung	5	5.7	120	Cocoons/Worm	LOEC		100	62					Bengtsson et al., 1986			ES/ER/TM-126/R2
Cadmium		Earthworm	*Dendrobaena rubida*	Soil and Dung	6	5.7	120	Cocoons/Worm; Hatchlings/Cocoon	LOEC		100	78,71					Bengtsson et al., 1986			ES/ER/TM-126/R2
Cadmium		Earthworm	*Dendrobaena rubida*	Soil and Dung	6	5.7	120	Total Hatchlings	LOEC		100	74					Bengtsson et al., 1986			ES/ER/TM-126/R2
Cadmium		Earthworm	*Dendrobaena rubida*	Soil and Dung	7	5.7	120	% Cocoon Hatching success	LOEC		100	47					Bengtsson et al., 1986			ES/ER/TM-126/R2
Cadmium		Earthworm	*Dendrobaena rubida*	Soil and Dung	7	5.7	120	Hatchlings/Conc; Total Hatchlings	LOEC		100	38,30					Bengtsson et al., 1986			ES/ER/TM-126/R2
Cadmium	Cd(NO3)2	Earthworm	*Eisenia fetida*	OECD Soil	6.1		21	Growth	LOEC		215	50					Spurgeon and Hopkin, 1995			ES/ER/TM-126/R2
Cadmium	CdCl2	Earthworm	*Lumbricus rubellas*	Sandy Loam	7	4	84	Survival	LOEC		1000	82					Ma, 1982			ES/ER/TM-126/R2
Cadmium		Earthworm	*Eisenia andrei*		6.0	10.0		Reproduction	MATC		13		1	16	Y	Y	Van Gestel et al., 1992		a	OSWER Directive 9285.7 65
Cadmium		Springtail	*Folsomia candida*		6.0	10.0		Reproduction	MATC		220		1	16	Y	Y	Crommentuijn et al., 1993			OSWER Directive 9285.7 65
Cadmium		Earthworm	*Eisenia andrei*		6.7	10.0		Growth	MATC		24		1	16	Y	Y	Van Gestel et al., 1991a		a	OSWER Directive 9285.7 65
Cadmium		Springtail	*Folsomia candida*		*6.0*	10.0		Reproduction	MATC		600		1	16	Y	Y	Sandifer and Hopkin, 1997			OSWER Directive 9285.7 65
Cadmium		Springtail	*Folsomia candida*		6.0	10.0		Reproduction	MATC		108		1	15	Y	Y	Crouau et al., 1999		a	OSWER Directive 9285.7 65
Cadmium		Springtail	*Folsomia candida*		6.0	10.0		Reproduction	MATC		600		1	14	Y	Y	Sandifer and Hopkin, 1996		a	OSWER Directive 9285.7 65
Cadmium		Springtail	*Folsomia candida*		4.5	10.0		Reproduction	MATC		600		1	14	Y	Y	Sandifer and Hopkin, 1996		c	OSWER Directive 9285.7 65
Cadmium		Springtail	*Folsomia candida*		5.0	10.0		Reproduction	MATC		600		1	14	Y	Y	Sandifer and Hopkin, 1996		b	OSWER Directive 9285.7 65

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Chemical		Test Organism		Soil			Toxicity Value						Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	Species	Type	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concentration (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Cadmium		Nematode	*Plectuc acuminatus*		5.5	10.0		Reproduction	MATC		566		1	14	Y	Y	Kammenga et al., 1996			OSWER Directive 9285.7 65
Cadmium		Earthworm	*Eisenia andrei*		6.0	10.0		Reproduction	LOAEC		10		1	15	N	N	Van Gestel et al., 1993			OSWER Directive 9285.7 65
Chromium	K2Cr2O7	Earthworm	Octochaetus pattoni	Soil and Dung			60	Survival	LOEC	LCT	2	75					Abbasi and Soni, 1983			ES/ER/TM-126/R2
Chromium	K2Cr2O7	Earthworm	Pheretima posthuma	Paddy Soil			61	Survival	LOEC	LCT	10	100					Soni and Abbasi, 1981			ES/ER/TM-126/R2
Chromium	Cr(NO3)3	Earthworm	Eisenia andrei	OECD Soil	6	5	21	Growth	LOEC		32	30					Van Gestel et al., 1992			ES/ER/TM-126/R2
Chromium	KCr(SO4)2	Earthworm	Eisenia fetida	Soil and Manure			56	Number Cocoons and Hatchlings	LOEC	LCT	625	55					Molnar et al., 1989			ES/ER/TM-126/R2
Chromium	K2Cr2O7	Earthworm	Eisenia fetida	Soil and Manure			14	Weight Gain of Juveniles	LOEC	LCT	625	43					Molnar et al., 1989			ES/ER/TM-126/R2
Chromium		Earthworm	*Eisenia andrei*		6.7	10		Reproduction	MATC		57		1	16	Y	N	Van Gestel et al., 1992	12874	a	OSWER Directive 9285.7 65
Chromium		Earthworm	*Eisenia andrei*		6	10		Reproduction	MATC		57		1	12	Y	N	Van Gestel et al., 1993	6828		OSWER Directive 9285.7 65
Copper		Earthworm	*Eisenia fetida*		3.8	5.9		Mortality	LOAEC		100		2	12	N	N	Phillips et al., 1996	11508	b	OSWER Directive 9285.7 68
Copper		Nematode	Not available		4	3.7		Population	MATC		116		2	14	Y	Y	Korthals et al., 1996a	7848	a	OSWER Directive 9285.7 68
Copper		Nematode	*Caenorhabditis elegans*		4	1.14		Mortality	LC50		20		2	13	N	N	Peredney and Williams, 2000b	56449	g	EPA, 2007 (February)
Copper		Nematode	*Caenorhabditis elegans*		4	1.14		Mortality	LC50		25		2	13	N	N	Peredney and Williams, 2000b	56449	h	EPA, 2007 (February)
Copper		Nematode	*Caenorhabditis elegans*		4	4.2		Mortality	LC50		186		2	13	N	N	Peredney and Williams, 2000b	56449	i	EPA, 2007 (February)
Copper		Nematode	*Caenorhabditis elegans*		4	4.2		Mortality	LC50		252		2	13	N	N	Peredney and Williams, 2000b	56449	j	EPA, 2007 (February)
Copper		Nematode	*Caenorhabditis elegans*		4	10		Mortality	LC50		1272		1	12	N	N	Peredney and Williams, 2000a	53082	--	OSWER Directive 9285.7 68
Copper		Nematode	*Caenorhabditis elegans*		4	10		Mortality	LC50		431		1	12	N	N	Peredney and Williams, 2000b	56449	k	OSWER Directive 9285.7 68
Copper		Nematode	*Caenorhabditis elegans*		4	10		Mortality	LC50		463		1	12	N	N	Peredney and Williams, 2000b	56449	l	OSWER Directive 9285.7 68
Copper		Nematode	Not available		4.1	3.2		Reproduction	MATC		141		2	13	Y	Y	Korthals et al., 1996b	4402	a	OSWER Directive 9285.7 68
Copper		Nematode	Not available		4.25	3.3		Population	MATC		141		2	13	Y	Y	Korthals et al., 1998	13828	--	OSWER Directive 9285.7 68
Copper		Springtail	*Folsomia candida*		4.5	10		Reproduction	MATC		1732		1	16	Y	N	Sandifer and Hopkin, 1996	4056	c	OSWER Directive 9285.7 68
Copper		Earthworm	*Eisenia fetida*		4.7	1.4		Growth	MATC		200		1	13	Y	N	Phillips et al., 1996	11508	a	OSWER Directive 9285.7 68
Copper		Earthworm	*Lumbricus rubellus*		4.8	5.7		Reproduction	MATC		84		2	14	Y	Y	Ma, 1984	11146	a	OSWER Directive 9285.7 68
Copper	CuCl2	Earthworm	Allolobophora chlorotica	Sandy Loam	5	2.5		Cocoon Production	LOEC		51	50					Ma, 1988			ES/ER/TM-126/R2
Copper	CuCl2	Earthworm	Apporectodea caliginosa	Sandy Loam	5	2.5	42	Cocoon Production	LOEC		68	50					Ma, 1988			ES/ER/TM-126/R2

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Name	Form	Name	Species	Type	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concentration (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Copper		Earthworm	Dendrobaena rubida	Soil and Dung	5	5.7	120	Cocoons/Worm; Hatchlings/Cocoon	LOEC	LCT	100	70, 64					Bengtsson et al., 1986			ES/ER/TM-126/R2
Copper	CuCl2	Earthworm	Lumbricus rubellus	Sandy Loam	5	2.5		Cocoon Production	LOEC		122	50					Ma, 1988			ES/ER/TM-126/R2
Copper	CuCl2	Earthworm	Lumbricus rubellus	Loamy Sand	5	2.9	42	Cocoon Production	LOEC		131	42					Ma, 1984			ES/ER/TM-126/R2
Copper	CuSO4	Earthworm	Lumbricus rubellus	Loamy Sand	5	2.9	18	Cocoon Production	LOEC		148	26					Ma, 1984			ES/ER/TM-126/R2
Copper		Earthworm	*Aporrectodea caliginosa*		5	5		Reproduction	EC10		27		2	13	Y	Y	Ma, 1988	7854	a	OSWER Directive 9285.7 68
Copper		Earthworm	*Allolobophora chlorotica*		5	5		Reproduction	EC10		28		2	13	Y	Y	Ma, 1988	7854	b	OSWER Directive 9285.7 68
Copper		Earthworm	*Lumbricus rubellus*		5	5		Reproduction	EC10		80		2	13	Y	Y	Ma, 1988	7854	c	OSWER Directive 9285.7 68
Copper		Springtail	*Folsomia candida*		5.1	10		Reproduction	MATC		447		1	16	Y	N	Sandifer and Hopkin, 1996	4056	b	OSWER Directive 9285.7 68
Copper		Nematode	*Caenorhabditis elegans*		5.1	3		Mortality	LC50		413		2	13	N	N	Donkin and Dusenbery, 1993	7838	b	OSWER Directive 9285.7 68
Copper		Nematode	*Caenorhabditis elegans*		5.2	1.7		Mortality	LC50		534		2	14	N	N	Donkin and Dusenbery, 1993	7838	a	OSWER Directive 9285.7 68
Copper		Springtail	*Folsomia fimetaria*		5.5	4		Reproduction	EC10		38		2	16	Y	Y	Scott-Fordsmand et al., 1997	2288	--	OSWER Directive 9285.7 68
Copper		Nematode	*Plectus acuminatus*		5.5	10		Reproduction	LOAEC		10		1	13	N	N	Kammenga et al., 1996	5515	--	OSWER Directive 9285.7 68
Copper		Earthworm	*Enchytraeus crypticus*		5.5	10		Reproduction	LC50		477		1	16	N	N	Posthuma et al., 1997	2380	a	OSWER Directive 9285.7 68
Copper		Earthworm	*Eisenia andrei*		5.6	<1.0		Reproduction	MATC		133		2	15	Y	Y	Svendsen and Weeks, 1997a	11490	--	OSWER Directive 9285.7 68
Copper		Earthworm	*Lumbricus rubellus*		5.6	<1.0		Growth	MATC		188		2	13	Y	Y	Svendsen and Weeks, 1997b	4449	--	OSWER Directive 9285.7 68
Copper		Earthworm	*Eisenia fetida*		5.8	4		Reproduction	MATC		18		1	11	Y	N	Kula and Larink, 1997	11046	d	OSWER Directive 9285.7 68
Copper		Earthworm	*Eisenia andrei*		5.8	4		Reproduction	MATC		6		1	11	Y	N	Kula and Larink, 1997	11046	b	OSWER Directive 9285.7 68
Copper		Springtail	*Folsomia candida*		5.8	10		Reproduction	MATC		447		1	16	Y	N	Sandifer and Hopkin, 1996	4056	a	OSWER Directive 9285.7 68
Copper	Cu(NO3)2	Earthworm	Eisenia fetida	OECD Soil	6		56	Cocoon Production	EC50		53.3	50					Spurgeon et al., 1994			ES/ER/TM-126/R2
Copper	CuCl2	Earthworm	Eisenia andrei	OECD Soil	6	5	84	Growth	LOEC		100	32					Van Gestel et al., 1991a			ES/ER/TM-126/R2
Copper	CuCl2	Earthworm	Eisenia fetida	OECD Soil	6	5	21	Cocoon Production	LOEC		180	36					Van Gestel et al., 1989			ES/ER/TM-126/R2
Copper	CuSO4	Earthworm	Lumbricus rubellus	Loamy Sand	6	2.9	18	Cocoon Production	LOEC		278	33					Ma, 1984			ES/ER/TM-126/R2
Copper		Earthworm	Dendrobaena rubida	Soil and Dung	6	5.7	120	Cocoons/Worm; Hatchlings/Cocoon	LOEC		500	100					Bengtsson et al., 1986			ES/ER/TM-126/R2
Copper		Earthworm	Dendrobaena rubida	Soil and Dung	6	5.7	120	% Hatching Success	LOEC		500	100					Bengtsson et al., 1986			ES/ER/TM-126/R2

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Copper	CuNO3	Earthworm	Eisenia fetida	OECD Soil	6	5	14	Survival	LC50		643	50					Neuhauser et al., 1985b			ES/ER/TM-126/R2
Copper		Springtail	*Folsomia candida*		6	10		Reproduction	MATC		447		1	13	Y	N	Sandifer and Hopkin, 1997	758	--	OSWER Directive 9285.7 68
Copper		Earthworm	*Eisenia fetida*		6	10		Reproduction	MATC		18		1	11	Y	N	Kula and Larink, 1997	11046	a	OSWER Directive 9285.7 68
Copper		Earthworm	*Eisenia andrei*		6	10		Reproduction	MATC		85		1	13	Y	N	Van Gestel et al., 1989	4111	--	OSWER Directive 9285.7 68
Copper		Earthworm	*Eisenia andrei*		6	10		Reproduction	MATC		179		1	11	Y	N	Kula and Larink, 1997	11046	c	OSWER Directive 9285.7 68
Copper		Earthworm	*Enchytraeus crypticus*		6	10		Reproduction	LC50		873		1	16	N	N	Posthuma et al., 1997	2380	b	OSWER Directive 9285.7 68
Copper		Earthworm	*Eisenia fetida*		6	10		Mortality	LC50		643		1	14	N	N	Neuhauser et al., 1985b	17707	--	OSWER Directive 9285.7 68
Copper		Earthworm	*Eisenia fetida*		6	10		Mortality	LC50		643		1	11	N	N	Neuhauser et al., 1985b	6812	--	OSWER Directive 9285.7 68
Copper	Cu-nitrate	Earthworm	Eisenia fetida	OECD Soil	6.1		21	Growth	LOEC		601	50					Spurgeon and Hopkin, 1995			ES/ER/TM-126/R2
Copper		Springtail	*Onychiurus folsomi*		6.1	9		Reproduction	EC20		425		0	17	Y	N	Aquaterra, 2000	22616	e	OSWER Directive 9285.7 68
Copper		Earthworm	*Lumbricus terrestris*		6.1	1.7		Mortality	LC50		98		2	13	N	N	Haque and Ebing, 1983	10944	--	OSWER Directive 9285.7 68
Copper		Nematode	*Caenorhabditis elegans*		6.1	3.4		Mortality	LC50		1061		1	12	N	N	Donkin and Dusenbery, 1993	7838	c	OSWER Directive 9285.7 68
Copper		Earthworm	*Eisenia fetida*		6.1	9		Mortality	LC50		632		0	15	N	N	Aquaterra, 2000	22616	aa	OSWER Directive 9285.7 68
Copper		Earthworm	*Lumbricus terrestris*		6.1	9		Mortality	LC50		456		0	15	N	N	Aquaterra, 2000	22616	ab	OSWER Directive 9285.7 68
Copper		Earthworm	*Eisenia andrei*		6.2	10		Growth	MATC		75		1	16	Y	N	Van Gestel et al., 1991a	6826	b	OSWER Directive 9285.7 68
Copper		Nematode	*Caenorhabditis elegans*		6.2	2.2		Mortality	LC50		629		1	12	N	N	Donkin and Dusenbery, 1993	7838	d	OSWER Directive 9285.7 68
Copper		Earthworm	*A. tuberclata*		6.3	5		Reproduction	MATC		141		1	16	Y	N	Bogomolov et al., 1996	4940	a	OSWER Directive 9285.7 68
Copper		Nematode	Not available		6.3	5		Population	MATC		566		1	16	Y	N	Bogomolov et al., 1996	4940	b	OSWER Directive 9285.7 68
Copper		Earthworm	*Eisenia fetida*		6.3	10		Reproduction	LC50		53		1	15	N	N	Spurgeon et al., 1994	4364	--	OSWER Directive 9285.7 68
Copper		Earthworm	Allolobophora caliginosa	Polder Soil			60	Cocoon Production	LOEC	LCT	110	27					Van Rhee, 1975			ES/ER/TM-126/R2
Copper		Earthworm	Allolobophora caliginosa	Polder Soil			60	Total Hatchlings	LOEC	LCT	110	74					Van Rhee, 1975			ES/ER/TM-126/R2
Copper	CuSO4	Earthworm	Octolasium cyaneum	Brown Soil		3	14	Survival	LC50		180	50					Streit and Jaggy, 1983			ES/ER/TM-126/R2
Copper	C4H6CuO4	Earthworm	Eisenia fetida	Horse Manure			56	Cocoon Production	LOEC		500	24					Malecki et al., 1982			ES/ER/TM-126/R2

Table 6-8. Summary of Terrestrial Invertebrate Effects Data

Chemical		Test Organism		Soil			Toxicity Value						Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	Species	Type	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concentration (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Copper	CuSO4	Earthworm	Octolasium cyaneum	Rendzina Soil		14	14	Survival	LC50		850	50					Streit and Jaggy, 1983			ES/ER/TM-126/R2
Copper	C4H6CuO4	Earthworm	Eisenia fetida	Horse Manure			140	Cocoon Production	LOEC		1000	24					Malecki et al., 1982			ES/ER/TM-126/R2
Copper	Soluble forms	Earthworm	Eisenia fetida	Horse Manure			42	Growth;Cocoon Production	LOEC		2000	85					Neuhauser et al., 1984			ES/ER/TM-126/R2
Copper	CuSO4	Earthworm	Octolasium cyaneum	Peat Soil		43	14	Survival	LC50		2500	50					Streit and Jaggy, 1983			ES/ER/TM-126/R2
Copper		Springtail	*Folsomia candida*		6.7	4.5		Reproduction	EC10		50		1	14	Y	N	Pedersen et al., 2000b	55995	a	OSWER Directive 9285.7 68
Copper		Springtail	*F. fimetaria*		6.7	4.5		Reproduction	EC10		141		1	14	Y	N	Pedersen et al., 2000b	55995	b	OSWER Directive 9285.7 68
Copper	CuCl2	Earthworm	Lumbricus rubellus	Sandy Loam	7	1.7	42	Cocoon Production	LOEC		63	41					Ma, 1984			ES/ER/TM-126/R2
Copper		Earthworm	Dendrobaena rubida	Soil and Dung	7	5.7	120	Cocoons/Worm; Hatchlings/Cocoon	LOEC		500	100					Bengtsson et al., 1986			ES/ER/TM-126/R2
Copper		Earthworm	Dendrobaena rubida	Soil and Dung	7	5.7	120	% Hatching Success	LOEC		500	100					Bengtsson et al., 1986			ES/ER/TM-126/R2
Copper	CuCl2	Earthworm	Lumbricus rubellus	Sandy Loam	7	4	84	Survival	LOEC		1000	82					Ma, 1982.			ES/ER/TM-126/R2
Copper	Cu-sulfate	Earthworm	Aporrectodea caliginosa	Egyptian	7.05	10.8	56	Cocoon Production	LOEC		100	36					Khalil et al., 1996			ES/ER/TM-126/R2
Copper		Earthworm	*Lumbricus rubellus*		7.1	5.7		Reproduction	MATC		203		1	14	Y	N	Ma, 1984	11146	b	OSWER Directive 9285.7 68
Copper		Earthworm	*Eisenia fetida*		7.8	2.9		Mortality	LC50		721		0	14	N	N	Aquaterra, 2000	22616	ca	OSWER Directive 9285.7 68
Copper		Earthworm	*Lumbricus terrestris*		7.8	2.9		Mortality	LC50		313		0	14	N	N	Aquaterra, 2000	22616	cb	OSWER Directive 9285.7 68
Copper		Earthworm	*Eisenia fetida*		8.1	3.5		Mortality	LC50		596		0	14	N	N	Aquaterra, 2000	22616	da	OSWER Directive 9285.7 68
Copper		Earthworm	*Lumbricus terrestris*		8.1	3.5		Mortality	LC50		486		0	14	N	N	Aquaterra, 2000	22616	db	OSWER Directive 9285.7 68
Copper		Springtail	*Folsomia fimetaria L.*		6.7-7.1	3.9-5.5		Reproduction	MATC		500		1	15	Y	N	Scott-Fordsmand et al., 2000	22634	a	OSWER Directive 9285.7 68
Lead		Nematode	Caenorhabditis elegans		4	1.14		Mortality	LC50		285		2	13	N	N	Peredney and Williams, 2000b		s	OSWER Directive 9285.7 70
Lead		Nematode	Caenorhabditis elegans		4	1.14		Mortality	LC50		297		2	13	N	N	Peredney and Williams, 2000b		t	OSWER Directive 9285.7 70
Lead		Nematode	Caenorhabditis elegans		4	4.2		Mortality	LC50		847		2	13	N	N	Peredney and Williams, 2000b		u	OSWER Directive 9285.7 70
Lead		Nematode	Caenorhabditis elegans		4	4.2		Mortality	LC50		1341		2	13	N	N	Peredney and Williams, 2000b		v	OSWER Directive 9285.7 70
Lead		Nematode	Caenorhabditis elegans		4	10		Mortality	LC50		1434		1	12	N	N	Peredney and Williams, 2000a; 2000b		w	OSWER Directive 9285.7 70
Lead		Collembola	Folsomia candida		4.5	10		Reproduction	MATC		3162		1	16	Y	Y	Sandifer and Hopkin,		c	OSWER Directive
Lead		Earthworm	Dendrobaena rubida	Soil and Dung	5	5.7	120	Cocoons/Worm; Hatchlings/Cocoo	LOEC		500	100					Bengtsson et al., 1986			ES/ER/TM-126/R2
Lead		Collembola	Folsomia candida		5	10		Reproduction	MATC		894		1	15	Y	Y	Sandifer and Hopkin,		b	EPA, 2005g
Lead		Nematode	Caenorhabditis		5.1	3		Mortality	LC50		891		2	14	N	N	Donkin and		b	EPA, 2005g

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Chemical		Test Organism		Soil			Toxicity Value						Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	Species	Type	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concentration (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Lead	Pb(NO3)2	Earthworm	Eisenia fetida	OECD Soil	6		56	Cocoon Production EC50	LOEC		1940	50					Spurgeon et al., 1994			ES/ER/TM-126/R2
Lead	PbNO3	Earthworm	Eisenia fetida	OECD Soil	6	5	14	Survival LC50	LOEC		5941	50					Neuhauser et al., 1986b			ES/ER/TM-126/R2
Lead		Collembola	Folsomia candida		6	10		Reproduction	MATC		3162		1	16	Y	Y	Sandifer and Hopkin, 1996		a	OSWER Directive 9285.7 70
Lead		Collembola	Folsomia candida		6	10		Reproduction	MATC		894		1	15	Y	Y	Sandifer and Hopkin, 1997			OSWER Directive 9285.7 70
Lead		Earthworm	Eisenia fetida		6	10		Mortality	LC50		3716		1	13	N	N	Neuhauser et al., 1985b; 1986a		b	OSWER Directive 9285.7 70
Lead	Pb-nitrate	Earthworm	Eisenia fetida	OECD Soil	6.1		21	Growth	LOEC		1629	50					Spurgeon and Hopkin, 1995			ES/ER/TM-126/R2
Lead		Earthworm	Eisenia fetida		6.1	10		Reproduction	EC50		1629		1	15	N	N	Spurgeon and Hopkin, 1995			OSWER Directive 9285.7 70
Lead		Nematode	Caenorhabditis elegans		6.1	3.4		Mortality	LC50		13.9		1	13	N	N	Donkin and Dusenbery, 1994		c	OSWER Directive 9285.7 70
Lead		Nematode	Caenorhabditis elegans		6.2	1.7		Mortality	LC50		1554		2	14	N	N	Donkin and Dusenbery, 1994		a	OSWER Directive 9285.7 70
Lead		Nematode	Caenorhabditis elegans		6.2	2.2		Mortality	LC50		11.6		1	13	N	N	Donkin and Dusenbery, 1994		d	OSWER Directive 9285.7 70
Lead		Earthworm	Eisenia fetida		6.3	10		Reproduction	EC50		1940		1	15	N	N	Spurgeon et al., 1994			OSWER Directive 9285.7 70
Lead		Earthworm	Eisenia fetida		6.5	10		Mortality	ILL		1.16		1	16	N	N	Conder and Lanno, 2000			OSWER Directive 9285.7 70
Lead	C4H6O4Pb	Earthworm	Eisenia fetida	Horse Manure			56	Cocoon Production	LOEC		4000	50					Malecki et al., 1982			ES/ER/TM-126/R2
Lead	C4H6O4Pb	Earthworm	Eisenia fetida	Horse Manure			140	Cocoon Production	LOEC		5000	28					Malecki et al., 1982			ES/ER/TM-126/R2
Lead	Sol forms	Earthworm	Eisenia fetida	Horse Manure			42	Cocoon Production	LOEC	LCT	5000	80					Neuhauser et al. 1984			ES/ER/TM-126/R2
Manganese		Potworm	*Enchytraeus crypticus*		4.86 - 5.39	1.2		Reproduction	EC20		116		2	17	Y	Y	Kuperman et al., 2002		62344	OSWER Directive 9285.7 71
Manganese		Springtail	*Folsomia candida*		4.56 - 5.29	1.2		Reproduction	EC20		1209		2	18	Y	Y	Phillips et al., 2002		62345	OSWER Directive 9285.7 71
Manganese		Earthworm	*Eisenia fetida*		4.58 - 5.29	1.2		Reproduction	EC20		629		2	16	Y	Y	Simini et al., 2002		62343	OSWER Directive 9285.7 71
Mercury	HgCl2	Earthworm	Octochaetus pattoni	Soil and Dung			60	Survival; Cocoon Production	LOEC	LCT	0.5	65, 40					Abbasi and Soni, 1983			ES/ER/TM-126/R2
Mercury	CH3HgCl	Earthworm	Eisenia fetida	Potting Soil			84	Survival; segment regeneration	LOEC		12.5	69					Beyer et al., 1985			ES/ER/TM-126/R2
Nickel	Soluble forms	Earthworm	*Eisenia fetida*	Horse Manure			42	Cocoon Production	LOEC	LCT	250	33					Neuhauser et al., 1984			ES/ER/TM-126/R2
Nickel		Roundworm	*Caenorhabditis elegans*		4.0	1.14		Mortality	LC50		144		2	13	N	N	Peredney and Williams, 2000b	56449	m	OSWER Directive 9285.7 76
Nickel		Roundworm	*Caenorhabditis elegans*		4.0	1.14		Mortality	LC50		44		2	13	N	N	Peredney and Williams, 2000b	56449	n	OSWER Directive 9285.7 76

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Chemical		Test Organism		Soil			Toxicity Value						Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	Species	Type	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concentration (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Nickel		Roundworm	*Caenorhabditis elegans*		4.0	4.2		Mortality	LC50		387		2	13	N	N	Peredney and Williams, 2000b	56449	o	OSWER Directive 9285.7 76
Nickel		Roundworm	*Caenorhabditis elegans*		4.0	4.2		Mortality	LC50		165		2	13	N	N	Peredney and Williams, 2000b	56449	p	OSWER Directive 9285.7 76
Nickel		Earthworm	*Eisenia fetida*		6.0	10.0		Mortality	LC50		242		1	11	N	N	Neuhauser et al., 1985b	6812	--	OSWER Directive 9285.7 76
Nickel		Roundworm	*Caenorhabditis elegans*		4	10		Mortality	LC50		797		1	12	N	N	Peredney and Williams, 2000a	53082	--	OSWER Directive 9285.7 76
Nickel		Roundworm	*Caenorhabditis elegans*		4	10		Mortality	LC50		800		1	12	N	N	Peredney and Williams, 2000b	56449	q	OSWER Directive 9285.7 76
Nickel		Roundworm	*Caenorhabditis elegans*		4	10		Mortality	LC50		348		1	12	N	N	Peredney and Williams, 2000b	56449	r	OSWER Directive 9285.7 76
Nickel		Earthworm	*Eisenia fetida*		6.0	10.0		Mortality	LC50		242		0	14	N	N	Neuhauser et al., 1986a	17707	--	OSWER Directive 9285.7 76
Nickel	NiNO3	Earthworm	*Eisenia fetida*	OECD Soil	6	5	14	Survival LC 50	LOEC		757	50					Neuhauser et al., 1985b			ES/ER/TM-126/R2
Nickel	C4H6NiO4	Earthworm	*Eisenia fetida*	Horse Manure			140	Cocoon Production	LOEC		200	23					Malecki et al., 1982			ES/ER/TM-126/R2
Nickel	C4H6NiO4	Earthworm	*Eisenia fetida*	Horse Manure			56	Cocoon Production	LOEC		300	41					Malecki et al., 1982			ES/ER/TM-126/R2
Nickel	NiCl2	Earthworm	*Lumbricus rubellus*	Sandy Loam	7	4	84	Survival	LOEC		1000	31					Ma, 1982			ES/ER/TM-126/R2
Nickel		Springtail	*Folsomia fimetaria L.*		5.8	4.0		Reproduction	MATC		387		1	16	Y	Y	Scott-Fordsmand et al., 1999	15163	--	OSWER Directive 9285.7 76
Nickel		Earthworm	*Eisenia veneta*		5.8	4.0		Reproduction	MATC		173		1	13	Y	Y	Scott-Fordsmand et al., 1998	18892	a	OSWER Directive 9285.7 76
Nickel		Earthworm	*Eisenia fetida*		6.0	10.0		Reproduction	MATC		240		1	14	Y	Y	Lock and Janssen, 2002	66195	a	OSWER Directive 9285.7 76
Nickel		Earthworm	*Enchytraeus albidus*		6.0	10.0		Reproduction	MATC		240		1	14	Y	Y	Lock and Janssen, 2002	66195	b	OSWER Directive 9285.7 76
Nickel		Springtail	*Folsomia candida*		6.0	10.0		Reproduction	MATC		423		1	14	Y	Y	Lock and Janssen, 2002	66195	c	OSWER Directive 9285.7 76
Nickel		Nematodes	nematoda (various sp.)		4.1	1.9		Population	LOAEC		100		1	14	N	N	Korthals et al., 1996	4402	--	OSWER Directive 9285.7 76
Selenium	Na2SeO3	Earthworm	Eisenia fetida	Soil and Manure			56	Cocoons/Worm	LOEC	LCT	77	69					Fischer and Koszorus, 1992			ES/ER/TM-126/R2
Selenium		Earthworm	*Eisenia fetida*		7.1	1		Reproduction	EC20		3.4		2	18	Y	Y	Checkai et al., 2004	92935		OSWER Directive 9285.7 72
Selenium		Enchytraeidae	*Enchytraeus crypticus*		7.1	1		Reproduction	EC20		4.4		2	18	Y	Y	Checkai et al., 2004	92935		OSWER Directive 9285.7 72
Selenium		Springtail	*Folsomia candida*		7.1	1		Reproduction	EC20		4.7		2	18	Y	Y	Checkai et al., 2004	92935		OSWER Directive 9285.7 72
Uranium		Springtail	*Onychiurus folsomi*	fine sand	6.2			survival and reproduction	EC20		92						Sheppard et al., 2004			Sheppard et al., 2005
Uranium		Earthworm	*Lumbricus sp.*	<10% clay			54 days	survival	LOEC		300						Sheppard and Evanden (1992)			Sheppard et al., 2005
Uranium		Springtail	*Folsomia candida*	fine sand	6.2			survival	EC20		350						Sheppard et al., 2004			Sheppard et al., 2005

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Name	Form	Name	Species	Type	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concentration (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Uranium		Springtail	*Onychiurus folsomi*	loam	7.5			survival and reproduction	EC20		>390						Sheppard et al., 2004			Sheppard et al., 2005
Uranium		Springtail	*Folsomia candida*	loam	7.5			survival and reproduction	EC20		>710						Sheppard et al., 2004			Sheppard et al., 2005
Uranium		Earthworm	*Lumbricus sp.*	NA				survival	EC25		1000						Sheppard et al., 1992			Sheppard et al., 2005
Zinc	Zn(NO3)2	Earthworm	Eisenia fetida	Artificial Soil	4	2.5	21	Cocoon Production	LOEC		142	50					Spurgeon and Hopkin, 1996b			ES/ER/TM-126/R2
Zinc	Zn(NO3)2	Earthworm	Eisenia fetida	Artificial Soil	4	5	21	Cocoon Production	LOEC		189	50					Spurgeon and Hopkin, 1996b			ES/ER/TM-126/R2
Zinc	Zn(NO3)2	Earthworm	Eisenia fetida	Artificial Soil	4	7.5	21	Cocoon Production	LOEC		230	50					Spurgeon and Hopkin, 1996b			ES/ER/TM-126/R2
Zinc		Nematode	*Caenorhabditis elegans*		4	1.14		Mortality	LC50		54.2		2	13	N	N	Peredney and Williams, 2000b	56449	y	OSWER Directive 9285.7 73
Zinc		Nematode	*Caenorhabditis elegans*		4	4.2		Mortality	LC50		186		2	13	N	N	Peredney and Williams, 2000b	56449	aa	OSWER Directive 9285.7 73
Zinc		Nematode	*Caenorhabditis elegans*		4	10		Mortality	LC50		670		1	12	N	N	Peredney and Williams, 2000a	53082		OSWER Directive 9285.7 73
Zinc		Nematode	*Caenorhabditis elegans*		4	10		Mortality	LC50		661		1	12	N	N	Peredney and Williams, 2000b	56449	ac	OSWER Directive 9285.7 73
Zinc		Nematode	multiple		4.1	4		Population	MATC		35		2	13	Y	Y	Korthals et al., 1998	13828		OSWER Directive 9285.7 73
Zinc		Nematode	multiple		4.1	3.2		Population	MATC		141		2	13	Y	Y	Korthals et al., 1996b	4402		OSWER Directive 9285.7 73
Zinc		Springtail	*Folsomia candida*		4.5	1.9		Reproduction	EC10		116		2	17	Y	Y	Smit and Van Gestel, 1997	4434		OSWER Directive 9285.7 73
Zinc		Springtail	*Folsomia candida*		4.5	10		Reproduction	MATC		548		1	14	Y	N	Sandifer and Hopkin, 1996	4056	c	OSWER Directive 9285.7 73
Zinc		Springtail	*Folsomia candida*		4.7	2.4		Reproduction	EC10		136		2	17	Y	Y	Smit and Van Gestel, 1998	6159	b	OSWER Directive 9285.7 73
Zinc		Springtail	*Folsomia candida*		4.7	2.4		Reproduction	EC10		355		2	17	Y	Y	Smit and Van Gestel, 1998	6159	d	OSWER Directive 9285.7 73
Zinc		Springtail	*Folsomia candida*		4.8	2.4		Reproduction	EC10		99		2	15	Y	Y	Smit et al., 1998	11279		OSWER Directive 9285.7 73
Zinc	Zn(NO3)2	Earthworm	Eisenia fetida	Artificial Soil	5	2.5	21	Cocoon Production	LOEC		199	50					Spurgeon and Hopkin,1996b			ES/ER/TM-126/R2
Zinc	Zn(NO3)2	Earthworm	Eisenia fetida	Artificial Soil	5	5	21	Cocoon Production	LOEC		343	50					Spurgeon and Hopkin, 1996b			ES/ER/TM-126/R2
Zinc	Zn(NO3)2	Earthworm	Eisenia fetida	Artificial Soil	5	7.5	21	Cocoon Production	LOEC		548	50					Spurgeon and Hopkin, 1996b			ES/ER/TM-126/R2
Zinc		Springtail	*Folsomia candida*		5	10		Reproduction	MATC		548		1	14	Y	N	Sandifer and Hopkin, 1996	4056	b	OSWER Directive 9285.7 73
Zinc		Nematode	*Caenorhabditis elegans*		5.1	3		Mortality	LC50		255		2	15	N	N	Donkin and Dusenbery, 1994	7877	b	OSWER Directive 9285.7 73
Zinc	Zn(NO3)2	Earthworm	Eisenia fetida	Artificial Soil	6	2.5	21	Cocoon Production	LOEC		136	50					Spurgeon and Hopkin, 1996b			ES/ER/TM-126/R2
Zinc	Zn(NO3)2	Earthworm	Eisenia fetida	OECD Soil	6		21	Growth rate	LOEC		190	69					Spurgeon and Hopkin, 1996a			ES/ER/TM-126/R2
Zinc	Zn(NO3)2	Earthworm	Aporrectodea rosea	OECD Soil	6		21	Growth rate	LOEC		190	48					Spurgeon and Hopkin, 1996a			ES/ER/TM-126/R2

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Zinc	Zn(NO3)2	Earthworm	Lumbricus rubellus	OECD Soil	6		21	Cocoon Production	LOEC		190	69					Spurgeon and Hopkin, 1996a			ES/ER/TM-126/R2
Zinc	Zn(NO3)2	Earthworm	Eisenia fetida	OECD Soil	6		56	Cocoon Production	EC50		276	50					Spurgeon et al., 1994			ES/ER/TM-126/R2
Zinc	Zn(NO3)2	Earthworm	Eisenia fetida	Artificial Soil	6	5	21	Cocoon Production	LOEC		462	50					Spurgeon and Hopkin, 1996b			ES/ER/TM-126/R2
Zinc	ZnCl2	Earthworm	Eisenia andrei	OECD Soil	6	5	21	Cocoons/Worm; Juveniles/Worm	LOEC		560	42					Van Gestel et al., 1993			ES/ER/TM-126/R2
Zinc	Zn(NO3)2	Earthworm	Eisenia fetida	Artificial Soil	6	7.5	21	Cocoon Production	LOEC		592	50					Spurgeon and Hopkin, 1996b			ES/ER/TM-126/R2
Zinc		Springtail	*Folsomia candida*		6	10		Reproduction	EC10		399		1	13	Y	N	Van Gestel and Hensbergen, 1997	10987		OSWER Directive 9285.7 73
Zinc		Springtail	*Folsomia candida*		6	10		Reproduction	MATC		863		1	14	Y	N	Sandifer and Hopkin, 1996	4056	a	OSWER Directive 9285.7 73
Zinc		Earthworm	*Eisenia fetida*		6	10		Reproduction	LOAEC		190		1	13	Y	N	Spurgeon et al., 1997	4442	a	OSWER Directive 9285.7 73
Zinc		Springtail	*Folsomia candida*		6	10		Reproduction	EC10		269		1	17	Y	N	90	6159	a	OSWER Directive 9285.7 73
Zinc		Earthworm	*Eisenia andrei*		6	10		Reproduction	MATC		423		1	12	Y	N	Van Gestel et al., 1993	6828		OSWER Directive 9285.7 73
Zinc		Springtail	*Folsomia candida*		6	10		Reproduction	MATC		548		1	15	Y	N	Sandifer and Hopkin, 1997	758		OSWER Directive 9285.7 73
Zinc		Earthworm	*Eisenia fetida*		6	10		Reproduction	MATC		466		1	12	Y	N	Spurgeon and Hopkin, 1996a	7870		OSWER Directive 9285.7 73
Zinc		Earthworm	*Eisenia fetida*		6	10		Reproduction	EC50		234		1	13	N	N	Spurgeon et al., 1997	4442	c	OSWER Directive 9285.7 73
Zinc		Springtail	*Folsomia candida*		6	3.3		Reproduction	EC50		348		1	15	N	N	Smit and Van Gestel, 1996	7869	a	OSWER Directive 9285.7 73
Zinc		Springtail	*Folsomia candida*		6	3		Reproduction	EC50		185		1	15	N	N	Smit and Van Gestel, 1996	7869	b	OSWER Directive 9285.7 73
Zinc		Earthworm	*Eisenia fetida*		6	10		Mortality	LC50		232		1	14	N	N	Neuhauser et al., 1985b	17707		OSWER Directive 9285.7 73
Zinc		Earthworm	*Eisenia fetida*		6	10		Reproduction	MATC		466		1	12	Y	N	Spurgeon and Hopkin, 1996a	7870		OSWER Directive 9285.7 73
Zinc	Zn(NO3)2	Earthworm	Eisenia fetida	OECD Soil	6.1		21	Growth	LOEC		1078	50					Spurgeon and Hopkin 1995			ES/ER/TM-126/R2
Zinc		Nematode	*Caenorhabditis elegans*		6.1	3.4		Mortality	LC50		392		1	15	N	N	Donkin and Dusenbery, 1994	7877	c	OSWER Directive 9285.7 73
Zinc		Nematode	*Caenorhabditis elegans*		6.2	1.7		Mortality	LC50		183		1	15	N	N	Donkin and Dusenbery, 1994	7877	a	OSWER Directive 9285.7 73
Zinc		Nematode	*Caenorhabditis elegans*		6.2	2.2		Mortality	LC50		549		1	15	N	N	Donkin and Dusenbery, 1994	7877	d	OSWER Directive 9285.7 73
Zinc		Earthworm	*Eisenia fetida*		6.3	10		Reproduction	EC50		276		1	11	N	N	Spurgeon et al., 1994	4364		OSWER Directive 9285.7 73
Zinc		Earthworm	*Enchytraeus crypticus*		6.4	10		Reproduction	EC50		188		1	13	N	N	Posthuma et al., 1997	2380	a	OSWER Directive 9285.7 73

Table 6-8. Summary of Terrestrial Invertebrate Effects Data

Chemical		Test Organism		Soil			Toxicity Value						Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	Species	Type	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concentration (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Zinc		Earthworm	*Enchytraeus crypticus*		6.4	10		Reproduction	EC50		336		1	13	N	N	Posthuma et al., 1997	2380	b	OSWER Directive 9285.7 73
Zinc		Earthworm	*Eisenia andrei*		6.5	10		Mortality	ILL		631		1	16	N	N	Conder and Lanno, 2000	46691		OSWER Directive 9285.7 73
Zinc	ZnNO3	Earthworm	Eisenia fetida	OECD Soil			14	Survival	LC50		662	50					Neuhauser et al., 1986a			ES/ER/TM-126/R2
Zinc		Earthworm	Allolobophora caliginosa	polder Soil				Body Weight; Cocoon Production; Mortality; Sexual Development	LOEC		1100	53, 100, 22, 100					Van Rhee, 1975			ES/ER/TM-126/R2
Zinc	C4H6O4Zn	Earthworm	Eisenia fetida	Horse Manure			56	Cocoon Production	LOEC		2000	36					Malecki et al., 1982			ES/ER/TM-126/R2
Zinc	Soluble Forms	Earthworm	Eisenia fetida	Horse Manure			42	Cocoon Production	LOEC		2500	50					Neuhauser et al., 1984			ES/ER/TM-126/R2
Zinc	C4H6O4Zn	Earthworm	Eisenia fetida	Horse Manure			140	Cocoon Production	LOEC		5000	53					Malecki et al., 1982			ES/ER/TM-126/R2
Zinc		Springtail	*Folsomia candida*		7	2		Reproduction	EC10		1059		1	17	Y	N	Smit and Van Gestel, 1998	6159	c	OSWER Directive 9285.7 73
Zinc	Zn-sulfate	Earthworm	Aporrectodea caliginosa	Egyptian	7.05	10.8	56	Cocoon Production	LOEC		300	20					Khalil et al. 1996			ES/ER/TM-126/R2
Chlorobenzene		Earthworm	*Eisenia fetida*	Sandy Soil	5	1.8	14	Survival	LC50		240	50					Van Gestel et al., 1991b			ES/ER/TM-126/R2
Chlorobenzene		Earthworm	*Eisenia fetida*	OECD Soil	6	4	14	Survival	LC50		446	50					Van Gestel et al., 1991b			ES/ER/TM-126/R2
Chlorobenzene		Earthworm	*Lumbricus rubellus*	Sandy Soil	5	1.8	14	Survival	LC50		547	50					Van Gestel et al., 1991b			ES/ER/TM-126/R2
Chlorobenzene		Earthworm	*Lumbricus rubellus*	OECD Soil	6	4	14	Survival	LC50		1107	50					Van Gestel et al., 1991b			ES/ER/TM-126/R2
Fluoranthene		springtail	*Folsomia fimetaria L.*		6.2	2.8		Reproduction	EC10		37		0	14	Y	Y	Sverdrup et al., 2001	20-6-1332	b	OSWER Directive 9285.7 78
Fluoranthene		potWorm	*Enchytraeus crypticus*		6.2	2.8		Reproduction	EC10		15		0	14	Y	Y	Sverdrup et al., 2002a	21-1-109	b	OSWER Directive 9285.7 78
Fluoranthene		Earthworm	*Eisenia veneta*		6.2	2.8		Growth	EC10		113		0	14	Y	Y	Sverdrup et al., 2002c	21-9-1927	b	OSWER Directive 9285.7 78
Fluorene		Earthworm	*Eisenia fetida*		6.0	10.0		Mortality	LC50		173		1	15	N	N	Neuhauser et al., 1985a	17707	a	OSWER Directive 9285.7 78
Fluorene		Earthworm	*Allolobophora tuberculata*	OECD Soil	6	5	14	Survival	LC50		206	50					Neuhauser et al., 1986b			ES/ER/TM-126/R2
Fluorene		Earthworm	*Eisenia fetida*	OECD Soil	6	5	14	Survival	LC50		173	50					Neuhauser et al., 1986b			ES/ER/TM-126/R2
Fluorene		Earthworm	*Eudrilus eugenia*	OECD Soil	6	5	14	Survival	LC50		197	50					Neuhauser et al., 1986b			ES/ER/TM-126/R2
Fluorene		Earthworm	*Perionyx excavatus*	OECD Soil	6	5	14	Survival	LC50		170	50					Neuhauser et al., 1986b			ES/ER/TM-126/R2
Fluorene		Earthworm	*Allolobophora tuberculata*		6.0	10.0		Mortality	LC50		206		1	15	N	N	Neuhauser et al., 1986b	1214	a	OSWER Directive 9285.7 78
Fluorene		Earthworm	*Eisenia fetida*		6.0	10.0		Mortality	LC50		173		1	15	N	N	Neuhauser et al., 1986b	1214	b	OSWER Directive 9285.7 78
Fluorene		Earthworm	*Eudrilus eugenia*		6.0	10.0		Mortality	LC50		197		1	15	N	N	Neuhauser et al., 1986b	1214	c	OSWER Directive 9285.7 78
Fluorene		Earthworm	*Perionyx excavatus*		6.0	10.0		Mortality	LC50		170		1	15	N	N	Neuhauser et al., 1986b	1214	d	OSWER Directive 9285.7 78

Table 6-8. Summary of Terrestrial Invertebrate Effects Data

Chemical		Test Organism		Soil			Toxicity Value						Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	Species	Type	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concentration (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Fluorene		springtail	*Folsomia fimetaria L.*		6.2	2.8		Reproduction	EC10		8		0	14	Y	Y	Neuhauser et al., 1986b	20-6-1332	d	OSWER Directive 9285.7 78
Fluorene		potWorm	*Enchytraeus crypticus*		6.2	2.8		Reproduction	EC10		25		0	14	Y	Y	Neuhauser et al., 1986b	21-1-109	d	OSWER Directive 9285.7 78
Fluorene		Earthworm	*Eisenia veneta*		6.2	2.8		Growth	EC10		31		0	14	Y	Y	Neuhauser et al., 1986b	21-9-1927	d	OSWER Directive 9285.7 78
Fluorene		Earthworm	*Eisenia fetida*	Horse Manure			56	Cocoon Production	LOEC		750	49					Neuhauser et al., 1986b			ES/ER/TM-126/R2
Phenanthrene		springtail	*Folsomia candida*		6.0	10.0		Reproduction	MATC		175		1	17	Y	Y	Neuhauser et al., 1986b	18893		OSWER Directive 9285.7 78
Phenanthrene		springtail	*Folsomia fimetaria L.*		6.2	2.8		Reproduction	EC10		23		0	14	Y	Y	Neuhauser et al., 1986b	20-6-1332	c	OSWER Directive 9285.7 78
Phenanthrene		potWorm	*Enchytraeus crypticus*		6.2	2.8		Reproduction	EC10		40		0	14	Y	Y	Neuhauser et al., 1986b	21-1-109	c	OSWER Directive 9285.7 78
Phenanthrene		springtail	*Folsomia fimetaria L.*		6.2	2.8		Reproduction	EC10		9		0	14	Y	Y	Neuhauser et al., 1986b	21-3-489	b	OSWER Directive 9285.7 78
Phenanthrene		Earthworm	*Eisenia veneta*		6.2	2.8		Growth	EC10		25		0	14	Y	Y	Neuhauser et al., 1986b	21-9-1927	c	OSWER Directive 9285.7 78
Pyrene		Earthworm	*Lumbricus rubellus*		NA	10.0		Reproduction	MATC		80		0	11	Y	Y	Neuhauser et al., 1986b	57-1675		OSWER Directive 9285.7 78
Pyrene		springtail	*Folsomia candida*		6.0	10.0		Reproduction	MATC		10		0	13	Y	Y	Neuhauser et al., 1986b	57-175	a	OSWER Directive 9285.7 78
Pyrene		springtail	*Folsomia fimetaria L.*		6.2	2.8		Reproduction	EC10		10		0	14	Y	Y	Neuhauser et al., 1986b	20-6-1332	a	OSWER Directive 9285.7 78
Pyrene		potWorm	*Enchytraeus crypticus*		6.2	2.8		Reproduction	EC10		11		0	14	Y	Y	Neuhauser et al., 1986b	21-1-109	a	OSWER Directive 9285.7 78
Pyrene		springtail	*Folsomia fimetaria L.*		6.2	2.8		Reproduction	EC10		10		0	14	Y	Y	Neuhauser et al., 1986b	21-3-489	a	OSWER Directive 9285.7 78
Pyrene		Earthworm	*Eisenia veneta*		6.2	2.8		Growth	EC10		38		0	14	Y	Y	Neuhauser et al., 1986b	21-9-1927	a	OSWER Directive 9285.7 78
TPH Diesel									EC>20		3400						Neuhauser et al., 1986b			Efroymson et al., 2004
Phenol		Earthworm	*Eudrilus eugeniae*	OECD Soil	6	5	14	Survival LC50	LOEC		188	50					Neuhauser et al., 1986b			ES/ER/TM-126/R2
Phenol		Earthworm	*Perionyx excavatus*	OECD Soil	6	5	14	Survival LC50	LOEC		258	50					Neuhauser et al., 1986b			ES/ER/TM-126/R2
Phenol		Earthworm	*Eisenia fetida*	OECD Soil	6	5	14	Survival LC50	LOEC		401	50					Neuhauser et al., 1986b			ES/ER/TM-126/R2
Phenol		Earthworm	*Allolobophora tuberculata*	OECD Soil	6	5	14	Survival LC50	LOEC		450	50					Neuhauser et al., 1986b			ES/ER/TM-126/R2
Phenol		Earthworm	*Eisenia fetida*	Horse Manure			56	Cocoon Production	LOEC		4900	26					Neuhauser and Callahan, 1990			ES/ER/TM-126/R2
DDT		Common Cricket	*Gryllus pennsylvanicus*		≤ 7	0		Mortality	LC50		0.08		1	13	N	N	Harris, 1966	9602	a	OSWER Directive 9285.7 57
DDT		Common Cricket	*Gryllus pennsylvanicus*		≤ 7	0.5		Mortality	LC50		1.75		1	13	N	N	Harris, 1966	9602	b	OSWER Directive 9285.7 57

Table 6-8. Summary of Terrestrial Invertebrate Effects Data

Chemical		Test Organism		Soil			Toxicity Value						Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	Species	Type	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concentration (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
DDT		Common Cricket	*Gryllus pennsylvanicus*		≤ 7	1.4		Mortality	LC50		3.1		1	13	N	N	Harris, 1966	9602	c	OSWER Directive 9285.7 57
DDT		Common Cricket	*Gryllus pennsylvanicus*		≤ 7	2		Mortality	LC50		4.1		1	13	N	N	Harris, 1966	9602	d	OSWER Directive 9285.7 57
DDT		Common Cricket	*Gryllus pennsylvanicus*		7.2	1.4		Mortality	LC50		4.3		1	12	N	N	Harris, 1964	7783	a	OSWER Directive 9285.7 57
DDT		Common Cricket	*Gryllus pennsylvanicus*		≤ 7	6.6		Mortality	LC50		11.4		0	12	N	N	Harris, 1966	9602	e	OSWER Directive 9285.7 57
DDT		Common Cricket	*Gryllus pennsylvanicus*		≤ 7	9.1		Mortality	LC50		4.2		0	12	N	N	Harris, 1966	9602	f	OSWER Directive 9285.7 57
DDT		Common Cricket	*Gryllus pennsylvanicus*		≤ 7	15.9		Mortality	LC50		11.8		0	12	N	N	Harris, 1966	9602	g	OSWER Directive 9285.7 57
DDT		Common Cricket	*Gryllus pennsylvanicus*		≤ 7	18.8		Mortality	LC50		20.4		0	12	N	N	Harris, 1966	9602	h	OSWER Directive 9285.7 57
DDT		Common Cricket	*Gryllus pennsylvanicus*		≤ 7	39.8		Mortality	LC50		45.3		0	12	N	N	Harris, 1966	9602	i	OSWER Directive 9285.7 57
DDT		Common Cricket	*Gryllus pennsylvanicus*		≤ 7	64.6		Mortality	LC50		77.2		0	12	N	N	Harris, 1966	9602	j	OSWER Directive 9285.7 57
Total PAHs	No Data																			
Boron	No Data																			
Cobalt	No Data																			
Iron	No Data																			
Lithium	No Data																			
Molybdenum	No Data																			
Silver	No Data																			
Strontium	No Data																			
Thallium	No Data																			
Tin	No Data																			
Vanadium	No Data																			
Uranium	No Data																			
Acenaphthene	No Data																			
Diethylphthalate	No Data																			
Toluene	No Data																			
Ammonia	No Data																			
Bismuth	No Data																			
Calcium	No Data																			
Chloride	No Data																			
Hexavalent Chromium	No Data																			
Hydrazine	No Data																			
Magnesium	No Data																			
Nitrate	No Data																			
Nitrite	No Data																			
Nitrogen in Nitrite and Nitrate	No Data																			
Phosphate	No Data																			
Potassium	No Data																			
Silicon	No Data																			
Sodium	No Data																			
Sulfate	No Data																			
Sulfide	No Data																			

Table 6-8. Summary of Terrestrial Invertebrate Effects Data

Chemical		Test Organism		Soil			Toxicity Value						Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	Species	Type	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concentration (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Thorium	No Data																			
Titanium	No Data																			
Zirconium	No Data																			
1,1,1-Trichloroethane	No Data																			
2-butanone (Methyl Ethyl Ketone/MEK)	No Data																			
4,4'-DDD (Dichlorodiphenyldichloroethane)	Same as DDT																			
Acetone	No Data																			
Anthracene	No Data																			
Benzene	No Data																			
Benzo(a)anthracene	No Data																			
Benzo(a)pyrene	No Data																			
Benzo(b)fluoranthene	No Data																			
Benzo(ghi)perylene	No Data																			
Benzo(k)fluoranthene	No Data																			
Bis(2-ethylhexyl) phthalate	No Data																			
Butylbenzylphthalate	No Data																			
Carbazole	No Data																			
Carbon disulfide	No Data																			
Chloroform	No Data																			
Chloromethane	No Data																			
Chrysene	No Data																			
Diacetone alcohol	No Data																			
Dibenz[a,h]anthracene	No Data																			
Di-n-butylphthalate	No Data																			
Fluoranthene	No Data																			
High boiling hydrocarbons	No Data																			
Indeno(1,2,3-cd)pyrene	No Data																			
Methylene chloride	No Data																			
Phenanthrene	No Data																			
Pyrene	No Data																			
Tetrachloroethene	No Data																			
Total organic carbon	No Data																			
Total petroleum hydrocarbons - motor oil (high boiling)	No Data																			
Xylenes (Total)	No Data																			
Ammonia/Ammonium	No Data																			
Cyanide	No Data																			
Fluoride	No Data																			
Iodine	No Data																			
Nitrate/Nitrite	No Data																			
Sulfate/Sulfite	No Data																			
1,1-dichloroethane	No Data																			
1,1-dichloroethene	No Data																			
1,1,2-trichloroethane	No Data																			
1,1,2,2-tetrachloroethane	No Data																			
1,2-dichlorobenzene	No Data																			
1,2-dichloroethane (DCA)	No Data																			
1,3-dichlorobenzene	No Data																			
2-hexanone	No Data																			
Butanol	No Data																			
Carbon Tetrachloride	No Data																			
Cis-1,2-dichloroethylene	No Data																			

Table 6-8. Summary of Terrestrial Invertebrate Effects Data

Chemical		Test Organism		Soil			Toxicity Value						Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	Species	Type	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concentration (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Dichloromethane	No Data																			
Ethyl Benzene	No Data																			
Methyl Isobutyl Ketone	No Data																			
n-butyl Benzene	No Data																			
Trans-1,2-dichloroethylene	No Data																			
Trichloroethylene (TCE)	No Data																			
2-Methylnaphthalene	No Data																			
Naphthalene	No Data																			
Gasoline Range Organics	No Data																			
TPH - diesel	No Data																			
TPH - kerosene	No Data																			
Normal paraffin hydrocarbons	No Data																			
2-methylphenol (ocresol)	No Data																			
4-methylphenol (pcresol)	No Data																			
2,4-dinitrotoluene	No Data																			
Polychlorinated Biphenyls (PCB)	No Data																			
Aroclor 1016	No Data																			
Aroclor 1221	No Data																			
Aroclor 1232	No Data																			
Aroclor 1242	No Data																			
Aroclor 1248	No Data																			
Aroclor 1254	No Data																			
Aroclor 1260	No Data																			
Aroclor-1262	No Data																			
Dichloroprop	No Data																			
Aldrin	No Data																			
beta-1,2,3,4,5,6-Hexachlorocyclohexane	No Data																			
alpha-Chlordane	No Data																			
gamma-Chlordane	No Data																			
Dieldrin	No Data																			
Endosulfan I	No Data																			
Endosulfan II	No Data																			
Endosulfan sulfate	No Data																			
Endrin aldehyde	No Data																			
Methoxychlor	No Data																			
Europium-154	No Data																			
Europium-155	No Data																			
Neptunium-237	No Data																			
Nickel-63	No Data																			
Plutonium-238	No Data																			
Plutonium-239/240	No Data																			
Potassium-40	No Data																			
Radium-226	No Data																			
Radium-228	No Data																			
Selenium-79	No Data																			
Strontium-90	No Data																			
Technetium-99	No Data																			
Thorium-230	No Data																			
Thorium-232	No Data																			
Tritium	No Data																			
Uranium-233/234	No Data																			
Uranium-234	No Data																			
Uranium-235	No Data																			

Table 6-8. Summary of Terrestrial Invertebrate Effects Data

Chemical		Test Organism		Soil			Toxicity Value						Ecological Soil Screening Level (EcoSSL) Details				Reference/Source			
Name	Form	Name	Species	Type	pH	% Organic Matter	Exposure (days)	Parameter	Type	Comment	Soil Concentration (mg/kg dw)	Parameter % Decrease	Bio-availability Score	Total Evaluation Score	Eligible for Eco-SSL Derivation?	Used for Eco-SSL?	Primary	IP Number	Study ID	Secondary
Uranium-238	No Data																			

Notes:

Geometric means were dervied using LOECs, LOAECs, EC20s, EC10s, and MATCs. ILLs, LC50s, and EC50s were not evaluated except for DDT for which all values available were LC50s.

EC25s, EC50s, and LC50s were only considered for analytes for which no other effects data were available. A geometric mean was derived from these effect levels and then the geometric mena was multiplied by uncertainty factor of 0.1.

Acronyms:

EC10 = concentration at which an effect is observed in 10% of exposed organisms
EC20 = concentration at which an effect is observed in 20% of exposed organisms
EC50 = concentration at which an effect is observed in 50% of exposed organisms
ILL = Incipient lethal level
LC50 = concentration lethal to 50% of exposed organisms
LOAEC = lowest observed adverse effect concentration
LOEC = lowest adverse effect concentration
MATC = maximum acceptable toxicant concentration (calculated as a geometric mean of the NOEC and LOEC)
NOEC = no observed effect concentration

Table 6-9. Summary of Tier 1 Values for Chemicals Based on No Observed Adverse Effect Levels

Analyte	California Quail	Meadowlark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grasshopper Mouse	Badger	Lowest
Aluminum	22020	18602	4921	61782	687	271	380	710	271
Antimony					8.8	0.66	0.60	17	0.60
Arsenic, Total all valence states	1800	1981	425	10344	265	105	171	549	105
Arsenic (III)	1800	1981	425	10344	265	105	171	549	105
Arsenic (V)	1800	1981	425	10344	265	105	171	549	105
Barium	1229	1271	660	14442	2082	1889	4605	18843	660
Beryllium					13.9	18.0	101	283	13.9
Bismuth									
Boron	63.9	86.5	140	797	39.8	49.9	284	767	39.8
Cadmium	151	2.8	0.9	1375	76.2	1.5	1.3	455	0.89
Chromium (total)	334	96.5	36.5	1286	320	74.7	78.0	752	36.5
Chromium (+3)	334	96.5	36.5	1286	320	74.7	78.0	752	36.5
Chromium (+6)					1233	288	300	3380	288
Cobalt	1425	305	109	1601	2174	261	250	1346	109
Copper	485	85.3	35.8	3728	873	100	109	2640	35.8
Lead	247	48.7	15.5	979	1204	151	153	2005	15.5
Lithium					3189	1258	1749	257	257
Manganese	16369	24184	9588	113951	4227	4115	18430	20464	4115
Mercury (methyl)	3.1	0.35	0.04	24.6	0.49	0.03	0.03	9	0.03
Mercury (inorganic)	46.0	31.65	5.60	162.8					5.60
Molybdenum	34.5	27.0	17.9	97.7	1.7	1.4	2.8	7	1.4
Nickel	1081	79.4	30.8	6037	303	17.8	16.3	637	16.3
Selenium	5.6	3.7	1.7	158	2.1	1.2	1.8	32	1.2
Silver	345	12.8	5.0	2044	1442	34.6	30.0	3097	5.0
Strontium					9442	4849	6476	4228	4228
Thallium					5.1	1.8	2.4	3	1.8
Tin	82.2	128	231	1852	187	252	2691	5107	82.2
Uranium	2502	2691	785	18730	56	36	68	155	36
Vanadium	67.0	58.2	15.6	268	1363	577	835	1864	15.6
Zinc	4973	714	66.6	70825	4612	633	794	38590	66.6
Ammonia/Ammonium									

Table 6-9. Summary of Tier 1 Values for Chemicals Based on No Observed Adverse Effect Levels

Analyte	California Quail	Meadowlark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grasshopper Mouse	Badger	Lowest
Chloride									
Cyanide					27971	20693	78123	38061	20693
Fluoride	1492	2812	556	9206	9825	8216	35673	17379	556
Iodine					159	183	1558	759	159
Nitrate/Nitrite					206422	152711	576537	280885	152711
Phosphate									
Sulfate/Sulfite									
Total Organic Carbon									
1,1-dichloroethane	3615	217	82.7	13955	20357	574	502	22894	82.7
1,1-dichloroethene	3615	217	82.5	11433	12214	344	301	12238	82.5
1,1,1-trichloroethane	3615	217	82.4	8936	407144	11444	10016	349074	82.4
1,1,2-trichloroethane	3615	217	82.6	12031	407144	11472	10041	420572	82.6
1,1,2,2-tetrachloroethane	3615	217	82.4	9549	3636	102	89.4	3255	82.4
1,2-dichlorobenzene	87.8	91.0	82.1	4343	282	294	854	17612	82.1
1,2-dichloroethane (DCA)	3615	222	84.3	16084	20357	586	513	24710	84.3
1,3-dichlorobenzene	96.1	95.9	82.0	4051	310	314	854	16652	82.0
2-butanone (Methyl Ethyl Ketone/MEK)	2102	1041	312	11538	721052	159713	176661	970851	312
2-hexanone	2102	548	186	9653	2036	244	237	2512	186
Benzene	8554	513	195	27053	285	8.0	7.0	286	7.0
Butanol					50893	2906	2626	67049	2626
Carbon Tetrachloride	3615	216	82.3	7382	6514	183	160	4904	82.3
Chlorobenzene	3615	216	82.3	6672	7939	223	195	5561	82.3
Chloroform	3615	217	82.6	13003	6107	172	151	6600	82.6
Cis-1,2-dichloroethylene	3615	217	82.6	13446	18403	518	453	20271	82.6
Dichloromethane (Methylene Chloride)	3615	218	82.9	17281	2382	67.3	58.9	2999	58.9
Ethyl Benzene	159	182	194	12721	342	384	1357	33025	159
Methyl Isobutyl Ketone	2102	573	193	10211	721052	90040	87996	915292	193
n-butyl Benzene	301	263	193	7857	530	485	1092	18135	193
Tetrachloroethylene	3615	216	82	7733	570	16.0	14.0	443	14.0
Toluene	8554	512	195	17200	21171	594	520	15763	195
Trans-1,2-dichloroethylene	3615	217	83	11881	18403	518	453	18869	83

Table 6-9. Summary of Tier 1 Values for Chemicals Based on No Observed Adverse Effect Levels

Analyte	California Quail	Meadowlark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grasshopper Mouse	Badger	Lowest
Trichloroethylene (TCE)	3615	217	82	7498	285	8.0	7.0	217	7.0
Xylene	149	175	194	13419	422	481	1787	45266	149
Acenaphthene	6831	285	110	38362	71250	1396	1211	96952	110
Acenaphthylene	3506	19	7.4	38362	24321	91.4	77.9	96952	7.4
Anthracene	3405	170	68	38362	178811	4784	4213	554013	68
Benzo(a)pyrene	47.2	6.0	2.4	767	60.4	8.1	7.6	554	2.4
Benzo(a)anthracene	118	5.2	2.0	767	307	7.3	6.4	554	2.0
Benzo(b)fluoranthene	22.5	3.0	1.3	767	24.7	4.1	3.9	554	1.3
Benzo(ghi)perylene	12.2	2.6	1.1	767	12.6	3.5	3.5	554	1.1
Benzo[k]fluoranthene	136	3.2	1.3	767	406	4.6	3.9	554	1.3
Chrysene	118	3.6	1.4	767	307	5.1	4.5	554	1.4
Dibenz(ah)anthracene	43.6	3.5	1.4	767	54.3	4.9	4.4	554	1.4
Fluoranthene	14.9	2.5	1.1	767	1957	421	420	69252	1.1
Fluorene	6831	45	17.5	38362	50893	157	134	69252	17.5
Indeno[1,2,3-cd]pyrene	48.7	2.9	1.2	767	62.6	4.0	3.6	554	1.2
2-Methylnaphthalene	5.0	5.7	155	38362	5.0	5.5	500	27867	5.0
Naphthalene	34.0	36.9	416	38362	33.3	36.2	116	27701	33.3
Phenanthrene	4329	236	94	38362	301134	6731	5919	554013	94.3
Pyrene	10.7	3.9	1.9	767	825	360	436	41551	1.9
Total PAHs									
Low MW PAHs	6592	12623	2316	38362	25369	19170	74597	36343	2316
High MW PAHs	39.5	72.4	46.3	767	29.1	39	699	341	29.1
Gasoline Range Organics									
TPH - Diesel	105086	199535	35638	590179	407144	301205	1137154	554013	35638
TPH - Kerosene	105086	199535	35638	590179	407144	301205	1137154	554013	35638
Normal paraffin hydrocarbons	170870	324445	57948	959632	407144	301205	1137154	554013	57948
Phenol					4886	526	504	5919	504
2-methylphenol (ocresol)					127436	10038	9293	134503	9293
4-methylphenol (pcresol)					127436	10102	9358	136361	9358
2,4-dinitrotoluene	0.29	0.30	0.20	7.2	13.8	13.5	35.6	286	0.20
Bis[2-ethylhexyl] phthalate	111	0.35	0.14	263	1733	5.4	4.6	3599	0.14

Table 6-9. Summary of Tier 1 Values for Chemicals Based on No Observed Adverse Effect Levels

Analyte	California Quail	Meadowlark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grasshopper Mouse	Badger	Lowest
Total PCBs	10.0	0.65	0.33	25.1	2.9	0.30	0.27	8	0.27
Aroclor 1016	6.4	0.64	0.33	21.8	35.2	2.8	2.5	150	0.33
Aroclor 1221	2.7	0.61	0.33	24.0	0.69	0.25	0.27	8	0.25
Aroclor 1232	2.2	0.59	0.33	26.2	0.55	0.24	0.27	9	0.24
Aroclor 1242	10.4	0.65	0.33	25.6	3.09	0.30	0.27	9	0.27
Aroclor 1248	9.4	0.65	0.33	24.3	0.35	0.06	0.06	1	0.06
Aroclor 1254	11.5	0.65	0.33	27.3	3.5	0.30	0.27	9	0.27
Aroclor 1260	20.4	0.66	0.33	51.5	7.7	0.30	0.27	15	0.27
Aroclor-1262	37.8	71.8	12.8	212	27.7	20.5	77.3	38	12.8
Dichloroprop									
Aldrin	0.45	0.08	0.03	1.1	10.2	2.0	2.0	27	0.03
beta-1,2,3,4,5,6-Hexachlorocyclohexane	4.1	3.6	2.7	112	1.9	1.7	4.0	67	1.7
alpha-Chlordane	122	24	10	302	92.5	20.5	20.7	264	10.1
gamma-Chlordane	122	24	10	302	92.5	20.4	20.6	264	10.0
Dichlorodiphenyldichloroethylene	30.4	0.21	0.07	0.06	20.5	0.11	0.09	0	0.03
Dichlorodiphenyltrichloroethane	30.4	0.30	0.10	2.5	20.5	0.16	0.14	1	0.10
Dieldrin	1.9	0.06	0.02	1.6	0.28	0.01	0.01	0	0.01
Endosulfan I	93.4	66.3	41.4	1671	0.92	0.71	1.3	22	0.71
Endosulfan II	93.4	66.3	41.4	1671	0.92	0.71	1.3	22	0.71
Endosulfan sulfate	62.9	55.4	41.4	2160	0.61	0.56	1.3	27	0.56
Endrin aldehyde	2.6	0.52	0.23	52.9	0.51	0.14	0.14	14	0.14
Methoxychlor					59.8	11.2	10.9	441	10.9

Note:
Highlighted cells represent limiting value.

Table 6-10. Summary of Tier 1 Values for Chemicals Based on Lowest Observed Adverse Effect Levels

Analyte	California Quail	Meadowlark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grasshopper Mouse	Badger	Lowest
Aluminum					6872	2708	3799	7101	2708
Antimony					96.6	6.6	6.0	167	6.0
Arsenic, Total all valence states	8104	10559	2132	45439	459	190	318	881	190
Arsenic (III)	8104	10559	2132	45439	459	190	318	881	190
Arsenic (V)	8104	10559	2132	45439	459	190	318	881	190
Barium	2464	2548	1323	28954	3470	3148	7676	31405	1323
Beryllium									
Bismuth									
Boron	222	300	485	2766	133	167	949	2563	133
Cadmium	278	5.1	1.6	2335	2065	27.5	23.6	5228	1.6
Chromium (total)	349	101	38.2	1355	1284	299	313	3536	38.2
Chromium (+3)	349	101	38.2	1355	1284	299	313	3536	38.2
Chromium (+6)					5340	1245	1300	16583	1245
Cobalt	1461	313	111	1633	3233	388	372	1869	111
Copper	1914	272	107	13021	1894	176	182	4672	107
Lead	537	115	35.6	2433	2544	332	336	4108	35.6
Lithium					6379	2517	3498	515	515
Manganese	31823	48820	19636	221536	5828	5798	27720	28213	5798
Mercury (methyl)	35.5	21.3	3.6	134	8.0	1.9	3.2	43.4	1.9
Mercury (inorganic)	110.8	112.5	22.1	326	31.0	12.3	32.4	100.3	12.3
Molybdenum	345	270	179	977	16.7	14.0	27.7	71.2	14.0
Nickel	1912	136	52.9	11078	676	35.8	32.6	1438	32.6
Selenium	10.5	8.2	4.3	417	3.0	1.9	3.2	60	1.9
Silver	3453	128	49.6	20437	14418	346	300	30969	49.6
Strontium									
Thallium					25.4	9.2	12.2	13.1	9.2
Tin	204	318	575	4603	279	377	4025	7639	204
Uranium					556	359	682	1545	359
Vanadium	134	116	31.1	537	2723	1153	1668	3723	31.1
Zinc	5015	726	67.8	71294	4661	644	810	38866	67.8
Ammonia/Ammonium									

Table 6-10. Summary of Tier 1 Values for Chemicals Based on Lowest Observed Adverse Effect Levels

Analyte	California Quail	Meadowlark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grasshopper Mouse	Badger	Lowest
Chloride									
Cyanide									
Fluoride	6123	11539	2281	37771	16521	13816	59985	29224	2281
Iodine					1594	1834	15579	7590	1594
Nitrate/Nitrite					460073	340361	1284984	626035	340361
Phosphate									
Sulfate/Sulfite									
Total Organic Carbon									
1,1-dichloroethane	7230	435	165	27909					165
1,1-dichloroethene	7230	434	165	22866					165
1,1,1-trichloroethane	7230	433	165	17871					165
1,1,2-trichloroethane	7230	434	165	24063					165
1,1,2,2-tetrachloroethane	7230	433	165	19098	36358	1022	894	32554	165
1,2-dichlorobenzene	176	182	164	8687					164
1,2-dichloroethane (DCA)	7230	444	169	32168					169
1,3-dichlorobenzene	192	192	164	8103					164
2-butanone (Methyl Ethyl Ketone/MEK)	21017	10406	3123	115382	1861055	412224	455968	2505793	3123
2-hexanone	21017	5483	1856	96532	14698	1759	1708	18135	1708
Benzene					2850	80.2	70.2	2856	70.2
Butanol					203572	11625	10503	268194	10503
Carbon Tetrachloride	7230	433	165	14765					165
Chlorobenzene	7230	433	165	13345	15756	442	387	11036	165
Chloroform	7230	434	165	26006	16693	470	412	18041	165
Cis-1,2-dichloroethylene	7230	434	165	26892					165
Dichloromethane (Methylene Chloride)	7230	436	166	34562	20357	576	504	25632	166
Ethyl Benzene					1027	1151	4073	99076	1027
Methyl Isobutyl Ketone	21017	5729	1927	102114	1861055	232395	227119	2362393	1927
n-butyl Benzene					1589	1454	3275	54406	1454
Tetrachloroethylene	7230	431	164	15467	2850	79.8	69.8	2216	69.8
Toluene					211715	5944	5202	157633	5202
Trans-1,2-dichloroethylene	7230	434	165	23763					165

Table 6-10. Summary of Tier 1 Values for Chemicals Based on Lowest Observed Adverse Effect Levels

Analyte	California Quail	Meadowlark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grasshopper Mouse	Badger	Lowest
Trichloroethylene (TCE)	7230	434	165	14996	2850	80.1	70.1	2169	70.1
Xylene					826	940	3494	88509	826
Acenaphthene	68306	2849	1096	383617	142500	2793	2422	193905	1096
Acenaphthylene	43766	186	73.6	383617	54132	183	156	193905	73.6
Anthracene	43405	1716	678	383617					678
Benzo(a)pyrene					635	81.2	76.4	5540	76.4
Benzo(a)anthracene					3636	73.4	64.0	5540	64.0
Benzo(b)fluoranthene					247	40.8	39.2	5540	39.2
Benzo(ghi)perylene					88.9	32.4	34.7	5540	32.4
Benzo[k]fluoranthene					4069	45.6	39.2	5540	39.2
Chrysene					3636	51.4	44.5	5540	44.5
Dibenz(ah)anthracene					543	48.6	44.1	5540	44.1
Fluoranthene					3915	841	839	138503	839
Fluorene	68306	446	175	383617	101786	313	267	138503	175
Indeno[1,2,3-cd]pyrene					626	40	35.7	5540	36
2-Methylnaphthalene	8.4	9.5	1547	383617	6.0	6.5	1132	63047	6.0
Naphthalene	340	369	378	383617	100	109	348	83102	100
Phenanthrene	56061	2406	943	383617					943
Pyrene					1375	600	727	69252	600
Total PAHs									
Low MW PAHs	67600	128679	23165	383617	130652	97560	372987	181716	23165
High MW PAHs					157	209	3491	1701	157
Gasoline Range Organics									
TPH - Diesel	1050862	1995354	356382	5901794	610716	451807	1705732	831020	356382
TPH - Kerosene	1050862	1995354	356382	5901794	610716	451807	1705732	831020	356382
Normal paraffin hydrocarbons					610716	451807	1705732	831020	451807
Phenol					14657	1578	1511	17756	1511
2-methylphenol (ocresol)									
4-methylphenol (pcresol)									
2,4-dinitrotoluene	38.1	39.1	26.4	932	28.8	28.1	74.4	597	26.4
Bis[2-ethylhexyl] phthalate					17332	53.5	45.4	35994	45.4

Table 6-10. Summary of Tier 1 Values for Chemicals Based on Lowest Observed Adverse Effect Levels

Analyte	California Quail	Meadowlark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grasshopper Mouse	Badger	Lowest
Total PCBs	100	3.6	1.8	251	29.2	1.6	1.5	85	1.5
Aroclor 1016	64	3.6	1.8	218	88.1	5.3	4.8	377	1.8
Aroclor 1221	27	3.4	1.8	240	6.9	1.5	1.5	82	1.5
Aroclor 1232	22	3.4	1.8	262	5.5	1.4	1.5	88	1.4
Aroclor 1242	104	3.6	1.8	256	30.9	1.6	1.5	87	1.5
Aroclor 1248	94	3.6	1.8	243	3.5	0.3	0.32	11	0.32
Aroclor 1254	115	3.6	1.8	273	34.8	1.6	1.5	91	1.5
Aroclor 1260	204	3.6	1.8	515	76.7	1.6	1.5	154	1.5
Aroclor-1262	378	718	128	2125	277	205	773	377	128
Dichloroprop									
Aldrin	2.2	0.40	0.16	5.3	51.1	9.9	9.8	134	0.16
beta-1,2,3,4,5,6-Hexachlorocyclohexane	6.2	5.5	4.1	168	9.4	8.7	19.9	335	4.1
alpha-Chlordane	608	121	50.4	1508	925	205	207	2641	50.4
gamma-Chlordane	608	121	50.2	1508	925	204	206	2641	50.2
Dichlorodiphenyldichloroethylene	300	2.3	0.80	1.7	136	0.71	0.6	0.40	0.40
Dichlorodiphenyltrichloroethane	300	3.5	1.2	46.3	136	1.0	0.9	12.7	0.88
Dieldrin	6.1	0.20	0.08	5.2	0.57	0.02	0.02	0.69	0.02
Endosulfan I									
Endosulfan II									
Endosulfan sulfate									
Endrin aldehyde					5.1	1.4	1.4	140	1.4
Methoxychlor					120	22.4	21.8	882	21.8

Notes:
Highlighted cells represent limiting value.

Table 6-11. Additional Parameters for Estimation of Radionuclide Exposure for Birds and Mammals

Endpoint	Assumed Longevity (years)	Assumed Geometry Category[a]	Geometry Dimensions
California Quail	7	3	10x2x2 cm
Meadowlark	6	3	10x2x2 cm
Killdeer	10	3	10x2x2 cm
Red-tailed Hawk	7	4	45x8.7x4.9 cm
Great Basin Pocket Mouse	4	3	10x2x2 cm
Deer Mouse	1	3	10x2x2 cm
Grasshopper mouse	5	3	10x2x2 cm
Badger	5	5	50x26x13 cm

a. From RESRAD-BIOTA

Table 6-12. Summary of Tier 1 Values in Soil (pCi/g) for Radionuclides

	California Quail	Western Meadowlark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grasshopper Mouse	Badger	Lowest
Am-241	28900.00	25000.00	11900.00	17800.00	72100.00	48700.00	41400.00	4840.00	4840.00
C-14	54.00	60.10	56.30	49.50	61.40	59.70	135.00	31.60	31.60
Cm-244	389000.00	252000.00	105000.00	207000.00	2300000.00	722000.00	499000.00	50800.00	50800.00
Co-60	805.00	805.00	805.00	863.00	805.00	805.00	806.00	1000.00	805.00
Cs-134	1140.00	1190.00	1200.00	854.00	1160.00	1180.00	1270.00	562.00	562.00
Cs-137	2390.00	2700.00	2800.00	1430.00	2510.00	2630.00	3280.00	924.00	924.00
Eu-152	1740.00	1740.00	1740.00	1880.00	1740.00	1740.00	1740.00	2220.00	1740.00
Eu-154	1610.00	1610.00	1610.00	1740.00	1610.00	1610.00	1610.00	2060.00	1610.00
Eu-155	33400.00	33400.00	33400.00	37300.00	33400.00	33400.00	33400.00	48600.00	33400.00
H-3	1430.00	1280.00	936.00	1130.00	3270.00	2290.00	2830.00	420.00	420.00
Np-237	8190.00	8140.00	7880.00	9150.00	8250.00	8170.00	8180.00	11200.00	7880.00
Pu-238	36300.00	56200.00	20900.00	26800.00	291000.00	161000.00	161000.00	5980.00	5980.00
Pu-239	38800.00	60300.00	22300.00	28400.00	324000.00	175000.00	176000.00	6270.00	6270.00
Ra-226	168.00	142.00	58.30	377.00	285.00	165.00	199.00	193.00	58.30
Ra-228	169.00	140.00	55.20	418.00	306.00	165.00	203.00	193.00	55.20
Sb-125	4580.00	4580.00	4580.00	5040.00	4580.00	4580.00	4580.00	6130.00	4580.00
Sr-90	521.00	302.00	151.00	112.00	706.00	519.00	413.00	91.10	91.10
Tc-99	5360.00	11500.00	137000.00	280000.00	8670.00	12100.00	412000.00	128000.00	5360.00
Th-232	5070.00	12900.00	5340.00	12400.00	34400.00	32500.00	86200.00	4560.00	4560.00
U-234	12700.00	21800.00	6370.00	40900.00	30300.00	24800.00	51600.00	14200.00	6370.00
U-235	6340.00	7810.00	4360.00	10200.00	8600.00	8130.00	9630.00	8060.00	4360.00
U-238	8020.00	10400.00	5150.00	22100.00	11900.00	11000.00	13900.00	13400.00	5150.00

Note:
Highlighted cells represent limiting value.

Table 6-13. Summary of Tier 1 Soil Screening Levels for Protection of Wildlife Receptors

			NOAEL-based site-specific PRGs									LOAEL-based site-specific PRGs								
Group	Soil Constituent	Units	California Quail	Meadow-lark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grass-hopper Mouse	Badger	NOAEL Lowest	California Quail	Meadow-lark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grass-hopper Mouse	Badger	LOAEL Lowest
Radionuclides	Americium-241	pCi/g	---	---	---	---	---	---	---	---	---	28900	25000	11900	17800	72100	48700	41400	4840	4840
	Carbon-14	pCi/g	---	---	---	---	---	---	---	---	---	54	60	56	50	61	60	135	32	32
	Curium-244	pCi/g	---	---	---	---	---	---	---	---	---	389000	252000	105000	207000	2300000	722000	499000	50800	50800
	Cobalt-60	pCi/g	---	---	---	---	---	---	---	---	---	805	805	805	863	805	805	806	1000	805
	Cesium-134	pCi/g	---	---	---	---	---	---	---	---	---	1140	1190	1200	854	1160	1180	1270	562	562
	Cesium 137	pCi/g	---	---	---	---	---	---	---	---	---	2390	2700	2800	1430	2510	2630	3280	924	924
	Europium-152	pCi/g	---	---	---	---	---	---	---	---	---	1740	1740	1740	1880	1740	1740	1740	2220	1740
	Europium-154	pCi/g	---	---	---	---	---	---	---	---	---	1610	1610	1610	1740	1610	1610	1610	2060	1610
	Europium-155	pCi/g	---	---	---	---	---	---	---	---	---	33400	33400	33400	37300	33400	33400	33400	48600	33400
	Hydrogen-3 (tritium)	pCi/g	---	---	---	---	---	---	---	---	---	1430	1280	936	1130	3270	2290	2830	420	420
	Neptunium-237	pCi/g	---	---	---	---	---	---	---	---	---	8190	8140	7880	9150	8250	8170	8180	11200	7880
	Nickel-63	pCi/g	---	---	---	---	---	---	---	---	---									
	Plutonium-238	pCi/g	---	---	---	---	---	---	---	---	---	36300	56200	20900	26800	291000	161000	161000	5980	5980
	Plutonium-239/240	pCi/g	---	---	---	---	---	---	---	---	---	38800	60300	22300	28400	324000	175000	176000	6270	6270
	Radium-226	pCi/g	---	---	---	---	---	---	---	---	---	168	142	58	377	285	165	199	193	58
	Radium-228	pCi/g	---	---	---	---	---	---	---	---	---	169	140	55	418	306	165	203	193	55
	Antimony-125	pCi/g	---	---	---	---	---	---	---	---	---	4580	4580	4580	5040	4580	4580	4580	6130	4580
	Strontium 90	pCi/g	---	---	---	---	---	---	---	---	---	521	302	151	112	706	519	413	91	91
	Technetium-99	pCi/g	---	---	---	---	---	---	---	---	---	5360	11500	137000	280000	8670	12100	412000	128000	5360
	Thorium-232	pCi/g	---	---	---	---	---	---	---	---	---	5070	12900	5340	12400	34400	32500	86200	4560	4560
	Uranium-234	pCi/g	---	---	---	---	---	---	---	---	---	12700	21800	6370	40900	30300	24800	51600	14200	6370
	Uranium-235	pCi/g	---	---	---	---	---	---	---	---	---	6340	7810	4360	10200	8600	8130	9630	8060	4360
	Uranium-238	pCi/g	---	---	---	---	---	---	---	---	---	8020	10400	5150	22100	11900	11000	13900	13400	5150
Metals	Aluminum	mg/kg	22020	18602	4921	61782	687	271	380	710	271	---	---	---	---	6872	2708	3799	7101	2708
	Antimony	mg/kg	---	---	---	---	8.82	0.66	0.60	16.66	0.60	---	---	---	---	97	7	6	167	6
	Arsenic, Total all valence states	mg/kg	1800	1981	425	10344	265	105	171	549	105	8104	10559	2132	45439	459	190	318	881	190
	Arsenic (III)	mg/kg	1800	1981	425	10344	265	105	171	549	105	8104	10559	2132	45439	459	190	318	881	190
	Arsenic (V)	mg/kg	1800	1981	425	10344	265	105	171	549	105	8104	10559	2132	45439	459	190	318	881	190
	Barium	mg/kg	1229	1271	660	14442	2082	1889	4605	18843	660	2464	2548	1323	28954	3470	3148	7676	31405	1323
	Beryllium	mg/kg	---	---	---	---	14	18	101	283	14	---	---	---	---	---	---	---	---	---
	Bismuth	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Boron	mg/kg	64	86	140	797	40	50	284	767	40	222	300	485	2766	133	167	949	2563	133
	Cadmium	mg/kg	151	2.8	0.9	1375	76	1.5	1.3	455	0.9	278	5	2	2335	2065	28	24	5228	2
	Chromium (total)	mg/kg	334	97	37	1286	320	75	78	752	37	349	101	38	1355	1284	299	313	3536	38
	Chromium (+3)	mg/kg	334	97	37	1286	320	75	78	752	37	349	101	38	1355	1284	299	313	3536	38
	Chromium (+6)	mg/kg	---	---	---	---	1233	288	300	3380	288	---	---	---	---	5340	1245	1300	16583	1245
	Cobalt	mg/kg	1425	305	109	1601	2174	261	250	1346	109	1461	313	111	1633	3233	388	372	1869	111
	Copper	mg/kg	485	85	36	3728	873	100	109	2640	36	1914	272	107	13021	1894	176	182	4672	107
	Lead	mg/kg	247	49	16	979	1204	151	153	2005	16	537	115	36	2433	2544	332	336	4108	36
	Lithium	mg/kg	---	---	---	---	3189	1258	1749	257	257	---	---	---	---	6379	2517	3498	515	515
	Manganese	mg/kg	16369	24184	9588	113951	4227	4115	18430	20464	4115	31823	48820	19636	221536	5828	5798	27720	28213	5798
	Mercury (methyl)	mg/kg	3.1	0.4	0.04	25	0.5	0.03	0.03	8.7	0.03	36	21	4	134	8	2	3	43	2
	mercury (Inorganic)		46.0	31.7	5.6	162.8					5.6	111	112	22	326	31	12	32	100	12
	Molybdenum	mg/kg	35	27	18	98	1.7	1.4	2.8	7.1	1.4	345	270	179	977	17	14	28	71	14
	Nickel	mg/kg	1081	79	31	6037	303	18	16	637	16	1912	136	53	11078	676	36	33	1438	33
	Selenium	mg/kg	5.6	3.7	1.7	158	2.1	1.2	1.8	32	1.2	10	8	4	417	3	2	3	60	2
	Silver	mg/kg	345	13	5.0	2044	1442	35	30	3097	5.0	3453	128	50	20437	14418	346	300	30969	50
	Strontium	mg/kg	---	---	---	---	9442	4849	6476	4228	4228	---	---	---	---	---	---	---	---	---
	Thallium	mg/kg	---	---	---	---	5.1	1.8	2.4	2.6	1.8	---	---	---	---	25	9	12	13	9
	Tin	mg/kg	82	128	231	1852	187	252	2691	5107	82	204	318	575	4603	279	377	4025	7639	204
	Uranium	mg/kg	2502	2691	785	18730	56	36	68	155	36	---	---	---	---	556	359	682	1545	359
	Vanadium	mg/kg	67	58	16	268	1363	577	835	1864	16	134	116	31	537	2723	1153	1668	3723	31
	Zinc	mg/kg	4973	714	67	70825	4612	633	794	38590	67	5015	726	68	71294	4661	644	810	38866	68
General Inorganics	Ammonia/Ammonium	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Chloride	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Cyanide	mg/kg	---	---	---	---	27971	20693	78123	38061	20693	---	---	---	---	---	---	---	---	---
	Fluoride (fluorine)	mg/kg	1492	2812	556	9206	9825	8216	35673	17379	556	6123	11539	2281	37771	16521	13816	59985	29224	2281
	Iodine	mg/kg	---	---	---	---	159	183	1558	759	159	---	---	---	---	1594	1834	15579	7590	1594
	Nitrate/Nitrite	mg/kg	---	---	---	---	206422	152711	576537	280885	152711	---	---	---	---	460073	340361	1284984	626035	340361
	Phosphate	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Sulfate/Sulfite	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Total Organic Carbon	%	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	1,1-dichloroethane	mg/kg	3615	217	83	13955	20357	574	502	22894	83	7230	435	165	27909	---	---	---	---	165
	1,1-dichloroethene	mg/kg	3615	217	83	11433	12214	344	301	12238	83	7230	434	165	22866	---	---	---	---	165
	1,1,1-trichloroethane	mg/kg	3615	217	82	8936	407144	11444	10016	349074	82	7230	433	165	17871	---	---	---	---	165
	1,1,2-trichloroethane	mg/kg	3615	217	83	12031	407144	11472	10041	420572	83	7230	434	165	24063	---	---	---	---	165

Table 6-13. Summary of Tier 1 Soil Screening Levels for Protection of Wildlife Receptors

			NOAEL-based site-specific PRGs									LOAEL-based site-specific PRGs								
Group	Soil Constituent	Units	California Quail	Meadow-lark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grass-hopper Mouse	Badger	NOAEL Lowest	California Quail	Meadow-lark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grass-hopper Mouse	Badger	LOAEL Lowest
Volatile Organics	1,1,2,2-tetrachloroethane	mg/kg	3615	217	82	9549	3636	102	89	3255	82	7230	433	165	19098	36358	1022	894	32554	165
	1,2-dichlorobenzene	mg/kg	88	91	82	4343	282	294	854	17612	82	176	182	164	8687	---	---	---	---	164
	1,2-dichloroethane (DCA)	mg/kg	3615	222	84	16084	20357	586	513	24710	84	7230	444	169	32168	---	---	---	---	169
	1,3-dichlorobenzene	mg/kg	96	96	82	4051	310	314	854	16652	82	192	192	164	8103	---	---	---	---	164
	2-butanone (Methyl Ethyl Ketone/MEK)	mg/kg	2102	1041	312	11538	721052	159713	176661	970851	312	21017	10406	3123	115382	1861055	412224	455968	2505793	3123
	2-hexanone	mg/kg	2102	548	186	9653	2036	244	237	2512	186	21017	5483	1856	96532	14698	1759	1708	18135	1708
	Benzene	mg/kg	8554	513	195	27053	285	8	7	286	7	---	---	---	---	2850	80	70	2856	70
	Butanol	mg/kg	---	---	---	---	50893	2906	2626	67049	2626	---	---	---	---	203572	11625	10503	268194	10503
	Carbon Tetrachloride	mg/kg	3615	216	82	7382	6514	183	160	4904	82	7230	433	165	14765	---	---	---	---	165
	Chlorobenzene	mg/kg	3615	216	82	6672	7939	223	195	5561	82	7230	433	165	13345	15756	442	387	11036	165
	Chloroform	mg/kg	3615	217	83	13003	6107	172	151	6600	83	7230	434	165	26006	16693	470	412	18041	165
	Cis-1,2-dichloroethylene	mg/kg	3615	217	83	13446	18403	518	453	20271	83	7230	434	165	26892	---	---	---	---	165
	Dichloromethane (Methylene Chloride)	mg/kg	3615	218	83	17281	2382	67	59	2999	59	7230	436	166	34562	20357	576	504	25632	166
	Ethyl Benzene	mg/kg	159	183	194	12721	342	384	1357	33025	159	---	---	---	---	1027	1151	4075	99076	1027
	Methyl Isobutyl Ketone	mg/kg	2102	573	193	10211	721052	90040	87996	915292	193	21017	5729	1927	102114	1861055	232395	227119	2362393	1927
	n-butyl Benzene	mg/kg	301	263	193	7857	530	485	1092	18135	193	---	---	---	---	1589	1454	3275	54406	1454
	Tetrachloroethylene	mg/kg	3615	216	82	7733	570	16	14	443	14	7230	431	164	15467	2850	80	70	2216	70
	Toluene	mg/kg	8554	512	195	17200	21171	594	520	15763	195	---	---	---	---	211715	5944	5202	157633	5202
	Trans-1,2-dichloroethylene	mg/kg	3615	217	83	11881	18403	518	453	18869	83	7230	434	165	23763	---	---	---	---	165
	Trichloroethylene (TCE)	mg/kg	3615	217	82	7498	285	8	7	217	7	7230	434	165	14996	2850	80	70	2169	70
	Xylene	mg/kg	149	175	194	13419	422	481	1787	45266	149	---	---	---	---	826	940	3494	88509	826

Table 6-13. Summary of Tier 1 Soil Screening Levels for Protection of Wildlife Receptors

			NOAEL-based site-specific PRGs									LOAEL-based site-specific PRGs								
Group	Soil Constituent	Units	California Quail	Meadow-lark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grass-hopper Mouse	Badger	NOAEL Lowest	California Quail	Meadow-lark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grass-hopper Mouse	Badger	LOAEL Lowest
Polycyclic Aromatic Hydrocarbons	Acenaphthene	mg/kg	6831	285	110	38362	71250	1396	1211	96952	110	68306	2849	1096	383617	142500	2793	2422	193905	1096
	Acenaphthylene	mg/kg	3506	19	7	38362	24321	91	78	96952	7	43766	186	74	383617	54132	183	156	193905	74
	Anthracene	mg/kg	3405	170	68	38362	178811	4784	4213	554013	68	43405	1716	678	383617	---	---	---	---	678
	Benzo(a)pyrene	mg/kg	47	6.0	2.4	767	60	8.1	7.6	554	2.4	---	---	---	---	635	81	76	5540	76
	Benzo(a)anthracene	mg/kg	118	5.2	2.0	767	307	7.3	6.4	554	2.0	---	---	---	---	3636	73	64	5540	64
	Benzo(b)fluoranthene	mg/kg	22	3.0	1.3	767	25	4.1	3.9	554	1.3	---	---	---	---	247	41	39	5540	39
	Benzo(ghi)perylene	mg/kg	12	2.6	1.1	767	13	3.5	3.5	554	1.1	---	---	---	---	89	32	35	5540	32
	Benzo[k]fluoranthene	mg/kg	136	3.2	1.3	767	406	4.6	3.9	554	1.3	---	---	---	---	4069	46	39	5540	39
	Chrysene	mg/kg	118	3.6	1.4	767	307	5.1	4.5	554	1.4	---	---	---	---	3636	51	45	5540	45
	Dibenz(ah)anthracene	mg/kg	44	3.5	1.4	767	54	4.9	4.4	554	1.4	---	---	---	---	543	49	44	5540	44
	Fluoranthene	mg/kg	15	2.5	1.1	767	1957	421	420	69252	1.1	---	---	---	---	3915	841	839	138503	839
	Fluorene	mg/kg	6831	45	18	38362	50893	157	134	69252	17.5	68306	446	175	383617	101786	313	267	138503	175
	Indeno[1,2,3-cd]pyrene	mg/kg	49	2.9	1.2	767	63	4.0	3.6	554	1.2	---	---	---	---	626	40	36	5540	36
	2-Methylnaphthalene	mg/kg	5	5.7	155	38362	5.0	5.5	500	27867	5.0	8	9	1547	383617	6	7	1132	63047	6
	Naphthalene	mg/kg	34	37	416	38362	33	36.2	116	27701	33.3	340	369	378	383617	100	109	348	83102	100
	Phenanthrene	mg/kg	4329	236	94	38362	301134	6731	5919	554013	94.3	56061	2406	943	383617	---	---	---	---	943
	Pyrene	mg/kg	11	3.9	1.9	767	825	360	436	41551	1.9	---	---	---	---	1375	600	727	69252	600
	Total PAHs	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Low MW PAHs	mg/kg	6592	12623	2316	38362	25369	19170	74597	36343	2316	67600	128679	23165	383617	130652	97560	372987	181716	23165
	High MW PAHs	mg/kg	40	72	46	767	29	39	699	341	29					157	209	3491	1701	157
Petro-leum	Gasoline Range Organics	mg/kg																		
	TPH - diesel	mg/kg	105086	199535	35638	590179	407144	301205	1137154	554013	35638	1050862	1995354	356382	5901794	610716	451807	1705732	831020	356382
	TPH - kerosene	mg/kg	105086	199535	35638	590179	407144	301205	1137154	554013	35638	1050862	1995354	356382	5901794	610716	451807	1705732	831020	356382
Semivolatile Organics	Normal paraffin hydrocarbons	mg/kg	170870	324445	57948	959632	407144	301205	1137154	554013	57948	---	---	---	---	610716	451807	1705732	831020	451807
	Phenol	mg/kg	---	---	---	---	4886	526	504	5919	504	---	---	---	---	14657	1578	1511	17756	1511
	2-methylphenol (ocresol)	mg/kg	---	---	---	---	127436	10038	9293	134503	9293	---	---	---	---	---	---	---	---	---
	4-methylphenol (pcresol)	mg/kg	---	---	---	---	127436	10102	9358	136361	9358	---	---	---	---	---	---	---	---	---
	2,4-dinitrotoluene	mg/kg	0.29	0.30	0.20	7.17	13.8	13.5	35.6	286	0.20	38	39	26	932	29	28	74	597	26
	Bis[2-ethylhexyl] phthalate	mg/kg	111.1	0.35	0.14	263.03	1733	5.35	4.55	3599	0.14	---	---	---	---	17332	54	45	35994	45
	Polychlorinated Biphenyls (PCB) [b]	mg/kg	10.0	0.65	0.33	25.09	2.92	0.30	0.27	8.5	0.27	100	3.6	1.8	251	29	1.6	1.5	85	1.5
	Aroclor 1016 [b]	mg/kg	6.4	0.64	0.33	21.75	35.2	2.75	2.47	150.4	0.33	64	3.6	1.8	218	88	5.3	4.8	377	1.8
	Aroclor 1221 [b]	mg/kg	2.7	0.61	0.33	24.02	0.69	0.25	0.27	8.2	0.25	27	3.4	1.8	240	7	1.5	1.5	82	1.5
	Aroclor 1232 [b]	mg/kg	2.2	0.59	0.33	26.24	0.55	0.24	0.27	8.8	0.24	22	3.4	1.8	262	5	1.4	1.5	88	1.4
	Aroclor 1242 [b]	mg/kg	10.4	0.65	0.33	25.55	3.1	0.30	0.27	8.7	0.27	104	3.6	1.8	256	31	1.6	1.5	87	1.5
	Aroclor 1248 [b]	mg/kg	9.4	0.65	0.33	24.33	0.35	0.06	0.06	1.1	0.06	94	3.6	1.8	243	3	0.3	0.3	11	0.3
	Aroclor 1254	mg/kg	11.5	0.65	0.33	27.26	3.5	0.30	0.27	9.1	0.27	115	3.6	1.8	273	35	1.6	1.5	91	1.5
	Aroclor 1260 [b]	mg/kg	20.4	0.66	0.33	51.49	7.7	0.30	0.27	15.4	0.27	204	3.6	1.8	515	77	1.6	1.5	154	1.5
	Aroclor-1262 [b]	mg/kg	37.8	71.8	12.8	212	27.7	20.5	77.3	37.7	12.8	378	718	128	2125	277	205	773	377	128
Herbicide	Dichloroprop	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

Table 6-13. Summary of Tier 1 Soil Screening Levels for Protection of Wildlife Receptors

			NOAEL-based site-specific PRGs									LOAEL-based site-specific PRGs								
Group	Soil Constituent	Units	California Quail	Meadow-lark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grass-hopper Mouse	Badger	NOAEL Lowest	California Quail	Meadow-lark	Killdeer	Red-tailed Hawk	Great Basin Pocket Mouse	Deer Mouse	Grass-hopper Mouse	Badger	LOAEL Lowest
Pesticide	Aldrin	mg/kg	0.45	0.08	0.03	1.1	10.2	2.0	2.0	27	0.03	2.2	0.4	0.2	5.3	51	9.9	9.8	134	0.2
	beta-1,2,3,4,5,6-Hexachlorocyclohexane	mg/kg	4.1	3.6	2.7	112.2	1.9	1.7	4.0	67	1.7	6.2	5.5	4.1	168	9.4	8.7	20	335	4.1
	alpha-Chlordane	mg/kg	122	24	10	302	93	21	21	264	10	608	121	50	1508	925	205	207	2641	50
	gamma-Chlordane	mg/kg	122	24	10	302	93	20	21	264	10	608	121	50	1508	925	204	206	2641	50
	Dichlorodiphenyldichloroethane (DDD) [c]	mg/kg	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
	Dichlorodiphenyldichloroethylene (DDE) [c]	mg/kg	30.4	0.21	0.07	0.06	20.5	0.11	0.09	0.03	0.03	300	2.3	0.8	1.7	136	0.7	0.6	0.4	0.4
	Dichlorodiphenyltrichloroethane	mg/kg	30.4	0.30	0.10	2.5	20.5	0.16	0.14	1.4	0.10	300	3.5	1.2	46.3	136	1.0	0.9	12.7	0.9
	Dieldrin	mg/kg	1.9	0.06	0.02	1.6	0.28	0.01	0.01	0.35	0.01	6.1	0.20	0.08	5.2	0.57	0.02	0.02	0.69	0.02
	Endosulfan I	mg/kg	93.4	66.3	41.4	1671	0.92	0.71	1.29	21.9	0.71	---	---	---	---	---	---	---	---	---
	Endosulfan II	mg/kg	93.4	66.3	41.4	1671	0.92	0.71	1.29	21.9	0.71	---	---	---	---	---	---	---	---	---
	Endosulfan sulfate	mg/kg	62.9	55.4	41.4	2160	0.61	0.56	1.29	27.2	0.56	---	---	---	---	---	---	---	---	---
	Endrin aldehyde	mg/kg	2.6	0.52	0.23	52.9	0.51	0.14	0.14	14.0	0.14	---	---	---	---	5.1	1.4	1.4	140	1.4
	Methoxychlor	mg/kg	---	---	---	---	59.78	11.20	10.92	441	10.9	---	---	---	---	120	22	22	882	22

a Values for diethyl phthalate and di-n-butyl phthalate were used as a surrogate for bis(2)ethylhexyl phthalate
b Aroclor 1254 value was used as surrogate.
c DDT values used as a surrogate for DDE and DDD.
High MW PAHs = High molecular weight polycyclic aromatic hydrocarbons
Low MW PAHs = Low molecular weight polycyclic aromatic hydrocarbons
mg/kg = Milligram per kilogram
pCi/g = Pico Curie per gram
PRG = Preliminary remedial goal
TPH = Total petroleum hydrocarbons
--- = Value not available

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Appendix A

Description of Studies Used to Calculate Benchmarks

Table A-1. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for California Quail

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Aluminum	22019.89			0.00287			0.043			0.0263	63.20	946.86	579.12	0.078	0	0	1	0.061	0.00	0.00	4.93	104.77	109.70	0.00%	0.00%	4.49%	95.51%	109.7	1.0
Antimony	1.00	-3.233	0.938				1			0.001 * 50 * Cdiet	0.04	1.00	0.05	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.01	0.00%	0.00%	39.27%	60.73%	---	---
Arsenic, Total all valence states	1799.96	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		9.35	47.98	3.63	0.078	0	0	1	0.061	0.00	0.00	0.73	8.56	9.29	0.00%	0.00%	7.85%	92.15%	9.3	1.0
Arsenic (III)	1799.96	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		9.35	47.98	3.63	0.078	0	0	1	0.061	0.00	0.00	0.73	8.56	9.29	0.00%	0.00%	7.85%	92.15%	9.3	1.0
Arsenic (V)	1799.96	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		9.35	47.98	3.63	0.078	0	0	1	0.061	0.00	0.00	0.73	8.56	9.29	0.00%	0.00%	7.85%	92.15%	9.3	1.0
Barium	1228.88			0.156			0.091			0.0168	191.71	111.83	20.65	0.078	0	0	1	0.061	0.00	0.00	14.95	5.85	20.80	0.00%	0.00%	71.89%	28.11%	20.8	1.0
Beryllium	1.00	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	0.59	0.05	0.00	0.078	0	0	1	0.061	0.00	0.00	0.05	0.00	0.05	0.00%	0.00%	90.56%	9.44%	---	---
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.01	0.00%	0.00%	7.58%	92.42%	---	---
Boron	63.94			5.714			1			1	365.33	63.94	63.94	0.078	0	0	1	0.061	0.00	0.00	28.50	0.30	28.80	0.00%	0.00%	98.94%	1.06%	28.8	1.0
Cadmium	151.07	-0.476	0.546		2.114	0.795		-1.2571	0.4723		9.62	447.24	3.04	0.078	0	0	1	0.061	0.00	0.00	0.75	0.72	1.47	0.00%	0.00%	51.07%	48.93%	1.47	1.0
Chromium (total)	334.34			0.041			0.306	-1.4599	0.7338		13.71	102.31	16.53	0.078	0	0	1	0.061	0.00	0.00	1.07	1.59	2.66	0.00%	0.00%	40.20%	59.80%	2.66	1.0
Chromium (+3)	334.34			0.041			0.306	-1.4599	0.7338		13.71	102.31	16.53	0.078	0	0	1	0.061	0.00	0.00	1.07	1.59	2.66	0.00%	0.00%	40.20%	59.80%	2.66	1.0
Chromium (+6)	1.00			0.041			0.306	-1.4599	0.7338		0.04	0.31	0.23	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.01	0.00%	0.00%	40.20%	59.80%	---	---
Cobalt	1425.33			0.00745			0.291	-4.4669	1.307		10.62	414.77	152.13	0.078	0	0	1	0.061	0.00	0.00	0.83	6.78	7.61	0.00%	0.00%	10.88%	89.12%	7.61	1.0
Copper	485.15	0.669	0.394				0.515	2.042	0.1444		22.32	249.85	18.82	0.078	0	0	1	0.061	0.00	0.00	1.74	2.31	4.05	0.00%	0.00%	43.00%	57.00%	4.05	1.0
Lead	247.02	-1.328	0.561		-0.218	0.807		0.0761	0.4422		5.83	68.59	12.33	0.078	0	0	1	0.061	0.00	0.00	0.45	1.18	1.63	0.00%	0.00%	27.89%	72.11%	1.63	1.0
Lithium	1.00			0.004			0.046			1	0.00	0.05	1.00	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.01	0.00%	0.00%	6.15%	93.85%	---	---
Manganese	16368.56			0.0792	-0.809	0.682				0.0205	1296.39	333.13	335.56	0.078	0	0	1	0.061	0.00	0.00	101.12	77.88	179.00	0.00%	0.00%	56.49%	43.51%	179	1.0
Mercury (methyl)	3.09	-0.996	0.544		0.0781	0.3369				0.054	0.68	1.58	0.17	0.078	0	0	1	0.061	0.00	0.00	0.05	0.01	0.07	0.00%	0.00%	78.34%	21.66%	0.068	1.0
Mercury (inorganic)	45.98	-0.996	0.544		0.0781	0.3369				0.054	2.96	3.93	2.50	0.078	0	0	1	0.061	0.00	0.00	0.23	0.22	0.45	0.00%	0.00%	51.38%	48.62%	0.45	1.0
Molybdenum	34.51			1.2504			0.953			1	43.15	32.89	34.51	0.078	0	0	1	0.061	0.00	0.00	3.37	0.16	3.53	0.00%	0.00%	95.35%	4.65%	3.53	1.0
Nickel	1080.61	-2.224	0.748				1.059	-0.2462	0.4658		20.11	1144.37	20.24	0.078	0	0	1	0.061	0.00	0.00	1.57	5.14	6.71	0.00%	0.00%	23.37%	76.63%	6.71	1.0
Selenium	5.57	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		3.38	3.27	1.26	0.078	0	0	1	0.061	0.00	0.00	0.26	0.03	0.29	0.00%	0.00%	90.87%	9.13%	0.29	1.0
Silver	345.30			0.014			2.045			0.0040	4.83	706.14	1.38	0.078	0	0	1	0.061	0.00	0.00	0.38	1.64	2.02	0.00%	0.00%	18.67%	81.33%	2.02	1.0
Strontium	1.00			0.207			0.4066			1.74	0.21	0.41	1.74	0.078	0	0	1	0.061	0.00	0.00	0.02	0.00	0.02	0.00%	0.00%	77.22%	22.78%	---	---
Thallium	1.00			0.004			0.0541			0.1124	0.00	0.05	0.11	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.01	0.00%	0.00%	6.15%	93.85%	---	---
Tin	82.17			1			0.08			0.08	82.17	6.57	6.57	0.078	0	0	1	0.061	0.00	0.00	6.41	0.39	6.80	0.00%	0.00%	94.25%	5.75%	6.8	1.0
Uranium	2501.56			0.021			0.033			0.0002	52.53	82.55	0.50	0.078	0	0	1	0.061	0.00	0.00	4.10	11.90	16.00	0.00%	0.00%	25.61%	74.39%	16	1.0
Vanadium	66.97			0.00485			0.042			0.0123	0.32	2.81	0.82	0.078	0	0	1	0.061	0.00	0.00	0.03	0.32	0.34	0.00%	0.00%	7.37%	92.63%	0.344	1.0
Zinc	4973.24	1.575	0.555		4.449	0.328		4.3632	0.0706		544.06	1395.32	143.18	0.078	0	0	1	0.061	0.00	0.00	42.44	23.66	66.10	0.00%	0.00%	64.20%	35.80%	66.1	1.0
Ammonia/Ammonium	1.00													0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Chloride	1.00													0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Cyanide	1.00													0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Fluoride	1492.54			0.006							8.96			0.078	0	0	1	0.061	0.00	0.00	0.70	7.10	7.80	0.00%	0.00%	8.96%	91.04%	7.8	1.0
Iodine	1.00			0.05							0.05			0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.01	0.00%	0.00%	45.05%	54.95%	---	---
Nitrate/Nitrite	1.00													0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Phosphate	1.00													0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Sulfate/Sulfite	1.00													0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Total Organic Carbon	1.00													0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---

Table A-1. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for California Quail

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
1,1-dichloroethane	3614.96						1.010			0.0109		3649.64	39.46	0.078	0	0	1	0.061	0.00	0.00	0.00	17.20	17.20	0.00%	0.00%	0.00%	100.00%	17.2	1.0
1,1-dichloroethene	3614.96						1.011			0.0186		3655.55	67.31	0.078	0	0	1	0.061	0.00	0.00	0.00	17.20	17.20	0.00%	0.00%	0.00%	100.00%	17.2	1.0
1,1,1-trichloroethane	3614.96						1.013			0.0305		3661.30	110.36	0.078	0	0	1	0.061	0.00	0.00	0.00	17.20	17.20	0.00%	0.00%	0.00%	100.00%	17.2	1.0
1,1,2-trichloroethane	3614.96						1.010			0.0165		3651.90	59.64	0.078	0	0	1	0.061	0.00	0.00	0.00	17.20	17.20	0.00%	0.00%	0.00%	100.00%	17.2	1.0
1,1,2,2-tetrachloroethane	3614.96						1.013			0.0270		3661.72	97.70	0.078	0	0	1	0.061	0.00	0.00	0.00	17.20	17.20	0.00%	0.00%	0.00%	100.00%	17.2	1.0
1,2-dichlorobenzene	87.76			2.45			1.018			0.0882	215.16	89.31	7.74	0.078	0	0	1	0.061	0.00	0.00	16.78	0.42	17.20	0.00%	0.00%	97.57%	2.43%	17.2	1.0
1,2-dichloroethane (DCA)	3614.96						0.988			0.0063		3572.93	22.75	0.078	0	0	1	0.061	0.00	0.00	0.00	17.20	17.20	0.00%	0.00%	0.00%	100.00%	17.2	1.0
1,3-dichlorobenzene	96.13			2.23			1.018			0.0963	214.65	97.86	9.25	0.078	0	0	1	0.061	0.00	0.00	16.74	0.46	17.20	0.00%	0.00%	97.34%	2.66%	17.2	1.0
2-butanone (Methyl Ethyl Ketone/MEK)	2101.72						0.094			0.0006		196.72	1.16	0.078	0	0	1	0.061	0.00	0.00	0.00	10.00	10.00	0.00%	0.00%	0.00%	100.00%	10	1.0
2-hexanone	2101.72						0.207			0.0053		435.69	11.24	0.078	0	0	1	0.061	0.00	0.00	0.00	10.00	10.00	0.00%	0.00%	0.00%	100.00%	10	1.0
Benzene	8554.01						1.011			0.0186		8650.06	159.26	0.078	0	0	1	0.061	0.00	0.00	0.00	40.70	40.70	0.00%	0.00%	0.00%	100.00%	40.7	1.0
Butanol	1.00						0.478			0.0017		0.48	0.00	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Carbon Tetrachloride	3614.96						1.015			0.0420		3668.14	151.83	0.078	0	0	1	0.061	0.00	0.00	0.00	17.20	17.20	0.00%	0.00%	0.00%	100.00%	17.2	1.0
Chlorobenzene	3614.96						1.015			0.0490		3667.87	177.22	0.078	0	0	1	0.061	0.00	0.00	0.00	17.20	17.20	0.00%	0.00%	0.00%	100.00%	17.2	1.0
Chloroform	3614.96						1.011			0.0135		3653.00	48.70	0.078	0	0	1	0.061	0.00	0.00	0.00	17.20	17.20	0.00%	0.00%	0.00%	100.00%	17.2	1.0
Cis-1,2-dichloroethylene	3614.96						1.011			0.0122		3655.02	44.24	0.078	0	0	1	0.061	0.00	0.00	0.00	17.20	17.20	0.00%	0.00%	0.00%	100.00%	17.2	1.0
Dichloromethane (Methylene Chloride)	3614.96						1.007			0.0042		3639.38	15.17	0.078	0	0	1	0.061	0.00	0.00	0.00	17.20	17.20	0.00%	0.00%	0.00%	100.00%	17.2	1.0
Ethyl Benzene	159.31			3.21			1.016			0.0666	512.08	161.89	10.62	0.078	0	0	1	0.061	0.00	0.00	39.94	0.76	40.70	0.00%	0.00%	98.14%	1.86%	40.7	1.0
Methyl Isobutyl Ketone	2101.72						0.197			0.0037		413.99	7.86	0.078	0	0	1	0.061	0.00	0.00	0.00	10.00	10.00	0.00%	0.00%	0.00%	100.00%	10	1.0
n-butyl Benzene	301.18			1.67			1.022			0.1227	503.42	307.91	36.97	0.078	0	0	1	0.061	0.00	0.00	39.27	1.43	40.70	0.00%	0.00%	96.48%	3.52%	40.7	1.0
Tetrachloroethylene	3614.96						1.018			0.0390		3678.25	141.01	0.078	0	0	1	0.061	0.00	0.00	0.00	17.20	17.20	0.00%	0.00%	0.00%	100.00%	17.2	1.0
Toluene	8554.01						1.014			0.0430		8674.41	368.11	0.078	0	0	1	0.061	0.00	0.00	0.00	40.70	40.70	0.00%	0.00%	0.00%	100.00%	40.7	1.0
Trans-1,2-dichloroethylene	3614.96						1.011			0.0170		3655.02	61.49	0.078	0	0	1	0.061	0.00	0.00	0.00	17.20	17.20	0.00%	0.00%	0.00%	100.00%	17.2	1.0
Trichloroethylene (TCE)	3614.96						1.012			0.0410		3659.98	148.16	0.078	0	0	1	0.061	0.00	0.00	0.00	17.20	17.20	0.00%	0.00%	0.00%	100.00%	17.2	1.0
Xylene	149.40			3.43			1.016			0.0619	512.68	151.80	9.25	0.078	0	0	1	0.061	0.00	0.00	39.99	0.71	40.70	0.00%	0.00%	98.25%	1.75%	40.7	1.0
Acenaphthene	6830.60	-5.562	-0.8556				1.470			0	0.00	10040.98	0.00	0.078	0	0	1	0.061	0.00	0.00	0.00	32.50	32.50	0.00%	0.00%	0.00%	100.00%	32.5	1.0
Acenaphthylene	3505.79	-1.144	0.791				22.9			0	202.81	80282.51	0.00	0.078	0	0	1	0.061	0.00	0.00	15.82	16.68	32.50	0.00%	0.00%	48.68%	51.32%	32.5	1.0
Anthracene	3405.23	-0.9887	0.7784				2.42			0	208.95	8240.66	0.00	0.078	0	0	1	0.061	0.00	0.00	16.30	16.20	32.50	0.00%	0.00%	50.15%	49.85%	32.5	1.0
Benzo(a)pyrene	47.19	-2.0615	0.975				1.33			0	5.45	62.77	0.00	0.078	0	0	1	0.061	0.00	0.00	0.43	0.22	0.65	0.00%	0.00%	65.45%	34.55%	0.65	1.0
Benzo(a)anthracene	117.98	-2.7078	0.5944				1.59			0	1.14	187.59	0.00	0.078	0	0	1	0.061	0.00	0.00	0.09	0.56	0.65	0.00%	0.00%	13.64%	86.36%	0.65	1.0
Benzo(b)fluoranthene	22.46			0.31			2.6			0	6.96	58.40	0.00	0.078	0	0	1	0.061	0.00	0.00	0.54	0.11	0.65	0.00%	0.00%	83.56%	16.44%	0.65	1.0
Benzo(ghi)perylene	12.19	-0.9313	1.1829				2.94			0	7.59	35.84	0.00	0.078	0	0	1	0.061	0.00	0.00	0.59	0.06	0.65	0.00%	0.00%	91.08%	8.92%	0.65	1.0
Benzo[k]fluoranthene	136.25	-4.6482	0.1668				2.6			0	0.02	354.24	0.00	0.078	0	0	1	0.061	0.00	0.00	0.00	0.65	0.65	0.00%	0.00%	0.26%	99.74%	0.65	1.0
Chrysene	117.98	-2.7078	0.5944				2.29			0	1.14	270.18	0.00	0.078	0	0	1	0.061	0.00	0.00	0.09	0.56	0.65	0.00%	0.00%	13.64%	86.36%	0.65	1.0
Dibenz(ah)anthracene	43.63			0.13			2.31			0	5.67	100.79	0.00	0.078	0	0	1	0.061	0.00	0.00	0.44	0.21	0.65	0.00%	0.00%	68.06%	31.94%	0.65	1.0
Fluoranthene	14.85			0.5			3.04			0	7.43	45.16	0.00	0.078	0	0	1	0.061	0.00	0.00	0.58	0.07	0.65	0.00%	0.00%	89.13%	10.87%	0.65	1.0
Fluorene	6830.60	-5.562	-0.8556				9.57			0	0.00	65368.85	0.00	0.078	0	0	1	0.061	0.00	0.00	0.00	32.50	32.50	0.00%	0.00%	0.00%	100.00%	32.5	1.0
Indeno[1,2,3-cd]pyrene	48.73			0.11			2.86			0	5.36	139.38	0.00	0.078	0	0	1	0.061	0.00	0.00	0.42	0.23	0.65	0.00%	0.00%	64.33%	35.67%	0.65	1.0

Table A-1. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for California Quail

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
2-Methylnaphthalene	5.04	-1.3205	4.544				1.020			0	416.34	5.14	0.00	0.078	0	0	1	0.061	0.00	0.00	32.47	0.02	32.50	0.00%	0.00%	99.93%	0.07%	32.5	1.0
Naphthalene	33.98			12.2			4.4			0	414.59	149.53	0.00	0.078	0	0	1	0.061	0.00	0.00	32.34	0.16	32.50	0.00%	0.00%	99.50%	0.50%	32.5	1.0
Phenanthrene	4329.17	-0.1665	0.6203				1.72			0	152.53	7446.16	0.00	0.078	0	0	1	0.061	0.00	0.00	11.90	20.60	32.50	0.00%	0.00%	36.61%	63.39%	32.5	1.0
Pyrene	10.67			0.72			1.75			0	7.68	18.67	0.00	0.078	0	0	1	0.061	0.00	0.00	0.60	0.05	0.65	0.00%	0.00%	92.19%	7.81%	0.65	1.0
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	0.078	0	0	1	0.061	0.00	0.00	0.08	0.00	0.09	0.00%	0.00%	94.68%	5.32%	---	---
Low MW PAHs	6592.49	-1.3205	0.4544							0	14.52		0.00	0.078	0	0	1	0.061	0.00	0.00	1.13	31.37	32.50	0.00%	0.00%	3.48%	96.52%	32.5	1.0
High MW PAHs	39.51	-1.7026	0.9469							0	5.92		0.00	0.078	0	0	1	0.061	0.00	0.00	0.46	0.19	0.65	0.00%	0.00%	71.08%	28.92%	0.65	1.0
Gasoline Range Organics																												500	---
TPH - Diesel	105086.17									0			0.00	0.078	0	0	1	0.061	0.00	0.00	0.00	500.00	500.00	0.00%	0.00%	0.00%	100.00%	500	1.0
TPH - Kerosene	105086.17									0			0.00	0.078	0	0	1	0.061	0.00	0.00	0.00	500.00	500.00	0.00%	0.00%	0.00%	100.00%	500	1.0
Normal paraffin hydrocarbons	170870.11									0			0.00	0.078	0	0	1	0.061	0.00	0.00	0.00	813.00	813.00	0.00%	0.00%	0.00%	100.00%	813	1.0
Phenol	1.00						0.235			0.0064		0.23	0.01	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
2-methylphenol (ocresol)	1.00						0.336			0.0150		0.34	0.02	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
4-methylphenol (pcresol)	1.00						0.333			0.0141		0.33	0.01	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
2,4-dinitrotoluene	0.29	1.873	-0.3768	0.376			0.184			0.0155	0.11	0.05	0.00	0.078	0	0	1	0.061	0.00	0.00	0.01	0.00	0.01	0.00%	0.00%	86.04%	13.96%	0.01	1.0
Bis[2-ethylhexyl] phthalate	111.06			0.07			41.144			0.0945	7.33	4569.64	10.49	0.078	0	0	1	0.061	0.00	0.00	0.57	0.53	1.10	0.00%	0.00%	51.96%	48.04%	1.1	1.0
Total PCBs	10.01			0.17	1.41	1.36				0.1792	1.70	93.99	1.79	0.078	0	0	1	0.061	0.00	0.00	0.13	0.05	0.18	0.00%	0.00%	73.53%	26.47%	0.18	1.0
Aroclor 1016	6.45			0.30	1.41	1.36				0.2104	1.91	51.67	1.36	0.078	0	0	1	0.061	0.00	0.00	0.15	0.03	0.18	0.00%	0.00%	82.95%	17.05%	0.18	1.0
Aroclor 1221	2.73			0.78	1.41	1.36				0.1883	2.14	16.05	0.51	0.078	0	0	1	0.061	0.00	0.00	0.17	0.01	0.18	0.00%	0.00%	92.78%	7.22%	0.18	1.0
Aroclor 1232	2.19			0.99	1.41	1.36				0.1704	2.17	11.93	0.37	0.078	0	0	1	0.061	0.00	0.00	0.17	0.01	0.18	0.00%	0.00%	94.20%	5.80%	0.18	1.0
Aroclor 1242	10.36			0.16	1.41	1.36				0.1756	1.68	98.45	1.82	0.078	0	0	1	0.061	0.00	0.00	0.13	0.05	0.18	0.00%	0.00%	72.62%	27.38%	0.18	1.0
Aroclor 1248	9.41			0.18	1.41	1.36				0.1855	1.73	86.33	1.75	0.078	0	0	1	0.061	0.00	0.00	0.14	0.04	0.18	0.00%	0.00%	75.14%	24.86%	0.18	1.0
Aroclor 1254	11.52			0.14	1.41	1.36				0.1630	1.60	113.76	1.88	0.078	0	0	1	0.061	0.00	0.00	0.13	0.05	0.18	0.00%	0.00%	69.55%	30.45%	0.18	1.0
Aroclor 1260	20.38			0.05	1.41	1.36				0.0750	1.06	247.09	1.53	0.078	0	0	1	0.061	0.00	0.00	0.08	0.10	0.18	0.00%	0.00%	46.13%	53.87%	0.18	1.0
Aroclor-1262	37.83													0.078	0	0	1	0.061	0.00	0.00	0.00	0.18	0.18	0.00%	0.00%	0.00%	100.00%	0.18	1.0
Dichloroprop	1.00													0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Aldrin	0.45			0.14			1.033			0.1630	0.06	0.46	0.07	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.01	0.00%	0.00%	69.55%	30.45%	0.007	1.0
beta-1,2,3,4,5,6-Hexachlorocyclohexane	4.11			1.72			1.021			0.1201	7.07	4.20	0.49	0.078	0	0	1	0.061	0.00	0.00	0.55	0.02	0.57	0.00%	0.00%	96.57%	3.43%	0.571	1.0
alpha-Chlordane	121.50			0.16			1.031			0.1771	20.02	125.33	21.51	0.078	0	0	1	0.061	0.00	0.00	1.56	0.58	2.14	0.00%	0.00%	72.99%	27.01%	2.14	1.0
gamma-Chlordane	121.50			0.16			1.036			0.1771	20.02	125.82	21.51	0.078	0	0	1	0.061	0.00	0.00	1.56	0.58	2.14	0.00%	0.00%	72.99%	27.01%	2.14	1.0
Dichlorodiphenyldichloroethylene	30.37	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		1.06	240.37	339.69	0.078	0	0	1	0.061	0.00	0.00	0.08	0.14	0.23	0.00%	0.00%	36.35%	63.65%	0.227	1.0
Dichlorodiphenyltrichloroethane	30.37	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		1.06	162.48	38.66	0.078	0	0	1	0.061	0.00	0.00	0.08	0.14	0.23	0.00%	0.00%	36.35%	63.65%	0.227	1.0
Dieldrin	1.93			0.41			14.70			1.20	0.79	28.37	2.32	0.078	0	0	1	0.061	0.00	0.00	0.06	0.01	0.07	0.00%	0.00%	87.05%	12.95%	0.0709	1.0
Endosulfan I	93.44			1.31			1.184			0.1455	122.51	110.61	13.59	0.078	0	0	1	0.061	0.00	0.00	9.56	0.44	10.00	0.00%	0.00%	95.55%	4.45%	10	1.0
Endosulfan II	93.44			1.31			1.184			0.1455	122.51	110.61	13.59	0.078	0	0	1	0.061	0.00	0.00	9.56	0.44	10.00	0.00%	0.00%	95.55%	4.45%	10	1.0
Endosulfan sulfate	62.89			1.98			1.184			0.1072	124.37	74.45	6.74	0.078	0	0	1	0.061	0.00	0.00	9.70	0.30	10.00	0.00%	0.00%	97.01%	2.99%	10	1.0
Endrin aldehyde	2.56			1.44			6.686			0.1368	3.69	17.14	0.35	0.078	0	0	1	0.061	0.00	0.00	0.29	0.01	0.30	0.00%	0.00%	95.93%	4.07%	0.3	1.0
Methoxychlor	1.00			0.52			3.739			0.2093	0.52	3.74	0.21	0.078	0	0	1	0.061	0.00	0.00	0.04	0.00	0.05	0.00%	0.00%	89.59%	10.41%	---	---

Notes:

It has been conservatively assumed that all chemical intake is absorbed by the receptor.

Table A-1. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for California Quail

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		

1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.

Acronyms:

BAF = Bioaccumulation factor

DW = Dry weight

FIR = Food ingestion rate

mg/kg = Miligrams per kilogram

mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight

mg/kg/d = Miligrams per kilogram per day

NOAEL = No observed adverse effect level

PRGs = Preliminary remediation goals

TRV = Toxicity reference value

Equations:

Total Estimated Exposure = Food Intake + Incidental Soil Intake

Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)

Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)

Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0

where: B1 = slope and B0 = intercept

Estimated Concentrations in Biota (method 2) = soil concentration X BAF

Hazard Quotient = Total Estimated Exposure (Dose) / TRV

Therefore, when the HQ = 1, soil concentration = PRG

where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Table A-2. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Western Meadowlark

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Aluminum	18601.60			0.00287			0.043			0.0263	53.39	799.87	489.22	0.12	0	0.63	0.37	0.0208	0.00	60.71	2.38	46.61	109.70	0.00%	55.34%	2.17%	42.49%	109.7	1.0
Antimony	1.00	-3.233	0.938				1			0.001 * 50 * Cdiet	0.04	1.00	0.05	0.12	0	0.63	0.37	0.0208	0.00	0.08	0.00	0.00	0.08	0.00%	94.68%	2.19%	3.13%	---	---
Arsenic, Total all valence states	1980.65	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		9.87	51.34	3.93	0.12	0	0.63	0.37	0.0208	0.00	3.90	0.44	4.96	9.30	0.00%	41.90%	4.73%	53.37%	9.3	1.0
Arsenic (III)	1980.65	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		9.87	51.34	3.93	0.12	0	0.63	0.37	0.0208	0.00	3.90	0.44	4.96	9.30	0.00%	41.90%	4.73%	53.37%	9.3	1.0
Arsenic (V)	1980.65	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		9.87	51.34	3.93	0.12	0	0.63	0.37	0.0208	0.00	3.90	0.44	4.96	9.30	0.00%	41.90%	4.73%	53.37%	9.3	1.0
Barium	1270.92			0.156			0.091			0.0168	198.26	115.65	21.35	0.12	0	0.63	0.37	0.0208	0.00	8.78	8.84	3.18	20.80	0.00%	42.20%	42.49%	15.31%	20.8	1.0
Beryllium	1.00	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	0.59	0.05	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.03	0.00	0.03	0.00%	10.67%	81.50%	7.83%	---	---
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	0.12	0	0.63	0.37	0.0208	0.00	0.08	0.00	0.00	0.08	0.00%	96.53%	0.28%	3.19%	---	---
Boron	86.46			5.714			1			1	494.03	86.46	86.46	0.12	0	0.63	0.37	0.0208	0.00	6.56	22.02	0.22	28.80	0.00%	22.78%	76.46%	0.75%	28.8	1.0
Cadmium	2.77	-0.476	0.546		2.114	0.795		-1.2571	0.4723		1.08	18.64	0.46	0.12	0	0.63	0.37	0.0208	0.00	1.41	0.05	0.01	1.47	0.00%	96.24%	3.29%	0.47%	1.47	1.0
Chromium (total)	96.52			0.041			0.306	-1.4599	0.7338		3.96	29.54	6.64	0.12	0	0.63	0.37	0.0208	0.00	2.24	0.18	0.24	2.66	0.00%	84.28%	6.63%	9.09%	2.66	1.0
Chromium (+3)	96.52			0.041			0.306	-1.4599	0.7338		3.96	29.54	6.64	0.12	0	0.63	0.37	0.0208	0.00	2.24	0.18	0.24	2.66	0.00%	84.28%	6.63%	9.09%	2.66	1.0
Chromium (+6)	1.00			0.041			0.306	-1.4599	0.7338		0.04	0.31	0.23	0.12	0	0.63	0.37	0.0208	0.00	0.02	0.00	0.00	0.03	0.00%	84.28%	6.63%	9.09%		---
Cobalt	305.33			0.00745			0.291	-4.4669	1.307		2.27	88.85	20.31	0.12	0	0.63	0.37	0.0208	0.00	6.74	0.10	0.77	7.61	0.00%	88.61%	1.33%	10.05%	7.61	1.0
Copper	85.30	0.669	0.394				0.515	2.042	0.1444		11.25	43.93	14.64	0.12	0	0.63	0.37	0.0208	0.00	3.33	0.50	0.21	4.05	0.00%	82.33%	12.39%	5.28%	4.05	1.0
Lead	48.68	-1.328	0.561		-0.218	0.807		0.0761	0.4422		2.34	18.49	6.01	0.12	0	0.63	0.37	0.0208	0.00	1.40	0.10	0.12	1.63	0.00%	86.11%	6.41%	7.48%	1.63	1.0
Lithium	1.00			0.004			0.046			1	0.00	0.05	1.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.01	0.00%	56.54%	2.89%	40.58%	---	---
Manganese	24183.51			0.0792	-0.809	0.682				0.0205	1915.33	434.73	495.76	0.12	0	0.63	0.37	0.0208	0.00	32.99	85.38	60.60	178.97	0.00%	18.44%	47.70%	33.86%	179	1.0
Mercury (methyl)	0.35	-0.996	0.544		0.0781	0.3369				0.054	0.21	0.76	0.02	0.12	0	0.63	0.37	0.0208	0.00	0.06	0.01	0.00	0.07	0.00%	84.95%	13.74%	1.30%	0.068	1.0
Mercury (inorganic)	31.65	-0.996	0.544		0.0781	0.3369				0.054	2.42	3.46	1.72	0.12	0	0.63	0.37	0.0208	0.00	0.26	0.11	0.08	0.45	0.00%	58.41%	23.97%	17.63%	0.45	1.0
Molybdenum	27.03			1.2504			0.953			1	33.80	25.76	27.03	0.12	0	0.63	0.37	0.0208	0.00	1.96	1.51	0.07	3.53	0.00%	55.39%	42.69%	1.92%	3.53	1.0
Nickel	79.37	-2.224	0.748				1.059	-0.2462	0.4658		2.85	84.05	6.00	0.12	0	0.63	0.37	0.0208	0.00	6.38	0.13	0.20	6.71	0.00%	95.14%	1.90%	2.97%	6.71	1.0
Selenium	3.72	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		2.16	2.43	1.08	0.12	0	0.63	0.37	0.0208	0.00	0.18	0.10	0.01	0.29	0.00%	63.55%	33.23%	3.21%	0.29	1.0
Silver	12.76			0.014			2.045			0.0040	0.18	26.09	0.05	0.12	0	0.63	0.37	0.0208	0.00	1.98	0.01	0.03	2.02	0.00%	98.02%	0.39%	1.58%	2.02	1.0
Strontium	1.00			0.207			0.4066			1.74	0.21	0.41	1.74	0.12	0	0.63	0.37	0.0208	0.00	0.03	0.01	0.00	0.04	0.00%	72.47%	21.65%	5.88%	---	---
Thallium	1.00			0.004			0.0541			0.1124	0.00	0.05	0.11	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.01	0.00%	60.47%	2.63%	36.90%	---	---
Tin	127.93			1			0.08			0.08	127.93	10.23	10.23	0.12	0	0.63	0.37	0.0208	0.00	0.78	5.70	0.32	6.80	0.00%	11.42%	83.86%	4.71%	6.8	1.0
Uranium	2690.66			0.021			0.033			0.0002	56.50	88.79	0.54	0.12	0	0.63	0.37	0.0208	0.00	6.74	2.52	6.74	16.00	0.00%	42.12%	15.74%	42.14%	16	1.0
Vanadium	58.21			0.00485			0.042			0.0123	0.28	2.44	0.72	0.12	0	0.63	0.37	0.0208	0.00	0.19	0.01	0.15	0.34	0.00%	53.94%	3.66%	42.40%	0.344	1.0
Zinc	714.12	1.575	0.555		4.449	0.328		4.3632	0.0706		185.29	738.27	124.85	0.12	0	0.63	0.37	0.0208	0.00	56.03	8.26	1.79	66.08	0.00%	84.79%	12.50%	2.71%	66.1	1.0
Ammonia/Ammonium	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Chloride	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Cyanide	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Fluoride	2812.56			0.006							16.88			0.12	0	0.63	0.37	0.0208	0.00	0.00	0.75	7.05	7.80	0.00%	0.00%	9.64%	90.36%	7.8	1.0
Iodine	1.00			0.05							0.05			0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	47.07%	52.93%	---	---
Nitrate/Nitrite	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Phosphate	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Sulfate/Sulfite	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Total Organic Carbon	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
1,1-dichloroethane	217.36						1.010			0.0109		219.45	2.37	0.12	0	0.63	0.37	0.0208	0.00	16.66	0.00	0.54	17.20	0.00%	96.83%	0.00%	3.17%	17.2	1.0
1,1-dichloroethene	217.02						1.011			0.0186		219.46	4.04	0.12	0	0.63	0.37	0.0208	0.00	16.66	0.00	0.54	17.20	0.00%	96.84%	0.00%	3.16%	17.2	1.0
1,1,1-trichloroethane	216.69						1.013			0.0305		219.47	6.62	0.12	0	0.63	0.37	0.0208	0.00	16.66	0.00	0.54	17.20	0.00%	96.84%	0.00%	3.16%	17.2	1.0
1,1,2-trichloroethane	217.23						1.010			0.0165		219.45	3.58	0.12	0	0.63	0.37	0.0208	0.00	16.66	0.00	0.54	17.20	0.00%	96.84%	0.00%	3.16%	17.2	1.0
1,1,2,2-tetrachloroethane	216.67						1.013			0.0270		219.47	5.86	0.12	0	0.63	0.37	0.0208	0.00	16.66	0.00	0.54	17.20	0.00%	96.84%	0.00%	3.16%	17.2	1.0
1,2-dichlorobenzene	90.99			2.45			1.018			0.0882	223.08	92.60	8.02	0.12	0	0.63	0.37	0.0208	0.00	7.03	9.94	0.23	17.20	0.00%	40.86%	57.81%	1.33%	17.2	1.0

Table A-2. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Western Meadowlark

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models: Plants intercept	Plants slope	Plants BAF	Soil Inverts intercept	Soil Inverts slope	Soil Inverts BAF	Small Mammals intercept	Small Mammals slope	Small Mammals BAF	Estimated Concentrations in Biota (mg/kg DW): Plants	Soil Invertbrates	Small Mammals	Food Intake Rate (kg/kg-bw/d, dw)	Diet Composition (proportion): Small Mammals	Soil Inverts	Plants	Soil	Estimated Exposure (mg/kg/d): Small Mammals	Soil Inverts	Plants	Soil	Total	Percent Estimated Exposure by Pathway: Small Mam.	Soil Inverts	Plants	Soil	Selected Avian NOAEL TRV (mg/kg/d)	NOAEL HQ
1,2-dichloroethane (DCA)	221.88						0.988			0.0063		219.30	1.40	0.12	0	0.63	0.37	0.0208	0.00	16.64	0.00	0.56	17.20	0.00%	96.77%	0.00%	3.23%	17.2	1.0
1,3-dichlorobenzene	95.93			2.23			1.018			0.0963	214.20	97.66	9.23	0.12	0	0.63	0.37	0.0208	0.00	7.41	9.55	0.24	17.20	0.00%	43.09%	55.51%	1.40%	17.2	1.0
2-butanone (Methyl Ethyl Ketone/MEK)	1040.62						0.094			0.0006		97.40	0.57	0.12	0	0.63	0.37	0.0208	0.00	7.39	0.00	2.61	10.00	0.00%	73.92%	0.00%	26.08%	10	1.0
2-hexanone	548.27						0.207			0.0053		113.66	2.93	0.12	0	0.63	0.37	0.0208	0.00	8.63	0.00	1.37	10.00	0.00%	86.26%	0.00%	13.74%	10	1.0
Benzene	513.53						1.011			0.0186		519.30	9.56	0.12	0	0.63	0.37	0.0208	0.00	39.41	0.00	1.29	40.70	0.00%	96.84%	0.00%	3.16%	40.7	1.0
Butanol	1.00						0.478			0.0017		0.48	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.04	0.00	0.00	0.04	0.00%	93.54%	0.00%	6.46%	---	---
Carbon Tetrachloride	216.30						1.015			0.0420		219.48	9.08	0.12	0	0.63	0.37	0.0208	0.00	16.66	0.00	0.54	17.20	0.00%	96.85%	0.00%	3.15%	17.2	1.0
Chlorobenzene	216.31						1.015			0.0490		219.48	10.60	0.12	0	0.63	0.37	0.0208	0.00	16.66	0.00	0.54	17.20	0.00%	96.85%	0.00%	3.15%	17.2	1.0
Chloroform	217.17						1.011			0.0135		219.45	2.93	0.12	0	0.63	0.37	0.0208	0.00	16.66	0.00	0.54	17.20	0.00%	96.84%	0.00%	3.16%	17.2	1.0
Cis-1,2-dichloroethylene	217.05						1.011			0.0122		219.46	2.66	0.12	0	0.63	0.37	0.0208	0.00	16.66	0.00	0.54	17.20	0.00%	96.84%	0.00%	3.16%	17.2	1.0
Dichloromethane (Methylene Chloride)	217.95						1.007			0.0042		219.43	0.91	0.12	0	0.63	0.37	0.0208	0.00	16.65	0.00	0.55	17.20	0.00%	96.82%	0.00%	3.18%	17.2	1.0
Ethyl Benzene	182.58			3.21			1.016			0.0666	586.89	185.54	12.17	0.12	0	0.63	0.37	0.0208	0.00	14.08	26.16	0.46	40.70	0.00%	34.60%	64.28%	1.12%	40.7	1.0
Methyl Isobutyl Ketone	572.87						0.197			0.0037		112.84	2.14	0.12	0	0.63	0.37	0.0208	0.00	8.56	0.00	1.44	10.00	0.00%	85.64%	0.00%	14.36%	10	1.0
n-butyl Benzene	263.25			1.67			1.022			0.1227	440.02	269.13	32.31	0.12	0	0.63	0.37	0.0208	0.00	20.43	19.61	0.66	40.70	0.00%	50.19%	48.19%	1.62%	40.7	1.0
Tetrachloroethylene	215.72						1.018			0.0390		219.50	8.41	0.12	0	0.63	0.37	0.0208	0.00	16.66	0.00	0.54	17.20	0.00%	96.86%	0.00%	3.14%	17.2	1.0
Toluene	512.13						1.014			0.0430		519.34	22.04	0.12	0	0.63	0.37	0.0208	0.00	39.42	0.00	1.28	40.70	0.00%	96.85%	0.00%	3.15%	40.7	1.0
Trans-1,2-dichloroethylene	217.05						1.011			0.0170		219.46	3.69	0.12	0	0.63	0.37	0.0208	0.00	16.66	0.00	0.54	17.20	0.00%	96.84%	0.00%	3.16%	17.2	1.0
Trichloroethylene (TCE)	216.77						1.012			0.0410		219.46	8.88	0.12	0	0.63	0.37	0.0208	0.00	16.66	0.00	0.54	17.20	0.00%	96.84%	0.00%	3.16%	17.2	1.0
Xylene	174.99			3.43			1.016			0.0619	600.50	177.80	10.84	0.12	0	0.63	0.37	0.0208	0.00	13.49	26.77	0.44	40.70	0.00%	33.16%	65.77%	1.08%	40.7	1.0
Acenaphthene	284.90	-5.562	-0.8556				1.470			0	0.00	418.80	0.00	0.12	0	0.63	0.37	0.0208	0.00	31.79	0.00	0.71	32.50	0.00%	97.80%	0.00%	2.20%	32.5	1.0
Acenaphthylene	18.59	-1.144	0.791				22.9			0	3.21	425.67	0.00	0.12	0	0.63	0.37	0.0208	0.00	32.31	0.14	0.05	32.50	0.00%	99.42%	0.44%	0.14%	32.5	1.0
Anthracene	169.72	-0.9887	0.7784				2.42			0	20.24	410.72	0.00	0.12	0	0.63	0.37	0.0208	0.00	31.17	0.90	0.43	32.50	0.00%	95.92%	2.78%	1.31%	32.5	1.0
Benzo(a)pyrene	5.97	-2.0615	0.975				1.33			0	0.73	7.94	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.60	0.03	0.01	0.65	0.00%	92.72%	4.98%	2.30%	0.65	1.0
Benzo(a)anthracene	5.21	-2.7078	0.5944				1.59			0	0.18	8.29	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.63	0.01	0.01	0.65	0.00%	96.77%	1.22%	2.01%	0.65	1.0
Benzo(b)fluoranthene	3.04			0.31			2.6			0	0.94	7.91	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.60	0.04	0.01	0.65	0.00%	92.36%	6.47%	1.17%	0.65	1.0
Benzo(ghi)perylene	2.64	-0.9313	1.1829				2.94			0	1.24	7.75	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.59	0.06	0.01	0.65	0.00%	90.48%	8.50%	1.02%	0.65	1.0
Benzo[k]fluoranthene	3.25	-4.6482	0.1668				2.6			0	0.01	8.45	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.64	0.00	0.01	0.65	0.00%	98.67%	0.08%	1.25%	0.65	1.0
Chrysene	3.65	-2.7078	0.5944				2.29			0	0.14	8.36	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.63	0.01	0.01	0.65	0.00%	97.61%	0.99%	1.41%	0.65	1.0
Dibenz(ah)anthracene	3.54			0.13			2.31			0	0.46	8.18	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.62	0.02	0.01	0.65	0.00%	95.48%	3.16%	1.36%	0.65	1.0
Fluoranthene	2.54			0.5			3.04			0	1.27	7.73	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.59	0.06	0.01	0.65	0.00%	90.30%	8.72%	0.98%	0.65	1.0
Fluorene	44.59	-5.562	-0.8556				9.57			0	0.00	426.74	0.00	0.12	0	0.63	0.37	0.0208	0.00	32.39	0.00	0.11	32.50	0.00%	99.66%	0.00%	0.34%	32.5	1.0
Indeno[1,2,3-cd]pyrene	2.90			0.11			2.86			0	0.32	8.28	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.63	0.01	0.01	0.65	0.00%	96.70%	2.18%	1.12%	0.65	1.0
2-Methylnaphthalene	5.69	-1.3205	4.544				1.020			0	718.80	5.80	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.44	32.04	0.01	32.49	0.00%	1.35%	98.60%	0.04%	32.5	1.0
Naphthalene	36.92			12.2			4.4			0	450.43	162.45	0.00	0.12	0	0.63	0.37	0.0208	0.00	12.33	20.08	0.09	32.50	0.00%	37.94%	61.78%	0.28%	32.5	1.0
Phenanthrene	235.76	-0.1665	0.6203				1.72			0	25.08	405.51	0.00	0.12	0	0.63	0.37	0.0208	0.00	30.78	1.12	0.59	32.49	0.00%	94.74%	3.44%	1.82%	32.5	1.0
Pyrene	3.88			0.72			1.75			0	2.80	6.79	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.52	0.12	0.01	0.65	0.00%	79.33%	19.17%	1.50%	0.65	1.0
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.05	0.00	0.05	0.00%	0.00%	95.08%	4.92%		---
Low MW PAHs	12622.80	-1.3205	0.4544							0	19.50		0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.87	31.63	32.50	0.00%	0.00%	2.67%	97.33%	32.5	1.0
High MW PAHs	72.42	-1.7026	0.9469							0	10.51		0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.47	0.18	0.65	0.00%	0.00%	72.08%	27.92%	0.65	1.0
Gasoline Range Organics																												500	---
TPH - Diesel	199535.36									0			0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	500.00	500.00	0.00%	0.00%	0.00%	100.00%	500	1.0
TPH - Kerosene	199535.36									0			0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	500.00	500.00	0.00%	0.00%	0.00%	100.00%	500	1.0
Normal paraffin hydrocarbons	324444.50									0			0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	813.00	813.00	0.00%	0.00%	0.00%	100.00%	813	1.0
Phenol	1.00						0.235			0.0064		0.23	0.01	0.12	0	0.63	0.37	0.0208	0.00	0.02	0.00	0.00	0.02	0.00%	87.67%	0.00%	12.33%	---	---
2-methylphenol (ocresol)	1.00						0.336			0.0150		0.34	0.02	0.12	0	0.63	0.37	0.0208	0.00	0.03	0.00	0.00	0.03	0.00%	91.05%	0.00%	8.95%	---	---

Table A-2. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Western Meadowlark

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
4-methylphenol (pcresol)	1.00						0.333			0.0141		0.33	0.01	0.12	0	0.63	0.37	0.0208	0.00	0.03	0.00	0.00	0.03	0.00%	90.99%	0.00%	9.01%	---	---
2,4-dinitrotoluene	0.30	1.873	-0.3768	0.376			0.184			0.0155	0.11	0.06	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.01	0.00	0.01	0.00%	41.98%	50.47%	7.55%	0.01	1.0
Bis[2-ethylhexyl] phthalate	0.35			0.07			41.144			0.0945	0.02	14.48	0.03	0.12	0	0.63	0.37	0.0208	0.00	1.10	0.00	0.00	1.10	0.00%	99.83%	0.09%	0.08%	1.1	1.0
Total PCBs	0.65			0.17	1.41	1.36				0.1792	0.11	2.29	0.12	0.12	0	0.63	0.37	0.0208	0.00	0.17	0.00	0.00	0.18	0.00%	96.36%	2.73%	0.91%	0.18	1.0
Aroclor 1016	0.64			0.30	1.41	1.36				0.2104	0.19	2.24	0.13	0.12	0	0.63	0.37	0.0208	0.00	0.17	0.01	0.00	0.18	0.00%	94.39%	4.71%	0.89%	0.18	1.0
Aroclor 1221	0.61			0.78	1.41	1.36				0.1883	0.48	2.07	0.11	0.12	0	0.63	0.37	0.0208	0.00	0.16	0.02	0.00	0.18	0.00%	87.39%	11.77%	0.84%	0.18	1.0
Aroclor 1232	0.59			0.99	1.41	1.36				0.1704	0.59	2.01	0.10	0.12	0	0.63	0.37	0.0208	0.00	0.15	0.03	0.00	0.18	0.00%	84.65%	14.52%	0.82%	0.18	1.0
Aroclor 1242	0.65			0.16	1.41	1.36				0.1756	0.11	2.29	0.11	0.12	0	0.63	0.37	0.0208	0.00	0.17	0.00	0.00	0.18	0.00%	96.48%	2.61%	0.91%	0.18	1.0
Aroclor 1248	0.65			0.18	1.41	1.36				0.1855	0.12	2.28	0.12	0.12	0	0.63	0.37	0.0208	0.00	0.17	0.01	0.00	0.18	0.00%	96.13%	2.97%	0.90%	0.18	1.0
Aroclor 1254	0.65			0.14	1.41	1.36				0.1630	0.09	2.30	0.11	0.12	0	0.63	0.37	0.0208	0.00	0.17	0.00	0.00	0.18	0.00%	96.84%	2.25%	0.91%	0.18	1.0
Aroclor 1260	0.66			0.05	1.41	1.36				0.0750	0.03	2.33	0.05	0.12	0	0.63	0.37	0.0208	0.00	0.18	0.00	0.00	0.18	0.00%	98.23%	0.85%	0.92%	0.18	1.0
Aroclor-1262	71.83													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.18	0.18	0.00%	0.00%	0.00%	100.00%	0.18	1.0
Dichloroprop	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Aldrin	0.08			0.14			1.033			0.1630	0.01	0.08	0.01	0.12	0	0.63	0.37	0.0208	0.00	0.01	0.00	0.00	0.01	0.00%	89.99%	7.13%	2.88%	0.007	1.0
beta-1,2,3,4,5,6-Hexachlorocyclohexane	3.65			1.72			1.021			0.1201	6.27	3.72	0.44	0.12	0	0.63	0.37	0.0208	0.00	0.28	0.28	0.01	0.57	0.00%	49.48%	48.92%	1.60%	0.571	1.0
alpha-Chlordane	24.28			0.16			1.031			0.1771	4.00	25.04	4.30	0.12	0	0.63	0.37	0.0208	0.00	1.90	0.18	0.06	2.14	0.00%	88.82%	8.33%	2.84%	2.14	1.0
gamma-Chlordane	24.19			0.16			1.036			0.1771	3.99	25.06	4.28	0.12	0	0.63	0.37	0.0208	0.00	1.90	0.18	0.06	2.14	0.00%	88.86%	8.31%	2.83%	2.14	1.0
Dichlorodiphenyldichloroethylene	0.21	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		0.02	2.97	13.87	0.12	0	0.63	0.37	0.0208	0.00	0.23	0.00	0.00	0.23	0.00%	99.29%	0.49%	0.23%	0.227	1.0
Dichlorodiphenyltrichloroethane	0.30	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		0.03	2.96	1.37	0.12	0	0.63	0.37	0.0208	0.00	0.22	0.00	0.00	0.23	0.00%	99.02%	0.65%	0.33%	0.227	1.0
Dieldrin	0.06			0.41			14.70			1.20	0.03	0.92	0.07	0.12	0	0.63	0.37	0.0208	0.00	0.07	0.00	0.00	0.07	0.00%	98.17%	1.61%	0.22%	0.0709	1.0
Endosulfan I	66.32			1.31			1.184			0.1455	86.95	78.50	9.65	0.12	0	0.63	0.37	0.0208	0.00	5.96	3.88	0.17	10.00	0.00%	59.58%	38.76%	1.66%	10	1.0
Endosulfan II	66.32			1.31			1.184			0.1455	86.95	78.50	9.65	0.12	0	0.63	0.37	0.0208	0.00	5.96	3.88	0.17	10.00	0.00%	59.58%	38.76%	1.66%	10	1.0
Endosulfan sulfate	55.40			1.98			1.184			0.1072	109.56	65.58	5.94	0.12	0	0.63	0.37	0.0208	0.00	4.98	4.88	0.14	10.00	0.00%	49.78%	48.84%	1.39%	10	1.0
Endrin aldehyde	0.52			1.44			6.686			0.1368	0.75	3.49	0.07	0.12	0	0.63	0.37	0.0208	0.00	0.27	0.03	0.00	0.30	0.00%	88.39%	11.18%	0.44%	0.3	1.0
Methoxychlor	1.00			0.52			3.739			0.2093	0.52	3.74	0.21	0.12	0	0.63	0.37	0.0208	0.00	0.28	0.02	0.00	0.31	0.00%	91.64%	7.55%	0.81%	---	---

Notes:

It has been conservatively assumed that all chemical intake is absorbed by the receptor.

1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.

Acronyms:

BAF = Bioaccumulation factor

DW = Dry weight

FIR = Food ingestion rate

mg/kg = Miligrams per kilogram

mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight

mg/kg/d = Miligrams per kilogram per day

NOAEL = No observed adverse effect level

PRGs = Preliminary remediation goals

TRV = Toxicity reference value

Equations:

Total Estimated Exposure = Food Intake + Incidental Soil Intake

Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)

Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)

Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0

where: B1 = slope and B0 = intercept

Estimated Concentrations in Biota (method 2) = soil concentration X BAF

Hazard Quotient = Total Estimated Exposure (Dose) / TRV

Therefore, when the HQ = 1, soil concentration = PRG

where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Table A-3. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Killdeer

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models: Plants intercept	Plants slope	Plants BAF	Soil Inverts intercept	Soil Inverts slope	Soil Inverts BAF	Small Mammals intercept	Small Mammals slope	Small Mammals BAF	Estimated Concentrations in Biota (mg/kg DW): Plants	Soil Invertbrates	Small Mammals	Food Intake Rate (kg/kg-bw/d, dw)	Diet Composition (proportion): Small Mammals	Soil Inverts	Plants	Soil	Estimated Exposure (mg/kg/d): Small Mammals	Soil Inverts	Plants	Soil	Total	Percent Estimated Exposure by Pathway: Small Mam.	Soil Inverts	Plants	Soil	Selected Avian NOAEL TRV (mg/kg/d)	NOAEL HQ
Aluminum	4920.58			0.00287			0.043			0.0263	14.12	211.59	129.41	0.192	0	1	0	0.073	0.00	40.66	0.00	69.04	109.70	0.00%	37.07%	0.00%	62.93%	109.7	1.0
Antimony	1.00	-3.233	0.938				1			0.001 * 50 * Cdiet	0.04	1.00	0.05	0.192	0	1	0	0.073	0.00	0.19	0.00	0.01	0.21	0.00%	93.20%	0.00%	6.80%	---	---
Arsenic, Total all valence states	425.03	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		4.14	17.32	1.11	0.192	0	1	0	0.073	0.00	3.33	0.00	5.96	9.29	0.00%	35.82%	0.00%	64.18%	9.3	1.0
Arsenic (III)	425.03	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		4.14	17.32	1.11	0.192	0	1	0	0.073	0.00	3.33	0.00	5.96	9.29	0.00%	35.82%	0.00%	64.18%	9.3	1.0
Arsenic (V)	425.03	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		4.14	17.32	1.11	0.192	0	1	0	0.073	0.00	3.33	0.00	5.96	9.29	0.00%	35.82%	0.00%	64.18%	9.3	1.0
Barium	659.91			0.156			0.091			0.0168	102.95	60.05	11.09	0.192	0	1	0	0.073	0.00	11.54	0.00	9.26	20.80	0.00%	55.49%	0.00%	44.51%	20.8	1.0
Beryllium	1.00	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	0.59	0.05	0.00	0.192	0	1	0	0.073	0.00	0.01	0.00	0.01	0.02	0.00%	38.14%	0.00%	61.86%	---	---
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	0.192	0	1	0	0.073	0.00	0.19	0.00	0.01	0.21	0.00%	93.20%	0.00%	6.80%	---	---
Boron	139.66			5.714			1			1	798.00	139.66	139.66	0.192	0	1	0	0.073	0.00	26.84	0.00	1.96	28.80	0.00%	93.20%	0.00%	6.80%	28.8	1.0
Cadmium	0.89	-0.476	0.546		2.114	0.795		-1.2571	0.4723		0.58	7.58	0.27	0.192	0	1	0	0.073	0.00	1.46	0.00	0.01	1.47	0.00%	99.15%	0.00%	0.85%	1.47	1.0
Chromium (total)	36.52			0.041			0.306	-1.4599	0.7338		1.50	11.17	3.25	0.192	0	1	0	0.073	0.00	2.15	0.00	0.51	2.66	0.00%	80.74%	0.00%	19.26%	2.66	1.0
Chromium (+3)	36.52			0.041			0.306	-1.4599	0.7338		1.50	11.17	3.25	0.192	0	1	0	0.073	0.00	2.15	0.00	0.51	2.66	0.00%	80.74%	0.00%	19.26%	2.66	1.0
Chromium (+6)	1.00			0.041			0.306	-1.4599	0.7338		0.04	0.31	0.23	0.192	0	1	0	0.073	0.00	0.06	0.00	0.01	0.07	0.00%	80.74%	0.00%	19.26%		---
Cobalt	108.78			0.00745			0.291	-4.4669	1.307		0.81	31.66	5.27	0.192	0	1	0	0.073	0.00	6.08	0.00	1.53	7.61	0.00%	79.95%	0.00%	20.05%	7.61	1.0
Copper	35.84	0.669	0.394				0.515	2.042	0.1444		8.00	18.46	12.92	0.192	0	1	0	0.073	0.00	3.55	0.00	0.50	4.05	0.00%	87.59%	0.00%	12.41%	4.05	1.0
Lead	15.51	-1.328	0.561		-0.218	0.807		0.0761	0.4422		1.23	7.35	3.63	0.192	0	1	0	0.073	0.00	1.41	0.00	0.22	1.63	0.00%	86.65%	0.00%	13.35%	1.63	1.0
Lithium	1.00			0.004			0.046			1	0.00	0.05	1.00	0.192	0	1	0	0.073	0.00	0.01	0.00	0.01	0.02	0.00%	38.66%	0.00%	61.34%	---	---
Manganese	9588.41			0.0792	-0.809	0.682				0.0205	759.40	231.32	196.56	0.192	0	1	0	0.073	0.00	44.46	0.00	134.52	178.98	0.00%	24.84%	0.00%	75.16%	179	1.0
Mercury (methyl)	0.04	-0.996	0.544		0.0781	0.3369				0.054	0.06	0.35	0.00	0.192	0	1	0	0.073	0.00	0.07	0.00	0.00	0.07	0.00%	99.27%	0.00%	0.73%	0.068	1.0
Mercury (inorganic)	5.60	-0.996	0.544		0.0781	0.3369				0.054	0.94	1.93	0.30	0.192	0	1	0	0.073	0.00	0.37	0.00	0.08	0.45	0.00%	82.53%	0.00%	17.47%	0.45	1.0
Molybdenum	17.90			1.2504			0.953			1	22.38	17.06	17.90	0.192	0	1	0	0.073	0.00	3.28	0.00	0.25	3.53	0.00%	92.88%	0.00%	7.12%	3.53	1.0
Nickel	30.84	-2.224	0.748				1.059	-0.2462	0.4658		1.41	32.66	3.86	0.192	0	1	0	0.073	0.00	6.28	0.00	0.43	6.71	0.00%	93.55%	0.00%	6.45%	6.71	1.0
Selenium	1.72	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		0.93	1.38	0.81	0.192	0	1	0	0.073	0.00	0.27	0.00	0.02	0.29	0.00%	91.66%	0.00%	8.34%	0.29	1.0
Silver	4.96			0.014			2.045			0.0040	0.07	10.15	0.02	0.192	0	1	0	0.073	0.00	1.95	0.00	0.07	2.02	0.00%	96.55%	0.00%	3.45%	2.02	1.0
Strontium	1.00			0.207			0.4066			1.74	0.21	0.41	1.74	0.192	0	1	0	0.073	0.00	0.08	0.00	0.01	0.09	0.00%	84.78%	0.00%	15.22%	---	---
Thallium	1.00			0.004			0.0541			0.1124	0.00	0.05	0.11	0.192	0	1	0	0.073	0.00	0.01	0.00	0.01	0.02	0.00%	42.56%	0.00%	57.44%	---	---
Tin	231.25			1			0.08			0.08	231.25	18.50	18.50	0.192	0	1	0	0.073	0.00	3.56	0.00	3.24	6.80	0.00%	52.29%	0.00%	47.71%	6.8	1.0
Uranium	785.38			0.021			0.033			0.0002	16.49	25.92	0.16	0.192	0	1	0	0.073	0.00	4.98	0.00	11.02	16.00	0.00%	31.13%	0.00%	68.87%	16	1.0
Vanadium	15.56			0.00485			0.042			0.0123	0.08	0.65	0.19	0.192	0	1	0	0.073	0.00	0.13	0.00	0.22	0.34	0.00%	36.52%	0.00%	63.48%	0.344	1.0
Zinc	66.60	1.575	0.555		4.449	0.328		4.3632	0.0706		49.66	339.06	105.60	0.192	0	1	0	0.073	0.00	65.16	0.00	0.93	66.10	0.00%	98.59%	0.00%	1.41%	66.1	1.0
Ammonia/Ammonium	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Chloride	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Cyanide	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Fluoride	555.96			0.006							3.34			0.192	0	1	0	0.073	0.00	0.00	0.00	7.80	7.80	0.00%	0.00%	0.00%	100.00%	7.8	1.0
Iodine	1.00			0.05							0.05			0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Nitrate/Nitrite	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Phosphate	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Sulfate/Sulfite	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Total Organic Carbon	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---

Table A-3. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Killdeer

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
1,1-dichloroethane	82.67						1.010			0.0109		83.46	0.90	0.192	0	1	0	0.073	0.00	16.04	0.00	1.16	17.20	0.00%	93.26%	0.00%	6.74%	17.2	1.0
1,1-dichloroethene	82.54						1.011			0.0186		83.47	1.54	0.192	0	1	0	0.073	0.00	16.04	0.00	1.16	17.20	0.00%	93.27%	0.00%	6.73%	17.2	1.0
1,1,1-trichloroethane	82.42						1.013			0.0305		83.48	2.52	0.192	0	1	0	0.073	0.00	16.04	0.00	1.16	17.20	0.00%	93.28%	0.00%	6.72%	17.2	1.0
1,1,2-trichloroethane	82.62						1.010			0.0165		83.46	1.36	0.192	0	1	0	0.073	0.00	16.04	0.00	1.16	17.20	0.00%	93.26%	0.00%	6.74%	17.2	1.0
1,1,2,2-tetrachloroethane	82.41						1.013			0.0270		83.48	2.23	0.192	0	1	0	0.073	0.00	16.04	0.00	1.16	17.20	0.00%	93.28%	0.00%	6.72%	17.2	1.0
1,2-dichlorobenzene	82.05			2.45			1.018			0.0882	201.16	83.50	7.24	0.192	0	1	0	0.073	0.00	16.05	0.00	1.15	17.20	0.00%	93.31%	0.00%	6.69%	17.2	1.0
1,2-dichloroethane (DCA)	84.32						0.988			0.0063		83.34	0.53	0.192	0	1	0	0.073	0.00	16.02	0.00	1.18	17.20	0.00%	93.12%	0.00%	6.88%	17.2	1.0
1,3-dichlorobenzene	82.03			2.23			1.018			0.0963	183.16	83.51	7.90	0.192	0	1	0	0.073	0.00	16.05	0.00	1.15	17.20	0.00%	93.31%	0.00%	6.69%	17.2	1.0
2-butanone (Methyl Ethyl Ketone/MEK)	312.32						0.094			0.0006		29.23	0.17	0.192	0	1	0	0.073	0.00	5.62	0.00	4.38	10.00	0.00%	56.18%	0.00%	43.82%	10	1.0
2-hexanone	185.63						0.207			0.0053		38.48	0.99	0.192	0	1	0	0.073	0.00	7.40	0.00	2.60	10.00	0.00%	73.96%	0.00%	26.04%	10	1.0
Benzene	195.32						1.011			0.0186		197.51	3.64	0.192	0	1	0	0.073	0.00	37.96	0.00	2.74	40.70	0.00%	93.27%	0.00%	6.73%	40.7	1.0
Butanol	1.00						0.478			0.0017		0.48	0.00	0.192	0	1	0	0.073	0.00	0.09	0.00	0.01	0.11	0.00%	86.76%	0.00%	13.24%	---	---
Carbon Tetrachloride	82.28						1.015			0.0420		83.49	3.46	0.192	0	1	0	0.073	0.00	16.05	0.00	1.15	17.20	0.00%	93.29%	0.00%	6.71%	17.2	1.0
Chlorobenzene	82.28						1.015			0.0490		83.49	4.03	0.192	0	1	0	0.073	0.00	16.05	0.00	1.15	17.20	0.00%	93.29%	0.00%	6.71%	17.2	1.0
Chloroform	82.60						1.011			0.0135		83.47	1.11	0.192	0	1	0	0.073	0.00	16.04	0.00	1.16	17.20	0.00%	93.26%	0.00%	6.74%	17.2	1.0
Cis-1,2-dichloroethylene	82.55						1.011			0.0122		83.47	1.01	0.192	0	1	0	0.073	0.00	16.04	0.00	1.16	17.20	0.00%	93.27%	0.00%	6.73%	17.2	1.0
Dichloromethane (Methylene Chloride)	82.88						1.007			0.0042		83.44	0.35	0.192	0	1	0	0.073	0.00	16.04	0.00	1.16	17.20	0.00%	93.24%	0.00%	6.76%	17.2	1.0
Ethyl Benzene	194.43			3.21			1.016			0.0666	624.96	197.58	12.96	0.192	0	1	0	0.073	0.00	37.97	0.00	2.73	40.70	0.00%	93.30%	0.00%	6.70%	40.7	1.0
Methyl Isobutyl Ketone	192.73						0.197			0.0037		37.96	0.72	0.192	0	1	0	0.073	0.00	7.30	0.00	2.70	10.00	0.00%	72.96%	0.00%	27.04%	10	1.0
n-butyl Benzene	193.33			1.67			1.022			0.1227	323.16	197.66	23.73	0.192	0	1	0	0.073	0.00	37.99	0.00	2.71	40.70	0.00%	93.34%	0.00%	6.66%	40.7	1.0
Tetrachloroethylene	82.07						1.018			0.0390		83.50	3.20	0.192	0	1	0	0.073	0.00	16.05	0.00	1.15	17.20	0.00%	93.31%	0.00%	6.69%	17.2	1.0
Toluene	194.81						1.014			0.0430		197.55	8.38	0.192	0	1	0	0.073	0.00	37.97	0.00	2.73	40.70	0.00%	93.28%	0.00%	6.72%	40.7	1.0
Trans-1,2-dichloroethylene	82.55						1.011			0.0170		83.47	1.40	0.192	0	1	0	0.073	0.00	16.04	0.00	1.16	17.20	0.00%	93.27%	0.00%	6.73%	17.2	1.0
Trichloroethylene (TCE)	82.45						1.012			0.0410		83.48	3.38	0.192	0	1	0	0.073	0.00	16.04	0.00	1.16	17.20	0.00%	93.27%	0.00%	6.73%	17.2	1.0
Xylene	194.45			3.43			1.016			0.0619	667.29	197.57	12.04	0.192	0	1	0	0.073	0.00	37.97	0.00	2.73	40.70	0.00%	93.30%	0.00%	6.70%	40.7	1.0
Acenaphthene	109.59	-5.562	-0.8556				1.470			0	0.00	161.10	0.00	0.192	0	1	0	0.073	0.00	30.96	0.00	1.54	32.50	0.00%	95.27%	0.00%	4.73%	32.5	1.0
Acenaphthylene	7.36	-1.144	0.791				22.9			0	1.54	168.57	0.00	0.192	0	1	0	0.073	0.00	32.40	0.00	0.10	32.50	0.00%	99.68%	0.00%	0.32%	32.5	1.0
Anthracene	67.83	-0.9887	0.7784				2.42			0	9.91	164.15	0.00	0.192	0	1	0	0.073	0.00	31.55	0.00	0.95	32.50	0.00%	97.07%	0.00%	2.93%	32.5	1.0
Benzo(a)pyrene	2.41	-2.0615	0.975				1.33			0	0.30	3.21	0.00	0.192	0	1	0	0.073	0.00	0.62	0.00	0.03	0.65	0.00%	94.80%	0.00%	5.20%	0.65	1.0
Benzo(a)anthracene	2.03	-2.7078	0.5944				1.59			0	0.10	3.23	0.00	0.192	0	1	0	0.073	0.00	0.62	0.00	0.03	0.65	0.00%	95.61%	0.00%	4.39%	0.65	1.0
Benzo(b)fluoranthene	1.27			0.31			2.6			0	0.39	3.29	0.00	0.192	0	1	0	0.073	0.00	0.63	0.00	0.02	0.65	0.00%	97.27%	0.00%	2.73%	0.65	1.0
Benzo(ghi)perylene	1.12	-0.9313	1.1829				2.94			0	0.45	3.30	0.00	0.192	0	1	0	0.073	0.00	0.63	0.00	0.02	0.65	0.00%	97.58%	0.00%	2.42%	0.65	1.0
Benzo[k]fluoranthene	1.27	-4.6482	0.1668				2.6			0	0.01	3.29	0.00	0.192	0	1	0	0.073	0.00	0.63	0.00	0.02	0.65	0.00%	97.27%	0.00%	2.73%	0.65	1.0
Chrysene	1.43	-2.7078	0.5944				2.29			0	0.08	3.28	0.00	0.192	0	1	0	0.073	0.00	0.63	0.00	0.02	0.65	0.00%	96.91%	0.00%	3.09%	0.65	1.0
Dibenz(ah)anthracene	1.42			0.13			2.31			0	0.18	3.28	0.00	0.192	0	1	0	0.073	0.00	0.63	0.00	0.02	0.65	0.00%	96.94%	0.00%	3.06%	0.65	1.0
Fluoranthene	1.09			0.5			3.04			0	0.54	3.30	0.00	0.192	0	1	0	0.073	0.00	0.63	0.00	0.02	0.65	0.00%	97.65%	0.00%	2.35%	0.65	1.0
Fluorene	17.54	-5.562	-0.8556				9.57			0	0.00	167.82	0.00	0.192	0	1	0	0.073	0.00	32.25	0.00	0.25	32.50	0.00%	99.24%	0.00%	0.76%	32.5	1.0
Indeno[1,2,3-cd]pyrene	1.15			0.11			2.86			0	0.13	3.30	0.00	0.192	0	1	0	0.073	0.00	0.63	0.00	0.02	0.65	0.00%	97.51%	0.00%	2.49%	0.65	1.0
2-Methylnaphthalene	154.74	-1.3205	4.544				1.020			0	2376974828.28	157.81	0.00	0.192	0	1	0	0.073	0.00	30.33	0.00	2.17	32.50	0.00%	93.32%	0.00%	6.68%	32.5	1.0

Table A-3. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Killdeer

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertebrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Naphthalene	415.86			12.2			4.4			0	5073.47	1829.78	0.00	0.192	0	1	0	0.073	0.00	351.67	0.00	5.83	357.50	0.00%	98.37%	0.00%	1.63%	32.5	---
Phenanthrene	94.31	-0.1665	0.6203				1.72			0	14.21	162.22	0.00	0.192	0	1	0	0.073	0.00	31.18	0.00	1.32	32.50	0.00%	95.93%	0.00%	4.07%	32.5	1.0
Pyrene	1.86			0.72			1.75			0	1.34	3.25	0.00	0.192	0	1	0	0.073	0.00	0.62	0.00	0.03	0.65	0.00%	96.00%	0.00%	4.00%	0.65	1.0
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%		---
Low MW PAHs	2316.48	-1.3205	0.4544							0	9.03		0.00	0.192	0	1	0	0.073	0.00	0.00	0.00	32.50	32.50	0.00%	0.00%	0.00%	100.00%	32.5	1.0
High MW PAHs	46.33	-1.7026	0.9469							0	6.89		0.00	0.192	0	1	0	0.073	0.00	0.00	0.00	0.65	0.65	0.00%	0.00%	0.00%	100.00%	0.65	1.0
Gasoline Range Organics																												500	---
TPH - Diesel	35638.15									0			0.00	0.192	0	1	0	0.073	0.00	0.00	0.00	500.00	500.00	0.00%	0.00%	0.00%	100.00%	500	1.0
TPH - Kerosene	35638.15									0			0.00	0.192	0	1	0	0.073	0.00	0.00	0.00	500.00	500.00	0.00%	0.00%	0.00%	100.00%	500	1.0
Normal paraffin hydrocarbons	57947.64									0			0.00	0.192	0	1	0	0.073	0.00	0.00	0.00	813.00	813.00	0.00%	0.00%	0.00%	100.00%	813	1.0
Phenol	1.00						0.235			0.0064		0.23	0.01	0.192	0	1	0	0.073	0.00	0.05	0.00	0.01	0.06	0.00%	76.28%	0.00%	23.72%	---	---
2-methylphenol (ocresol)	1.00						0.336			0.0150		0.34	0.02	0.192	0	1	0	0.073	0.00	0.06	0.00	0.01	0.08	0.00%	82.14%	0.00%	17.86%	---	---
4-methylphenol (pcresol)	1.00						0.333			0.0141		0.33	0.01	0.192	0	1	0	0.073	0.00	0.06	0.00	0.01	0.08	0.00%	82.03%	0.00%	17.97%	---	---
2,4-dinitrotoluene	0.20	1.873	-0.3768	0.376			0.184			0.0155	0.08	0.04	0.00	0.192	0	1	0	0.073	0.00	0.01	0.00	0.00	0.01	0.00%	71.56%	0.00%	28.44%	0.01	1.0
Bis[2-ethylhexyl] phthalate	0.14			0.07			41.144			0.0945	0.01	5.71	0.01	0.192	0	1	0	0.073	0.00	1.10	0.00	0.00	1.10	0.00%	99.82%	0.00%	0.18%	1.1	1.0
Total PCBs	0.33			0.17	1.41	1.36				0.1792	0.06	0.91	0.06	0.192	0	1	0	0.073	0.00	0.18	0.00	0.00	0.18	0.00%	97.42%	0.00%	2.58%	0.18	1.0
Aroclor 1016	0.33			0.30	1.41	1.36				0.2104	0.10	0.91	0.07	0.192	0	1	0	0.073	0.00	0.18	0.00	0.00	0.18	0.00%	97.42%	0.00%	2.58%	0.18	1.0
Aroclor 1221	0.33			0.78	1.41	1.36				0.1883	0.26	0.91	0.06	0.192	0	1	0	0.073	0.00	0.18	0.00	0.00	0.18	0.00%	97.42%	0.00%	2.58%	0.18	1.0
Aroclor 1232	0.33			0.99	1.41	1.36				0.1704	0.33	0.91	0.06	0.192	0	1	0	0.073	0.00	0.18	0.00	0.00	0.18	0.00%	97.42%	0.00%	2.58%	0.18	1.0
Aroclor 1242	0.33			0.16	1.41	1.36				0.1756	0.05	0.91	0.06	0.192	0	1	0	0.073	0.00	0.18	0.00	0.00	0.18	0.00%	97.42%	0.00%	2.58%	0.18	1.0
Aroclor 1248	0.33			0.18	1.41	1.36				0.1855	0.06	0.91	0.06	0.192	0	1	0	0.073	0.00	0.18	0.00	0.00	0.18	0.00%	97.42%	0.00%	2.58%	0.18	1.0
Aroclor 1254	0.33			0.14	1.41	1.36				0.1630	0.05	0.91	0.05	0.192	0	1	0	0.073	0.00	0.18	0.00	0.00	0.18	0.00%	97.42%	0.00%	2.58%	0.18	1.0
Aroclor 1260	0.33			0.05	1.41	1.36				0.0750	0.02	0.91	0.02	0.192	0	1	0	0.073	0.00	0.18	0.00	0.00	0.18	0.00%	97.42%	0.00%	2.58%	0.18	1.0
Aroclor-1262	12.83													0.192	0	1	0	0.073	0.00	0.00	0.00	0.18	0.18	0.00%	0.00%	0.00%	100.00%	0.18	1.0
Dichloroprop	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Aldrin	0.03			0.14			1.033			0.1630	0.00	0.03	0.01	0.192	0	1	0	0.073	0.00	0.01	0.00	0.00	0.01	0.00%	93.40%	0.00%	6.60%	0.007	1.0
beta-1,2,3,4,5,6-Hexachlorocyclohexane	2.72			1.72			1.021			0.1201	4.67	2.77	0.33	0.192	0	1	0	0.073	0.00	0.53	0.00	0.04	0.57	0.00%	93.33%	0.00%	6.67%	0.571	1.0
alpha-Chlordane	10.08			0.16			1.031			0.1771	1.66	10.40	1.78	0.192	0	1	0	0.073	0.00	2.00	0.00	0.14	2.14	0.00%	93.39%	0.00%	6.61%	2.14	1.0
gamma-Chlordane	10.04			0.16			1.036			0.1771	1.66	10.40	1.78	0.192	0	1	0	0.073	0.00	2.00	0.00	0.14	2.14	0.00%	93.41%	0.00%	6.59%	2.14	1.0
Dichlorodiphenyldichloroethylene	0.07	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		0.01	1.18	7.06	0.192	0	1	0	0.073	0.00	0.23	0.00	0.00	0.23	0.00%	99.55%	0.00%	0.45%	0.227	1.0
Dichlorodiphenyltrichloroethane	0.10	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		0.01	1.17	0.63	0.192	0	1	0	0.073	0.00	0.23	0.00	0.00	0.23	0.00%	99.36%	0.00%	0.64%	0.227	1.0
Dieldrin	0.02			0.41			14.70			1.20	0.01	0.37	0.03	0.192	0	1	0	0.073	0.00	0.07	0.00	0.00	0.07	0.00%	99.51%	0.00%	0.49%	0.0709	1.0
Endosulfan I	41.40			1.31			1.184			0.1455	54.28	49.01	6.02	0.192	0	1	0	0.073	0.00	9.42	0.00	0.58	10.00	0.00%	94.19%	0.00%	5.81%	10	1.0
Endosulfan II	41.40			1.31			1.184			0.1455	54.28	49.01	6.02	0.192	0	1	0	0.073	0.00	9.42	0.00	0.58	10.00	0.00%	94.19%	0.00%	5.81%	10	1.0
Endosulfan sulfate	41.40			1.98			1.184			0.1072	81.87	49.01	4.44	0.192	0	1	0	0.073	0.00	9.42	0.00	0.58	10.00	0.00%	94.19%	0.00%	5.81%	10	1.0
Endrin aldehyde	0.23			1.44			6.686			0.1368	0.33	1.54	0.03	0.192	0	1	0	0.073	0.00	0.30	0.00	0.00	0.30	0.00%	98.92%	0.00%	1.08%	0.3	1.0
Methoxychlor	1.00			0.52			3.739			0.2093	0.52	3.74	0.21	0.192	0	1	0	0.073	0.00	0.72	0.00	0.01	0.73	0.00%	98.09%	0.00%	1.91%	---	---

Notes:

It has been conservatively assumed that all chemical intake is absorbed by the receptor.

1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.

Acronyms:

Table A-3. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Killdeer

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		

BAF = Bioaccumulation factor
DW = Dry weight
FIR = Food ingestion rate
mg/kg = Miligrams per kilogram
mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight
mg/kg/d = Miligrams per kilogram per day
NOAEL = No observed adverse effect level
PRGs = Preliminary remediation goals
TRV = Toxicity reference value

Equations:

Total Estimated Exposure = Food Intake + Incidental Soil Intake
Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)
Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)
Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0
where: B1 = slope and B0 = intercept
Estimated Concentrations in Biota (method 2) = soil concentration X BAF
Hazard Quotient = Total Estimated Exposure (Dose) / TRV
Therefore, when the HQ = 1, soil concentration = PRG
where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Table A-4. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Red-tailed Hawk

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Aluminum	61782.28			0.00287			0.043			0.0263	177.32	2656.64	1624.87	0.035	1	0	0	0.024	57.36	0.00	0.00	52.34	109.70	52.29%	0.00%	0.00%	47.71%	109.7	1.0
Antimony	1.00	-3.233	0.938				1			0.001 * 50 * Cdiet	0.04	1.00	0.05	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	67.57%	0.00%	0.00%	32.43%	---	---
Arsenic, Total all valence states	10343.53	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		25.07	164.90	15.21	0.035	1	0	0	0.024	0.54	0.00	0.00	8.76	9.30	5.77%	0.00%	0.00%	94.23%	9.3	1.0
Arsenic (III)	10343.53	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		25.07	164.90	15.21	0.035	1	0	0	0.024	0.54	0.00	0.00	8.76	9.30	5.77%	0.00%	0.00%	94.23%	9.3	1.0
Arsenic (V)	10343.53	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		25.07	164.90	15.21	0.035	1	0	0	0.024	0.54	0.00	0.00	8.76	9.30	5.77%	0.00%	0.00%	94.23%	9.3	1.0
Barium	14442.04			0.156			0.091			0.0168	2252.96	1314.23	242.63	0.035	1	0	0	0.024	8.56	0.00	0.00	12.24	20.80	41.18%	0.00%	0.00%	58.82%	20.8	1.0
Beryllium	1.00	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	0.59	0.05	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	8.57%	0.00%	0.00%	91.43%	---	---
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	0.035	1	0	0	0.024	0.04	0.00	0.00	0.00	0.04	97.66%	0.00%	0.00%	2.34%	---	---
Boron	796.74			5.714			1			1	4552.58	796.74	796.74	0.035	1	0	0	0.024	28.13	0.00	0.00	0.68	28.80	97.66%	0.00%	0.00%	2.34%	28.8	1.0
Cadmium	1374.94	-0.476	0.546		2.114	0.795		-1.2571	0.4723		32.12	2588.41	8.63	0.035	1	0	0	0.024	0.30	0.00	0.00	1.16	1.47	20.74%	0.00%	0.00%	79.26%	1.47	1.0
Chromium (total)	1286.46			0.041			0.306	-1.4599	0.7338		52.75	393.66	44.43	0.035	1	0	0	0.024	1.57	0.00	0.00	1.09	2.66	59.00%	0.00%	0.00%	41.00%	2.66	1.0
Chromium (+3)	1286.46			0.041			0.306	-1.4599	0.7338		52.75	393.66	44.43	0.035	1	0	0	0.024	1.57	0.00	0.00	1.09	2.66	59.00%	0.00%	0.00%	41.00%	2.66	1.0
Chromium (+6)	1.00			0.041			0.306	-1.4599	0.7338		0.04	0.31	0.23	0.035	1	0	0	0.024	0.01	0.00	0.00	0.00	0.01	90.63%	0.00%	0.00%	9.37%	---	---
Cobalt	1601.40			0.00745			0.291	-4.4669	1.307		11.93	466.01	177.15	0.035	1	0	0	0.024	6.25	0.00	0.00	1.36	7.61	82.17%	0.00%	0.00%	17.83%	7.61	1.0
Copper	3727.67	0.669	0.394				0.515	2.042	0.1444		49.85	1919.75	25.27	0.035	1	0	0	0.024	0.89	0.00	0.00	3.16	4.05	22.02%	0.00%	0.00%	77.98%	4.05	1.0
Lead	978.92	-1.328	0.561		-0.218	0.807		0.0761	0.4422		12.62	208.38	22.68	0.035	1	0	0	0.024	0.80	0.00	0.00	0.83	1.63	49.11%	0.00%	0.00%	50.89%	1.63	1.0
Lithium	1.00			0.004			0.046			1	0.00	0.05	1.00	0.035	1	0	0	0.024	0.04	0.00	0.00	0.00	0.04	97.66%	0.00%	0.00%	2.34%	---	---
Manganese	113951.05			0.0792	-0.809	0.682				0.0205	9024.92	1251.23	2336.00	0.035	1	0	0	0.024	82.46	0.00	0.00	96.54	179.00	46.07%	0.00%	0.00%	53.93%	179	1.0
Mercury (methyl)	24.60	-0.996	0.544		0.0781	0.3369				0.054	2.11	3.18	1.34	0.035	1	0	0	0.024	0.05	0.00	0.00	0.02	0.07	69.35%	0.00%	0.00%	30.65%	0.068	1.0
Mercury (inorganic)	162.81	-0.996	0.544		0.0781	0.3369				0.054	5.90	6.01	8.84	0.035	1	0	0	0.024	0.31	0.00	0.00	0.14	0.45	69.35%	0.00%	0.00%	30.65%	0.45	1.0
Molybdenum	97.66			1.2504			0.953			1	122.11	93.07	97.66	0.035	1	0	0	0.024	3.45	0.00	0.00	0.08	3.53	97.66%	0.00%	0.00%	2.34%	3.53	1.0
Nickel	6037.33	-2.224	0.748				1.059	-0.2462	0.4658		72.81	6393.53	45.10	0.035	1	0	0	0.024	1.59	0.00	0.00	5.11	6.71	23.74%	0.00%	0.00%	76.26%	6.71	1.0
Selenium	157.63	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		135.44	37.87	4.43	0.035	1	0	0	0.024	0.16	0.00	0.00	0.13	0.29	53.95%	0.00%	0.00%	46.05%	0.29	1.0
Silver	2043.71			0.014			2.045			0.0040	28.61	4179.38	8.17	0.035	1	0	0	0.024	0.29	0.00	0.00	1.73	2.02	14.29%	0.00%	0.00%	85.71%	2.02	1.0
Strontium	1.00			0.207			0.4066			1.74	0.21	0.41	1.74	0.035	1	0	0	0.024	0.06	0.00	0.00	0.00	0.06	98.64%	0.00%	0.00%	1.36%	---	---
Thallium	1.00			0.004			0.0541			0.1124	0.00	0.05	0.11	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	82.40%	0.00%	0.00%	17.60%	---	---
Tin	1852.26			1			0.08			0.08	1852.26	148.18	148.18	0.035	1	0	0	0.024	5.23	0.00	0.00	1.57	6.80	76.92%	0.00%	0.00%	23.08%	6.8	1.0
Uranium	18729.66			0.021			0.033			0.0002	393.32	618.08	3.75	0.035	1	0	0	0.024	0.13	0.00	0.00	15.87	16.00	0.83%	0.00%	0.00%	99.17%	16	1.0
Vanadium	268.46			0.00485			0.042			0.0123	1.30	11.28	3.30	0.035	1	0	0	0.024	0.12	0.00	0.00	0.23	0.34	33.88%	0.00%	0.00%	66.12%	0.344	1.0
Zinc	70825.06	1.575	0.555		4.449	0.328		4.3632	0.0706		2376.12	3334.55	172.72	0.035	1	0	0	0.024	6.10	0.00	0.00	60.00	66.10	9.22%	0.00%	0.00%	90.78%	66.1	1.0
Ammonia/Ammonium	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Chloride	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Cyanide	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Fluoride	9206.80			0.006							55.24			0.035	1	0	0	0.024	0.00	0.00	0.00	7.80	7.80	0.00%	0.00%	0.00%	100.00%	7.8	1.0
Iodine	1.00			0.05							0.05			0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Nitrate/Nitrite	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Phosphate	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---

Table A-4. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Red-tailed Hawk

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Sulfate/Sulfite	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Total Organic Carbon	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
1,1-dichloroethane	13954.67						1.010			0.0109		14088.51	152.34	0.035	1	0	0	0.024	5.38	0.00	0.00	11.82	17.20	31.27%	0.00%	0.00%	68.73%	17.2	1.0
1,1-dichloroethene	11432.85						1.011			0.0186		11561.23	212.86	0.035	1	0	0	0.024	7.51	0.00	0.00	9.69	17.20	43.69%	0.00%	0.00%	56.31%	17.2	1.0
1,1,1-trichloroethane	8935.68						1.013			0.0305		9050.21	272.80	0.035	1	0	0	0.024	9.63	0.00	0.00	7.57	17.20	55.99%	0.00%	0.00%	44.01%	17.2	1.0
1,1,2-trichloroethane	12031.27						1.010			0.0165		12154.21	198.50	0.035	1	0	0	0.024	7.01	0.00	0.00	10.19	17.20	40.74%	0.00%	0.00%	59.26%	17.2	1.0
1,1,2,2-tetrachloroethane	9548.86						1.013			0.0270		9672.37	258.08	0.035	1	0	0	0.024	9.11	0.00	0.00	8.09	17.20	52.97%	0.00%	0.00%	47.03%	17.2	1.0
1,2-dichlorobenzene	4343.45			2.45			1.018			0.0882	10648.38	4420.25	383.01	0.035	1	0	0	0.024	13.52	0.00	0.00	3.68	17.20	78.61%	0.00%	0.00%	21.39%	17.2	1.0
1,2-dichloroethane (DCA)	16083.77						0.988			0.0063		15896.76	101.24	0.035	1	0	0	0.024	3.57	0.00	0.00	13.63	17.20	20.78%	0.00%	0.00%	79.22%	17.2	1.0
1,3-dichlorobenzene	4051.47			2.23			1.018			0.0963	9046.73	4124.57	390.02	0.035	1	0	0	0.024	13.77	0.00	0.00	3.43	17.20	80.04%	0.00%	0.00%	19.96%	17.2	1.0
2-butanone (Methyl Ethyl Ketone/MEK)	11538.19						0.094			0.0006		1079.95	6.37	0.035	1	0	0	0.024	0.22	0.00	0.00	9.78	10.00	2.25%	0.00%	0.00%	97.75%	10	1.0
2-hexanone	9653.17						0.207			0.0053		2001.10	51.61	0.035	1	0	0	0.024	1.82	0.00	0.00	8.18	10.00	18.22%	0.00%	0.00%	81.78%	10	1.0
Benzene	27053.32						1.011			0.0186		27357.09	503.69	0.035	1	0	0	0.024	17.78	0.00	0.00	22.92	40.70	43.69%	0.00%	0.00%	56.31%	40.7	1.0
Butanol	1.00						0.478			0.0017		0.48	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	6.65%	0.00%	0.00%	93.35%	---	---
Carbon Tetrachloride	7382.46						1.015			0.0420		7491.05	310.07	0.035	1	0	0	0.024	10.95	0.00	0.00	6.25	17.20	63.64%	0.00%	0.00%	36.36%	17.2	1.0
Chlorobenzene	6672.38						1.015			0.0490		6770.04	327.11	0.035	1	0	0	0.024	11.55	0.00	0.00	5.65	17.20	67.13%	0.00%	0.00%	32.87%	17.2	1.0
Chloroform	13002.94						1.011			0.0135		13139.75	175.18	0.035	1	0	0	0.024	6.18	0.00	0.00	11.02	17.20	35.95%	0.00%	0.00%	64.05%	17.2	1.0
Cis-1,2-dichloroethylene	13446.00						1.011			0.0122		13594.99	164.55	0.035	1	0	0	0.024	5.81	0.00	0.00	11.39	17.20	33.77%	0.00%	0.00%	66.23%	17.2	1.0
Dichloromethane (Methylene Chloride)	17281.03						1.007			0.0042		17397.76	72.51	0.035	1	0	0	0.024	2.56	0.00	0.00	14.64	17.20	14.88%	0.00%	0.00%	85.12%	17.2	1.0
Ethyl Benzene	12721.13			3.21			1.016			0.0666	40891.01	12927.29	847.67	0.035	1	0	0	0.024	29.92	0.00	0.00	10.78	40.70	73.52%	0.00%	0.00%	26.48%	40.7	1.0
Methyl Isobutyl Ketone	10211.45						0.197			0.0037		2011.42	38.21	0.035	1	0	0	0.024	1.35	0.00	0.00	8.65	10.00	13.49%	0.00%	0.00%	86.51%	10	1.0
n-butyl Benzene	7857.27			1.67			1.022			0.1227	13133.60	8033.04	964.40	0.035	1	0	0	0.024	34.04	0.00	0.00	6.66	40.70	83.64%	0.00%	0.00%	16.36%	40.7	1.0
Tetrachloroethylene	7733.34						1.018			0.0390		7868.74	301.65	0.035	1	0	0	0.024	10.65	0.00	0.00	6.55	17.20	61.91%	0.00%	0.00%	38.09%	17.2	1.0
Toluene	17199.83						1.014			0.0430		17441.90	740.18	0.035	1	0	0	0.024	26.13	0.00	0.00	14.57	40.70	64.20%	0.00%	0.00%	35.80%	40.7	1.0
Trans-1,2-dichloroethylene	11881.41						1.011			0.0170		12013.06	202.10	0.035	1	0	0	0.024	7.13	0.00	0.00	10.07	17.20	41.48%	0.00%	0.00%	58.52%	17.2	1.0
Trichloroethylene (TCE)	7497.82						1.012			0.0410		7591.18	307.30	0.035	1	0	0	0.024	10.85	0.00	0.00	6.35	17.20	63.07%	0.00%	0.00%	36.93%	17.2	1.0
Xylene	13419.08			3.43			1.016			0.0619	46049.36	13634.45	830.92	0.035	1	0	0	0.024	29.33	0.00	0.00	11.37	40.70	72.07%	0.00%	0.00%	27.93%	40.7	1.0
Acenaphthene	38361.66	-5.562	-0.8556				1.470			0	0.00	56391.64	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	32.50	32.50	0.00%	0.00%	0.00%	100.00%	32.5	1.0
Acenaphthylene	38361.66	-1.144	0.791				22.9			0	1345.95	878482.06	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	32.50	32.50	0.00%	0.00%	0.00%	100.00%	32.5	1.0
Anthracene	38361.66	-0.9887	0.7784				2.42			0	1376.32	92835.22	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	32.50	32.50	0.00%	0.00%	0.00%	100.00%	32.5	1.0
Benzo(a)pyrene	767.23	-2.0615	0.975				1.33			0	82.70	1020.42	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.65	0.65	0.00%	0.00%	0.00%	100.00%	0.65	1.0
Benzo(a)anthracene	767.23	-2.7078	0.5944				1.59			0	3.46	1219.90	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.65	0.65	0.00%	0.00%	0.00%	100.00%	0.65	1.0
Benzo(b)fluoranthene	767.23			0.31			2.6			0	237.84	1994.81	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.65	0.65	0.00%	0.00%	0.00%	100.00%	0.65	1.0
Benzo(ghi)perylene	767.23	-0.9313	1.1829				2.94			0	1018.88	2255.67	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.65	0.65	0.00%	0.00%	0.00%	100.00%	0.65	1.0
Benzo[k]fluoranthene	767.23	-4.6482	0.1668				2.6			0	0.03	1994.81	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.65	0.65	0.00%	0.00%	0.00%	100.00%	0.65	1.0
Chrysene	767.23	-2.7078	0.5944				2.29			0	3.46	1756.96	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.65	0.65	0.00%	0.00%	0.00%	100.00%	0.65	1.0
Dibenz(ah)anthracene	767.23			0.13			2.31			0	99.74	1772.31	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.65	0.65	0.00%	0.00%	0.00%	100.00%	0.65	1.0

Table A-4. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Red-tailed Hawk

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Fluoranthene	767.23			0.5			3.04			0	383.62	2332.39	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.65	0.65	0.00%	0.00%	0.00%	100.00%	0.65	1.0
Fluorene	38361.66	-5.562	-0.8556				9.57			0	0.00	367121.10	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	32.50	32.50	0.00%	0.00%	0.00%	100.00%	32.5	1.0
Indeno[1,2,3-cd]pyrene	767.23			0.11			2.86			0	84.40	2194.29	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.65	0.65	0.00%	0.00%	0.00%	100.00%	0.65	1.0
2-Methylnaphthalene	38361.66	-1.3205	4.544				1.020			0	18019551830566900000 00.00	39122.94	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	32.50	32.50	0.00%	0.00%	0.00%	100.00%	32.5	1.0
Naphthalene	38361.66			12.2			4.4			0	468012.28	168791.31	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	32.50	32.50	0.00%	0.00%	0.00%	100.00%	32.5	1.0
Phenanthrene	38361.66	-0.1665	0.6203				1.72			0	590.31	65982.06	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	32.50	32.50	0.00%	0.00%	0.00%	100.00%	32.5	1.0
Pyrene	767.23			0.72			1.75			0	552.41	1342.66	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.65	0.65	0.00%	0.00%	0.00%	100.00%	0.65	1.0
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Low MW PAHs	38361.66	-1.3205	0.4544							0	32.32		0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	32.50	32.50	0.00%	0.00%	0.00%	100.00%	32.5	1.0
High MW PAHs	767.23	-1.7026	0.9469							0	98.24		0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.65	0.65	0.00%	0.00%	0.00%	100.00%	0.65	1.0
Gasoline Range Organics																												500	---
TPH - Diesel	590179.41									0			0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	500.00	500.00	0.00%	0.00%	0.00%	100.00%	500	1.0
TPH - Kerosene	590179.41									0			0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	500.00	500.00	0.00%	0.00%	0.00%	100.00%	500	1.0
Normal paraffin hydrocarbons	959631.73									0			0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	813.00	813.00	0.00%	0.00%	0.00%	100.00%	813	1.0
Phenol	1.00						0.235			0.0064		0.23	0.01	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	21.07%	0.00%	0.00%	78.93%	---	---
2-methylphenol (ocresol)	1.00						0.336			0.0150		0.34	0.02	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	38.52%	0.00%	0.00%	61.48%	---	---
4-methylphenol (pcresol)	1.00						0.333			0.0141		0.33	0.01	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	37.05%	0.00%	0.00%	62.95%	---	---
2,4-dinitrotoluene	7.17	1.873	-0.3768	0.376			0.184			0.0155	2.70	1.32	0.11	0.035	1	0	0	0.024	0.00	0.00	0.00	0.01	0.01	39.26%	0.00%	0.00%	60.74%	0.01	1.0
Bis[2-ethylhexyl] phthalate	263.03			0.07			41.144			0.0945	17.35	10822.33	24.85	0.035	1	0	0	0.024	0.88	0.00	0.00	0.22	1.10	79.74%	0.00%	0.00%	20.26%	1.1	1.0
Total PCBs	25.09			0.17	1.41	1.36				0.1792	4.25	327.82	4.50	0.035	1	0	0	0.024	0.16	0.00	0.00	0.02	0.18	88.19%	0.00%	0.00%	11.81%	0.18	1.0
Aroclor 1016	21.75			0.30	1.41	1.36				0.2104	6.46	270.01	4.58	0.035	1	0	0	0.024	0.16	0.00	0.00	0.02	0.18	89.76%	0.00%	0.00%	10.24%	0.18	1.0
Aroclor 1221	24.02			0.78	1.41	1.36				0.1883	18.84	308.94	4.52	0.035	1	0	0	0.024	0.16	0.00	0.00	0.02	0.18	88.70%	0.00%	0.00%	11.30%	0.18	1.0
Aroclor 1232	26.24			0.99	1.41	1.36				0.1704	25.99	348.38	4.47	0.035	1	0	0	0.024	0.16	0.00	0.00	0.02	0.18	87.65%	0.00%	0.00%	12.35%	0.18	1.0
Aroclor 1242	25.55			0.16	1.41	1.36				0.1756	4.13	336.08	4.49	0.035	1	0	0	0.024	0.16	0.00	0.00	0.02	0.18	87.97%	0.00%	0.00%	12.03%	0.18	1.0
Aroclor 1248	24.33			0.18	1.41	1.36				0.1855	4.49	314.50	4.52	0.035	1	0	0	0.024	0.16	0.00	0.00	0.02	0.18	88.55%	0.00%	0.00%	11.45%	0.18	1.0
Aroclor 1254	27.26			0.14	1.41	1.36				0.1630	3.80	367.09	4.44	0.035	1	0	0	0.024	0.16	0.00	0.00	0.02	0.18	87.17%	0.00%	0.00%	12.83%	0.18	1.0
Aroclor 1260	51.49			0.05	1.41	1.36				0.0750	2.69	871.55	3.86	0.035	1	0	0	0.024	0.14	0.00	0.00	0.04	0.18	75.77%	0.00%	0.00%	24.23%	0.18	1.0
Aroclor-1262	212.46													0.035	1	0	0	0.024	0.00	0.00	0.00	0.18	0.18	0.00%	0.00%	0.00%	100.00%	0.18	1.0
Dichloroprop	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Aldrin	1.06			0.14			1.033			0.1630	0.15	1.10	0.17	0.035	1	0	0	0.024	0.01	0.00	0.00	0.00	0.01	87.17%	0.00%	0.00%	12.83%	0.007	1.0
beta-1,2,3,4,5,6-Hexachlorocyclohexane	112.24			1.72			1.021			0.1201	192.94	114.61	13.48	0.035	1	0	0	0.024	0.48	0.00	0.00	0.10	0.57	83.35%	0.00%	0.00%	16.65%	0.571	1.0
alpha-Chlordane	301.53			0.16			1.031			0.1771	49.69	311.02	53.39	0.035	1	0	0	0.024	1.88	0.00	0.00	0.26	2.14	88.06%	0.00%	0.00%	11.94%	2.14	1.0
gamma-Chlordane	301.53			0.16			1.036			0.1771	49.69	312.26	53.39	0.035	1	0	0	0.024	1.88	0.00	0.00	0.26	2.14	88.06%	0.00%	0.00%	11.94%	2.14	1.0
Dichlorodiphenyldichloroethylene	0.06	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		0.01	1.03	6.43	0.035	1	0	0	0.024	0.23	0.00	0.00	0.00	0.23	99.98%	0.00%	0.00%	0.02%	0.227	1.0
Dichlorodiphenyltrichloroethane	2.53	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		0.16	18.74	6.37	0.035	1	0	0	0.024	0.22	0.00	0.00	0.00	0.23	99.06%	0.00%	0.00%	0.94%	0.227	1.0
Dieldrin	1.64			0.41			14.70			1.20	0.67	24.12	1.97	0.035	1	0	0	0.024	0.07	0.00	0.00	0.00	0.07	98.04%	0.00%	0.00%	1.96%	0.0709	1.0
Endosulfan I	1671.48			1.31			1.184			0.1455	2191.45	1978.68	243.17	0.035	1	0	0	0.024	8.58	0.00	0.00	1.42	10.00	85.84%	0.00%	0.00%	14.16%	10	1.0

Table A-4. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Red-tailed Hawk

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Endosulfan II	1671.48			1.31			1.184			0.1455	2191.45	1978.68	243.17	0.035	1	0	0	0.024	8.58	0.00	0.00	1.42	10.00	85.84%	0.00%	0.00%	14.16%	10	1.0
Endosulfan sulfate	2159.84			1.98			1.184			0.1072	4271.29	2556.79	231.45	0.035	1	0	0	0.024	8.17	0.00	0.00	1.83	10.00	81.70%	0.00%	0.00%	18.30%	10	1.0
Endrin aldehyde	52.86			1.44			6.686			0.1368	76.09	353.43	7.23	0.035	1	0	0	0.024	0.26	0.00	0.00	0.04	0.30	85.07%	0.00%	0.00%	14.93%	0.3	1.0
Methoxychlor	1.00			0.52			3.739			0.2093	0.52	3.74	0.21	0.035	1	0	0	0.024	0.01	0.00	0.00	0.00	0.01	89.71%	0.00%	0.00%	10.29%	---	---

Notes:

It has been conservatively assumed that all chemical intake is absorbed by the receptor.

1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.

Acronyms:

BAF = Bioaccumulation factor

DW = Dry weight

FIR = Food ingestion rate

mg/kg = Miligrams per kilogram

mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight

mg/kg/d = Miligrams per kilogram per day

NOAEL = No observed adverse effect level

PRGs = Preliminary remediation goals

TRV = Toxicity reference value

Equations:

Total Estimated Exposure = Food Intake + Incidental Soil Intake

Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)

Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)

Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0

where: B1 = slope and B0 = intercept

Estimated Concentrations in Biota (method 2) = soil concentration X BAF

Hazard Quotient = Total Estimated Exposure (Dose) / TRV

Therefore, when the HQ = 1, soil concentration = PRG

where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Table A-5. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Great Basin Pocket Mouse

Analyte	Soil PRG[1] (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Aluminum	687.18			0.00287			0.043			0.0263	1.97	29.55	18.07	0.123	0	0	1	0.02	0.00	0.00	0.24	1.69	1.93	0.00%	0.00%	12.55%	87.45%	1.93	1.0
Antimony	8.82	-3.233	0.938				1			0.001 * 50 * Cdiet	0.30	8.82	0.44	0.123	0	0	1	0.02	0.00	0.00	0.04	0.02	0.06	0.00%	0.00%	63.28%	36.72%	0.059	1.0
Arsenic, Total all valence states	264.76	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		3.17	12.40	0.76	0.123	0	0	1	0.02	0.00	0.00	0.39	0.65	1.04	0.00%	0.00%	37.46%	62.54%	1.04	1.0
Arsenic (III)	264.76	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		3.17	12.40	0.76	0.123	0	0	1	0.02	0.00	0.00	0.39	0.65	1.04	0.00%	0.00%	37.46%	62.54%	1.04	1.0
Arsenic (V)	264.76	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		3.17	12.40	0.76	0.123	0	0	1	0.02	0.00	0.00	0.39	0.65	1.04	0.00%	0.00%	37.46%	62.54%	1.04	1.0
Barium	2081.99			0.156			0.091			0.0168	324.79	189.46	34.98	0.123	0	0	1	0.02	0.00	0.00	39.89	5.11	45.00	0.00%	0.00%	88.64%	11.36%	45	1.0
Beryllium	13.95	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	4.05	0.63	0.03	0.123	0	0	1	0.02	0.00	0.00	0.50	0.03	0.53	0.00%	0.00%	93.56%	6.44%	0.532	1.0
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	20.00%	80.00%	---	---
Boron	39.76			5.714			1			1	227.21	39.76	39.76	0.123	0	0	1	0.02	0.00	0.00	27.90	0.10	28.00	0.00%	0.00%	99.65%	0.35%	28	1.0
Cadmium	76.19	-0.476	0.546		2.114	0.795		-1.2571	0.4723		6.62	259.54	2.20	0.123	0	0	1	0.02	0.00	0.00	0.81	0.19	1.00	0.00%	0.00%	81.29%	18.71%	1	1.0
Chromium (total)	320.38			0.041			0.306	-1.4599	0.7338		13.14	98.03	16.02	0.123	0	0	1	0.02	0.00	0.00	1.61	0.79	2.40	0.00%	0.00%	67.21%	32.79%	2.4	1.0
Chromium (+3)	320.38			0.041			0.306	-1.4599	0.7338		13.14	98.03	16.02	0.123	0	0	1	0.02	0.00	0.00	1.61	0.79	2.40	0.00%	0.00%	67.21%	32.79%	2.4	1.0
Chromium (+6)	1233.45			0.041			0.306	-1.4599	0.7338		50.57	377.43	43.08	0.123	0	0	1	0.02	0.00	0.00	6.21	3.03	9.24	0.00%	0.00%	67.21%	32.79%	9.24	1.0
Cobalt	2174.40			0.00745			0.291	-4.4669	1.307		16.20	632.75	264.21	0.123	0	0	1	0.02	0.00	0.00	1.99	5.34	7.33	0.00%	0.00%	27.14%	72.86%	7.33	1.0
Copper	872.95	0.669	0.394				0.515	2.042	0.1444		28.14	449.57	20.49	0.123	0	0	1	0.02	0.00	0.00	3.46	2.14	5.60	0.00%	0.00%	61.71%	38.29%	5.6	1.0
Lead	1204.17	-1.328	0.561		-0.218	0.807		0.0761	0.4422		14.17	246.29	24.85	0.123	0	0	1	0.02	0.00	0.00	1.74	2.96	4.70	0.00%	0.00%	37.05%	62.95%	4.7	1.0
Lithium	3189.29			0.004			0.046			1	12.76	146.71	3189.29	0.123	0	0	1	0.02	0.00	0.00	1.57	7.83	9.40	0.00%	0.00%	16.67%	83.33%	9.4	1.0
Manganese	4227.40			0.0792	-0.809	0.682				0.0205	334.81	132.32	86.66	0.123	0	0	1	0.02	0.00	0.00	41.12	10.38	51.50	0.00%	0.00%	79.84%	20.16%	51.5	1.0
Mercury (methyl)	0.49	-0.996	0.544		0.0781	0.3369				0.054	0.25	0.85	0.03	0.123	0	0	1	0.02	0.00	0.00	0.03	0.00	0.03	0.00%	0.00%	96.23%	3.77%	0.032	1.0
Mercury (inorganic)	1.00	-0.996	0.544		0.0781	0.3369				0.054	0.37	1.08	0.05	0.123	0	0	1	0.02	0.00	0.00	0.05	0.00	0.05	0.00%	0.00%	94.86%	5.14%	---	---
Molybdenum	1.67			1.2504			0.953			1	2.08	1.59	1.67	0.123	0	0	1	0.02	0.00	0.00	0.26	0.00	0.26	0.00%	0.00%	98.43%	1.57%	0.26	1.0
Nickel	303.26	-2.224	0.748				1.059	-0.2462	0.4658		7.77	321.16	11.20	0.123	0	0	1	0.02	0.00	0.00	0.95	0.74	1.70	0.00%	0.00%	56.17%	43.83%	1.7	1.0
Selenium	2.05	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		1.12	1.57	0.87	0.123	0	0	1	0.02	0.00	0.00	0.14	0.01	0.14	0.00%	0.00%	96.47%	3.53%	0.143	1.0
Silver	1441.77			0.014			2.045			0.0040	20.18	2948.42	5.77	0.123	0	0	1	0.02	0.00	0.00	2.48	3.54	6.02	0.00%	0.00%	41.18%	58.82%	6.02	1.0
Strontium	9442.09			0.207			0.4066			1.74	1952.74	3839.42	16431.42	0.123	0	0	1	0.02	0.00	0.00	239.81	23.19	263.00	0.00%	0.00%	91.18%	8.82%	263	1.0
Thallium	5.09			0.004			0.0541			0.1124	0.02	0.28	0.57	0.123	0	0	1	0.02	0.00	0.00	0.00	0.01	0.02	0.00%	0.00%	16.67%	83.33%	0.015	1.0
Tin	186.81			1			0.08			0.08	186.81	14.94	14.94	0.123	0	0	1	0.02	0.00	0.00	22.94	0.46	23.40	0.00%	0.00%	98.04%	1.96%	23.4	1.0
Uranium	55.61			0.021			0.033			0.0002	1.17	1.84	0.01	0.123	0	0	1	0.02	0.00	0.00	0.14	0.14	0.28	0.00%	0.00%	51.22%	48.78%	0.28	1.0
Vanadium	1363.15			0.00485			0.042			0.0123	6.61	57.25	16.77	0.123	0	0	1	0.02	0.00	0.00	0.81	3.35	4.16	0.00%	0.00%	19.52%	80.48%	4.16	1.0
Zinc	4611.56	1.575	0.555		4.449	0.328		4.3632	0.0706		521.73	1361.19	142.42	0.123	0	0	1	0.02	0.00	0.00	64.07	11.33	75.40	0.00%	0.00%	84.98%	15.02%	75.4	1.0
Ammonia/Ammonium	1.00													0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Chloride	1.00													0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Cyanide	27970.79													0.123	0	0	1	0.02	0.00	0.00	0.00	68.70	68.70	0.00%	0.00%	0.00%	100.00%	68.7	1.0
Fluoride	9824.70			0.006							58.95			0.123	0	0	1	0.02	0.00	0.00	7.24	24.13	31.37	0.00%	0.00%	23.08%	76.92%	31.37	1.0
Iodine	159.37			0.05							7.97			0.123	0	0	1	0.02	0.00	0.00	0.98	0.39	1.37	0.00%	0.00%	71.43%	28.57%	1.37	1.0
Nitrate/Nitrite	206421.95													0.123	0	0	1	0.02	0.00	0.00	0.00	507.00	507.00	0.00%	0.00%	0.00%	100.00%	507	1.0
Phosphate	1.00													0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Sulfate/Sulfite	1.00													0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Total Organic Carbon	1.00													0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---

Table A-5. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Great Basin Pocket Mouse

Analyte	Soil PRG[1] (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
1,1-dichloroethane	20357.19						1.010			0.0109		20552.44	222.23	0.123	0	0	1	0.02	0.00	0.00	0.00	50.00	50.00	0.00%	0.00%	0.00%	100.00%	50	1.0
1,1-dichloroethene	12214.32						1.011			0.0186		12351.46	227.41	0.123	0	0	1	0.02	0.00	0.00	0.00	30.00	30.00	0.00%	0.00%	0.00%	100.00%	30	1.0
1,1,1-trichloroethane	407143.89						1.013			0.0305		412362.69	12429.63	0.123	0	0	1	0.02	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0
1,1,2-trichloroethane	407143.89						1.010			0.0165		411304.24	6717.39	0.123	0	0	1	0.02	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0
1,1,2,2-tetrachloroethane	3635.79						1.013			0.0270		3682.82	98.27	0.123	0	0	1	0.02	0.00	0.00	0.00	8.93	8.93	0.00%	0.00%	0.00%	100.00%	8.93	1.0
1,2-dichlorobenzene	282.35			2.45			1.018			0.0882	692.20	287.34	24.90	0.123	0	0	1	0.02	0.00	0.00	85.01	0.69	85.70	0.00%	0.00%	99.19%	0.81%	85.7	1.0
1,2-dichloroethane (DCA)	20357.19						0.988			0.0063		20120.49	128.14	0.123	0	0	1	0.02	0.00	0.00	0.00	50.00	50.00	0.00%	0.00%	0.00%	100.00%	50	1.0
1,3-dichlorobenzene	309.75			2.23			1.018			0.0963	691.65	315.34	29.82	0.123	0	0	1	0.02	0.00	0.00	84.94	0.76	85.70	0.00%	0.00%	99.11%	0.89%	85.7	1.0
2-butanone (Methyl Ethyl Ketone/MEK)	721051.83						0.094			0.0006		67489.02	398.05	0.123	0	0	1	0.02	0.00	0.00	0.00	1771.00	1771.00	0.00%	0.00%	0.00%	100.00%	1771	1.0
2-hexanone	2035.72						0.207			0.0053		422.00	10.88	0.123	0	0	1	0.02	0.00	0.00	0.00	5.00	5.00	0.00%	0.00%	0.00%	100.00%	5	1.0
Benzene	285.00						1.011			0.0186		288.20	5.31	0.123	0	0	1	0.02	0.00	0.00	0.00	0.70	0.70	0.00%	0.00%	0.00%	100.00%	0.7	1.0
Butanol	50892.99						0.478			0.0017		24337.90	86.96	0.123	0	0	1	0.02	0.00	0.00	0.00	125.00	125.00	0.00%	0.00%	0.00%	100.00%	125	1.0
Carbon Tetrachloride	6514.30						1.015			0.0420		6610.13	273.61	0.123	0	0	1	0.02	0.00	0.00	0.00	16.00	16.00	0.00%	0.00%	0.00%	100.00%	16	1.0
Chlorobenzene	7939.31						1.015			0.0490		8055.51	389.23	0.123	0	0	1	0.02	0.00	0.00	0.00	19.50	19.50	0.00%	0.00%	0.00%	100.00%	19.5	1.0
Chloroform	6107.16						1.011			0.0135		6171.41	82.28	0.123	0	0	1	0.02	0.00	0.00	0.00	15.00	15.00	0.00%	0.00%	0.00%	100.00%	15	1.0
Cis-1,2-dichloroethylene	18402.90						1.011			0.0122		18606.82	225.21	0.123	0	0	1	0.02	0.00	0.00	0.00	45.20	45.20	0.00%	0.00%	0.00%	100.00%	45.2	1.0
Dichloromethane (Methylene Chloride)	2381.79						1.007			0.0042		2397.88	9.99	0.123	0	0	1	0.02	0.00	0.00	0.00	5.85	5.85	0.00%	0.00%	0.00%	100.00%	5.85	1.0
Ethyl Benzene	342.39			3.21			1.016			0.0666	1100.58	347.94	22.82	0.123	0	0	1	0.02	0.00	0.00	135.16	0.84	136.00	0.00%	0.00%	99.38%	0.62%	136	1.0
Methyl Isobutyl Ketone	721051.83						0.197			0.0037		142030.74	2698.19	0.123	0	0	1	0.02	0.00	0.00	0.00	1771.00	1771.00	0.00%	0.00%	0.00%	100.00%	1771	1.0
n-butyl Benzene	529.53			1.67			1.022			0.1227	885.13	541.38	64.99	0.123	0	0	1	0.02	0.00	0.00	108.70	1.30	110.00	0.00%	0.00%	98.82%	1.18%	110	1.0
Tetrachloroethylene	570.00						1.018			0.0390		579.98	22.23	0.123	0	0	1	0.02	0.00	0.00	0.00	1.40	1.40	0.00%	0.00%	0.00%	100.00%	1.4	1.0
Toluene	21171.48						1.014			0.0430		21469.46	911.10	0.123	0	0	1	0.02	0.00	0.00	0.00	52.00	52.00	0.00%	0.00%	0.00%	100.00%	52	1.0
Trans-1,2-dichloroethylene	18402.90						1.011			0.0170		18606.82	313.03	0.123	0	0	1	0.02	0.00	0.00	0.00	45.20	45.20	0.00%	0.00%	0.00%	100.00%	45.2	1.0
Trichloroethylene (TCE)	285.00						1.012			0.0410		288.55	11.68	0.123	0	0	1	0.02	0.00	0.00	0.00	0.70	0.70	0.00%	0.00%	0.00%	100.00%	0.7	1.0
Xylene	422.29			3.43			1.016			0.0619	1449.13	429.06	26.15	0.123	0	0	1	0.02	0.00	0.00	177.96	1.04	179.00	0.00%	0.00%	99.42%	0.58%	179	1.0
Acenaphthene	71250.18	-5.562	-0.8556				1.470			0	0.00	104737.77	0.00	0.123	0	0	1	0.02	0.00	0.00	0.00	175.00	175.00	0.00%	0.00%	0.00%	100.00%	175	1.0
Acenaphthylene	24320.69	-1.144	0.791				22.9			0	938.59	556943.73	0.00	0.123	0	0	1	0.02	0.00	0.00	115.26	59.73	175.00	0.00%	0.00%	65.87%	34.13%	175	1.0
Anthracene	178810.67	-0.9887	0.7784				2.42			0	4561.17	432721.83	0.00	0.123	0	0	1	0.02	0.00	0.00	560.14	439.18	999.33	0.00%	0.00%	56.05%	43.95%	1000	1.0
Benzo(a)pyrene	60.38	-2.0615	0.975				1.33			0	6.94	80.30	0.00	0.123	0	0	1	0.02	0.00	0.00	0.85	0.15	1.00	0.00%	0.00%	85.17%	14.83%	1	1.0
Benzo(a)anthracene	306.81	-2.7078	0.5944				1.59			0	2.01	487.83	0.00	0.123	0	0	1	0.02	0.00	0.00	0.25	0.75	1.00	0.00%	0.00%	24.63%	75.37%	1	1.0
Benzo(b)fluoranthene	24.68			0.31			2.6			0	7.65	64.16	0.00	0.123	0	0	1	0.02	0.00	0.00	0.94	0.06	1.00	0.00%	0.00%	93.94%	6.06%	1	1.0
Benzo(ghi)perylene	12.60	-0.9313	1.1829				2.94			0	7.89	37.04	0.00	0.123	0	0	1	0.02	0.00	0.00	0.97	0.03	1.00	0.00%	0.00%	96.91%	3.09%	1	1.0
Benzo[k]fluoranthene	405.73	-4.6482	0.1668				2.6			0	0.03	1054.90	0.00	0.123	0	0	1	0.02	0.00	0.00	0.00	1.00	1.00	0.00%	0.00%	0.32%	99.68%	1	1.0
Chrysene	306.81	-2.7078	0.5944				2.29			0	2.01	702.59	0.00	0.123	0	0	1	0.02	0.00	0.00	0.25	0.75	1.00	0.00%	0.00%	24.63%	75.37%	1	1.0
Dibenz(ah)anthracene	54.29			0.13			2.31			0	7.06	125.40	0.00	0.123	0	0	1	0.02	0.00	0.00	0.87	0.13	1.00	0.00%	0.00%	86.67%	13.33%	1	1.0
Fluoranthene	1957.42			0.5			3.04			0	978.71	5950.56	0.00	0.123	0	0	1	0.02	0.00	0.00	120.19	4.81	125.00	0.00%	0.00%	96.15%	3.85%	125	1.0
Fluorene	50892.99	-5.562	-0.8556				9.57			0	0.00	487045.88	0.00	0.123	0	0	1	0.02	0.00	0.00	0.00	125.00	125.00	0.00%	0.00%	0.00%	100.00%	125	1.0
Indeno[1,2,3-cd]pyrene	62.64			0.11			2.86			0	6.89	179.14	0.00	0.123	0	0	1	0.02	0.00	0.00	0.85	0.15	1.00	0.00%	0.00%	84.62%	15.38%	1	1.0
2-Methylnaphthalene	5.02	-1.3205	4.544				1.020			0	409.47	5.12	0.00	0.123	0	0	1	0.02	0.00	0.00	50.29	0.01	50.30	0.00%	0.00%	99.98%	0.02%	50.3	1.0

Table A-5. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Great Basin Pocket Mouse

Analyte	Soil PRG[1] (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Naphthalene	33.32			12.2			4.4			0	406.48	146.60	0.00	0.123	0	0	1	0.02	0.00	0.00	49.92	0.08	50.00	0.00%	0.00%	99.84%	0.16%	50	1.0
Phenanthrene	301134.27	-0.1665	0.6203				1.72			0	2119.17	517950.95	0.00	0.123	0	0	1	0.02	0.00	0.00	260.25	739.63	999.87	0.00%	0.00%	26.03%	73.97%	1000	1.0
Pyrene	825.29			0.72			1.75			0	594.21	1444.26	0.00	0.123	0	0	1	0.02	0.00	0.00	72.97	2.03	75.00	0.00%	0.00%	97.30%	2.70%	75	1.0
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	0.123	0	0	1	0.02	0.00	0.00	0.13	0.00	0.14	0.00%	0.00%	98.19%	1.81%		---
Low MW PAHs	25368.94	-1.3205	0.4544							0	26.78		0.00	0.123	0	0	1	0.02	0.00	0.00	3.29	62.31	65.60	0.00%	0.00%	5.01%	94.99%	65.6	1.0
High MW PAHs	29.05	-1.7026	0.9469							0	4.43		0.00	0.123	0	0	1	0.02	0.00	0.00	0.54	0.07	0.61	0.00%	0.00%	88.40%	11.60%	0.615	1.0
Gasoline Range Organics																												1000	---
TPH - Diesel	407143.89									0			0.00	0.123	0	0	1	0.02	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0
TPH - Kerosene	407143.89									0			0.00	0.123	0	0	1	0.02	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0
Normal paraffin hydrocarbons	407143.89									0			0.00	0.123	0	0	1	0.02	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0
Phenol	4885.73						0.235			0.0064		1147.19	31.31	0.123	0	0	1	0.02	0.00	0.00	0.00	12.00	12.00	0.00%	0.00%	0.00%	100.00%	12	1.0
2-methylphenol (ocresol)	127436.04						0.336			0.0150		42779.65	1916.65	0.123	0	0	1	0.02	0.00	0.00	0.00	313.00	313.00	0.00%	0.00%	0.00%	100.00%	313	1.0
4-methylphenol (pcresol)	127436.04						0.333			0.0141		42476.12	1800.30	0.123	0	0	1	0.02	0.00	0.00	0.00	313.00	313.00	0.00%	0.00%	0.00%	100.00%	313	1.0
2,4-dinitrotoluene	13.78	1.873	-0.3768	0.376			0.184			0.0155	5.18	2.53	0.21	0.123	0	0	1	0.02	0.00	0.00	0.64	0.03	0.67	0.00%	0.00%	94.95%	5.05%	0.67	1.0
Bis[2-ethylhexyl] phthalate	1733.20			0.07			41.144			0.0945	114.35	71311.01	163.73	0.123	0	0	1	0.02	0.00	0.00	14.04	4.26	18.30	0.00%	0.00%	76.74%	23.26%	18.3	1.0
Total PCBs	2.92			0.17	1.41	1.36				0.1792	0.50	17.61	0.52	0.123	0	0	1	0.02	0.00	0.00	0.06	0.01	0.07	0.00%	0.00%	89.45%	10.55%	0.068	1.0
Aroclor 1016	35.21			0.30	1.41	1.36				0.2104	10.45	519.70	7.41	0.123	0	0	1	0.02	0.00	0.00	1.28	0.09	1.37	0.00%	0.00%	93.69%	6.31%	1.37	1.0
Aroclor 1221	0.69			0.78	1.41	1.36				0.1883	0.54	2.47	0.13	0.123	0	0	1	0.02	0.00	0.00	0.07	0.00	0.07	0.00%	0.00%	97.51%	2.49%	0.068	1.0
Aroclor 1232	0.55			0.99	1.41	1.36				0.1704	0.54	1.81	0.09	0.123	0	0	1	0.02	0.00	0.00	0.07	0.00	0.07	0.00%	0.00%	98.02%	1.98%	0.068	1.0
Aroclor 1242	3.09			0.16	1.41	1.36				0.1756	0.50	19.01	0.54	0.123	0	0	1	0.02	0.00	0.00	0.06	0.01	0.07	0.00%	0.00%	89.00%	11.00%	0.069	1.0
Aroclor 1248	0.35			0.18	1.41	1.36				0.1855	0.06	0.97	0.06	0.123	0	0	1	0.02	0.00	0.00	0.01	0.00	0.01	0.00%	0.00%	90.21%	9.79%	0.0087	1.0
Aroclor 1254	3.48			0.14	1.41	1.36				0.1630	0.48	22.30	0.57	0.123	0	0	1	0.02	0.00	0.00	0.06	0.01	0.07	0.00%	0.00%	87.45%	12.55%	0.068	1.0
Aroclor 1260	7.67			0.05	1.41	1.36				0.0750	0.40	65.36	0.58	0.123	0	0	1	0.02	0.00	0.00	0.05	0.02	0.07	0.00%	0.00%	72.31%	27.69%	0.068	1.0
Aroclor-1262	27.69													0.123	0	0	1	0.02	0.00	0.00	0.00	0.07	0.07	0.00%	0.00%	0.00%	100.00%	0.068	1.0
Dichloroprop	1.00													0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Aldrin	10.22			0.14			1.033			0.1630	1.42	10.56	1.67	0.123	0	0	1	0.02	0.00	0.00	0.17	0.03	0.20	0.00%	0.00%	87.45%	12.55%	0.2	1.0
beta-1,2,3,4,5,6-Hexachlorocyclohexane	1.87			1.72			1.021			0.1201	3.22	1.91	0.22	0.123	0	0	1	0.02	0.00	0.00	0.40	0.00	0.40	0.00%	0.00%	98.85%	1.15%	0.4	1.0
alpha-Chlordane	92.53			0.16			1.031			0.1771	15.25	95.44	16.38	0.123	0	0	1	0.02	0.00	0.00	1.87	0.23	2.10	0.00%	0.00%	89.18%	10.82%	2.1	1.0
gamma-Chlordane	92.53			0.16			1.036			0.1771	15.25	95.82	16.38	0.123	0	0	1	0.02	0.00	0.00	1.87	0.23	2.10	0.00%	0.00%	89.18%	10.82%	2.1	1.0
Dichlorodiphenyldichloroethylene	20.48	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		0.79	169.96	263.92	0.123	0	0	1	0.02	0.00	0.00	0.10	0.05	0.15	0.00%	0.00%	65.76%	34.24%	0.147	1.0
Dichlorodiphenyltrichloroethane	20.48	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		0.79	115.40	29.06	0.123	0	0	1	0.02	0.00	0.00	0.10	0.05	0.15	0.00%	0.00%	65.76%	34.24%	0.147	1.0
Dieldrin	0.28			0.41			14.70			1.20	0.12	4.18	0.34	0.123	0	0	1	0.02	0.00	0.00	0.01	0.00	0.02	0.00%	0.00%	95.35%	4.65%	0.015	1.0
Endosulfan I	0.92			1.31			1.184			0.1455	1.20	1.09	0.13	0.123	0	0	1	0.02	0.00	0.00	0.15	0.00	0.15	0.00%	0.00%	98.50%	1.50%	0.15	1.0
Endosulfan II	0.92			1.31			1.184			0.1455	1.20	1.09	0.13	0.123	0	0	1	0.02	0.00	0.00	0.15	0.00	0.15	0.00%	0.00%	98.50%	1.50%	0.15	1.0
Endosulfan sulfate	0.61			1.98			1.184			0.1072	1.21	0.72	0.07	0.123	0	0	1	0.02	0.00	0.00	0.15	0.00	0.15	0.00%	0.00%	99.00%	1.00%	0.15	1.0
Endrin aldehyde	0.51			1.44			6.686			0.1368	0.74	3.43	0.07	0.123	0	0	1	0.02	0.00	0.00	0.09	0.00	0.09	0.00%	0.00%	98.63%	1.37%	0.092	1.0
Methoxychlor	59.78			0.52			3.739			0.2093	31.38	223.52	12.51	0.123	0	0	1	0.02	0.00	0.00	3.85	0.15	4.00	0.00%	0.00%	96.33%	3.67%	4	1.0

Notes:

It has been conservatively assumed that all chemical intake is absorbed by the receptor.

1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.

Acronyms:

Table A-5. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Great Basin Pocket Mouse

Analyte	Soil PRG[1] (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		

BAF = Bioaccumulation factor
DW = Dry weight
FIR = Food ingestion rate
mg/kg = Miligrams per kilogram
mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight
mg/kg/d = Miligrams per kilogram per day
NOAEL = No observed adverse effect level
PRGs = Preliminary remediation goals
TRV = Toxicity reference value

Equations:

Total Estimated Exposure = Food Intake + Incidental Soil Intake
Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)
Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)
Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0
where: B1 = slope and B0 = intercept
Estimated Concentrations in Biota (method 2) = soil concentration X BAF
Hazard Quotient = Total Estimated Exposure (Dose) / TRV
Therefore, when the HQ = 1, soil concentration = PRG
where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Table A-6. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Deer Mouse

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Aluminum	270.79			0.00287			0.043			0.0263	0.78	11.64	7.12	0.166	0	0.5	0.5	0.02	0.00	0.97	0.06	0.90	1.93	0.00%	50.08%	3.34%	46.58%	1.93	1.0
Antimony	0.66	-3.233	0.938				1			0.001 * 50 * Cdiet	0.03	0.66	0.03	0.166	0	0.5	0.5	0.02	0.00	0.05	0.00	0.00	0.06	0.00%	92.55%	3.75%	3.70%	0.059	1.0
Arsenic, Total all valence states	104.92	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		1.88	6.45	0.35	0.166	0	0.5	0.5	0.02	0.00	0.54	0.16	0.35	1.04	0.00%	51.48%	15.02%	33.50%	1.04	1.0
Arsenic (III)	104.92	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		1.88	6.45	0.35	0.166	0	0.5	0.5	0.02	0.00	0.54	0.16	0.35	1.04	0.00%	51.48%	15.02%	33.50%	1.04	1.0
Arsenic (V)	104.92	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		1.88	6.45	0.35	0.166	0	0.5	0.5	0.02	0.00	0.54	0.16	0.35	1.04	0.00%	51.48%	15.02%	33.50%	1.04	1.0
Barium	1889.09			0.156			0.091			0.0168	294.70	171.91	31.74	0.166	0	0.5	0.5	0.02	0.00	14.27	24.46	6.27	45.00	0.00%	31.71%	54.36%	13.94%	45	1.0
Beryllium	17.96	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	4.88	0.81	0.04	0.166	0	0.5	0.5	0.02	0.00	0.07	0.41	0.06	0.53	0.00%	12.61%	76.17%	11.21%	0.532	1.0
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	0.166	0	0.5	0.5	0.02	0.00	0.08	0.00	0.00	0.09	0.00%	95.69%	0.48%	3.83%	---	---
Boron	49.95			5.714			1			1	285.40	49.95	49.95	0.166	0	0.5	0.5	0.02	0.00	4.15	23.69	0.17	28.00	0.00%	14.81%	84.60%	0.59%	28	1.0
Cadmium	1.47	-0.476	0.546		2.114	0.795		-1.2571	0.4723		0.77	11.22	0.34	0.166	0	0.5	0.5	0.02	0.00	0.93	0.06	0.00	1.00	0.00%	93.16%	6.35%	0.49%	1	1.0
Chromium (total)	74.72			0.041			0.306	-1.4599	0.7338		3.06	22.86	5.50	0.166	0	0.5	0.5	0.02	0.00	1.90	0.25	0.25	2.40	0.00%	79.07%	10.59%	10.34%	2.4	1.0
Chromium (+3)	74.72			0.041			0.306	-1.4599	0.7338		3.06	22.86	5.50	0.166	0	0.5	0.5	0.02	0.00	1.90	0.25	0.25	2.40	0.00%	79.07%	10.59%	10.34%	2.4	1.0
Chromium (+6)	287.66			0.041			0.306	-1.4599	0.7338		11.79	88.02	14.80	0.166	0	0.5	0.5	0.02	0.00	7.31	0.98	0.96	9.24	0.00%	79.07%	10.59%	10.34%	9.24	1.0
Cobalt	260.93			0.00745			0.291	-4.4669	1.307		1.94	75.93	16.54	0.166	0	0.5	0.5	0.02	0.00	6.30	0.16	0.87	7.33	0.00%	85.98%	2.20%	11.82%	7.33	1.0
Copper	99.95	0.669	0.394				0.515	2.042	0.1444		11.98	51.47	14.98	0.166	0	0.5	0.5	0.02	0.00	4.27	0.99	0.33	5.60	0.00%	76.31%	17.76%	5.93%	5.6	1.0
Lead	151.05	-1.328	0.561		-0.218	0.807		0.0761	0.4422		4.42	46.12	9.92	0.166	0	0.5	0.5	0.02	0.00	3.83	0.37	0.50	4.70	0.00%	81.50%	7.82%	10.68%	4.7	1.0
Lithium	1258.37			0.004			0.046			1	5.03	57.88	1258.37	0.166	0	0.5	0.5	0.02	0.00	4.80	0.42	4.18	9.40	0.00%	51.11%	4.44%	44.44%	9.4	1.0
Manganese	4115.32			0.0792	-0.809	0.682				0.0205	325.93	129.92	84.36	0.166	0	0.5	0.5	0.02	0.00	10.78	27.05	13.66	51.50	0.00%	20.94%	52.53%	26.53%	51.5	1.0
Mercury (methyl)	0.03	-0.996	0.544		0.0781	0.3369				0.054	0.05	0.33	0.00	0.166	0	0.5	0.5	0.02	0.00	0.03	0.00	0.00	0.03	0.00%	85.59%	14.10%	0.31%	0.032	1.0
Mercury (inorganic)	1.00	-0.996	0.544		0.0781	0.3369				0.054	0.37	1.08	0.05	0.166	0	0.5	0.5	0.02	0.00	0.09	0.03	0.00	0.12	0.00%	72.54%	24.78%	2.68%	---	---
Molybdenum	1.40			1.2504			0.953			1	1.75	1.33	1.40	0.166	0	0.5	0.5	0.02	0.00	0.11	0.14	0.00	0.26	0.00%	42.48%	55.74%	1.78%	0.26	1.0
Nickel	17.77	-2.224	0.748				1.059	-0.2462	0.4658		0.93	18.82	2.99	0.166	0	0.5	0.5	0.02	0.00	1.56	0.08	0.06	1.70	0.00%	91.98%	4.55%	3.47%	1.7	1.0
Selenium	1.19	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		0.62	1.06	0.71	0.166	0	0.5	0.5	0.02	0.00	0.09	0.05	0.00	0.14	0.00%	61.36%	35.86%	2.77%	0.143	1.0
Silver	34.55			0.014			2.045			0.0040	0.48	70.66	0.14	0.166	0	0.5	0.5	0.02	0.00	5.87	0.04	0.11	6.02	0.00%	97.43%	0.67%	1.91%	6.02	1.0
Strontium	4849.22			0.207			0.4066			1.74	1002.88	1971.83	8438.77	0.166	0	0.5	0.5	0.02	0.00	163.66	83.24	16.10	263.00	0.00%	62.23%	31.65%	6.12%	263	1.0
Thallium	1.84			0.004			0.0541			0.1124	0.01	0.10	0.21	0.166	0	0.5	0.5	0.02	0.00	0.01	0.00	0.01	0.02	0.00%	55.15%	4.08%	40.77%	0.015	1.0
Tin	251.72			1			0.08			0.08	251.72	20.14	20.14	0.166	0	0.5	0.5	0.02	0.00	1.67	20.89	0.84	23.40	0.00%	7.14%	89.29%	3.57%	23.4	1.0
Uranium	35.89			0.021			0.033			0.0002	0.75	1.18	0.01	0.166	0	0.5	0.5	0.02	0.00	0.10	0.06	0.12	0.28	0.00%	35.11%	22.34%	42.55%	0.28	1.0
Vanadium	577.09			0.00485			0.042			0.0123	2.80	24.24	7.10	0.166	0	0.5	0.5	0.02	0.00	2.01	0.23	1.92	4.16	0.00%	48.36%	5.58%	46.06%	4.16	1.0
Zinc	633.13	1.575	0.555		4.449	0.328		4.3632	0.0706		173.32	709.69	123.79	0.166	0	0.5	0.5	0.02	0.00	58.90	14.39	2.10	75.39	0.00%	78.13%	19.08%	2.79%	75.4	1.0
Ammonia/Ammonium	1.00													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Chloride	1.00													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Cyanide	20692.77													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	68.70	68.70	0.00%	0.00%	0.00%	100.00%	68.7	1.0
Fluoride	8216.34			0.006							49.30			0.166	0	0.5	0.5	0.02	0.00	0.00	4.09	27.28	31.37	0.00%	0.00%	13.04%	86.96%	31.37	1.0
Iodine	183.40			0.05							9.17			0.166	0	0.5	0.5	0.02	0.00	0.00	0.76	0.61	1.37	0.00%	0.00%	55.56%	44.44%	1.37	1.0
Nitrate/Nitrite	152710.84													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	507.00	507.00	0.00%	0.00%	0.00%	100.00%	507	1.0
Phosphate	1.00													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Sulfate/Sulfite	1.00													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Total Organic Carbon	1.00													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
1,1-dichloroethane	573.95						1.010			0.0109		579.45	6.27	0.166	0	0.5	0.5	0.02	0.00	48.09	0.00	1.91	50.00	0.00%	96.19%	0.00%	3.81%	50	1.0
1,1-dichloroethene	343.83						1.011			0.0186		347.69	6.40	0.166	0	0.5	0.5	0.02	0.00	28.86	0.00	1.14	30.00	0.00%	96.19%	0.00%	3.81%	30	1.0

Table A-6. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Deer Mouse

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
1,1,1-trichloroethane	11443.76						1.013			0.0305		11590.44	349.36	0.166	0	0.5	0.5	0.02	0.00	962.01	0.00	37.99	1000.00	0.00%	96.20%	0.00%	3.80%	1000	1.0
1,1,2-trichloroethane	11472.08						1.010			0.0165		11589.31	189.28	0.166	0	0.5	0.5	0.02	0.00	961.91	0.00	38.09	1000.00	0.00%	96.19%	0.00%	3.81%	1000	1.0
1,1,2,2-tetrachloroethane	102.18						1.013			0.0270		103.50	2.76	0.166	0	0.5	0.5	0.02	0.00	8.59	0.00	0.34	8.93	0.00%	96.20%	0.00%	3.80%	8.93	1.0
1,2-dichlorobenzene	294.23			2.45			1.018			0.0882	721.33	299.43	25.95	0.166	0	0.5	0.5	0.02	0.00	24.85	59.87	0.98	85.70	0.00%	29.00%	69.86%	1.14%	85.7	1.0
1,2-dichloroethane (DCA)	585.79						0.988			0.0063		578.98	3.69	0.166	0	0.5	0.5	0.02	0.00	48.06	0.00	1.94	50.00	0.00%	96.11%	0.00%	3.89%	50	1.0
1,3-dichlorobenzene	313.74			2.23			1.018			0.0963	700.57	319.41	30.20	0.166	0	0.5	0.5	0.02	0.00	26.51	58.15	1.04	85.70	0.00%	30.93%	67.85%	1.22%	85.7	1.0
2-butanone (Methyl Ethyl Ketone/MEK)	159713.07						0.094			0.0006		14948.83	88.17	0.166	0	0.5	0.5	0.02	0.00	1240.75	0.00	530.25	1771.00	0.00%	70.06%	0.00%	29.94%	1771	1.0
2-hexanone	243.60						0.207			0.0053		50.50	1.30	0.166	0	0.5	0.5	0.02	0.00	4.19	0.00	0.81	5.00	0.00%	83.83%	0.00%	16.17%	5	1.0
Benzene	8.02						1.011			0.0186		8.11	0.15	0.166	0	0.5	0.5	0.02	0.00	0.67	0.00	0.03	0.70	0.00%	96.19%	0.00%	3.81%	0.7	1.0
Butanol	2906.16						0.478			0.0017		1389.78	4.97	0.166	0	0.5	0.5	0.02	0.00	115.35	0.00	9.65	125.00	0.00%	92.28%	0.00%	7.72%	125	1.0
Carbon Tetrachloride	182.77						1.015			0.0420		185.46	7.68	0.166	0	0.5	0.5	0.02	0.00	15.39	0.00	0.61	16.00	0.00%	96.21%	0.00%	3.79%	16	1.0
Chlorobenzene	222.77						1.015			0.0490		226.03	10.92	0.166	0	0.5	0.5	0.02	0.00	18.76	0.00	0.74	19.50	0.00%	96.21%	0.00%	3.79%	19.5	1.0
Chloroform	172.03						1.011			0.0135		173.84	2.32	0.166	0	0.5	0.5	0.02	0.00	14.43	0.00	0.57	15.00	0.00%	96.19%	0.00%	3.81%	15	1.0
Cis-1,2-dichloroethylene	518.11						1.011			0.0122		523.85	6.34	0.166	0	0.5	0.5	0.02	0.00	43.48	0.00	1.72	45.20	0.00%	96.19%	0.00%	3.81%	45.2	1.0
Dichloromethane (Methylene Chloride)	67.33						1.007			0.0042		67.79	0.28	0.166	0	0.5	0.5	0.02	0.00	5.63	0.00	0.22	5.85	0.00%	96.18%	0.00%	3.82%	5.85	1.0
Ethyl Benzene	383.68			3.21			1.016			0.0666	1233.31	389.90	25.57	0.166	0	0.5	0.5	0.02	0.00	32.36	102.36	1.27	136.00	0.00%	23.80%	75.27%	0.94%	136	1.0
Methyl Isobutyl Ketone	90039.69						0.197			0.0037		17735.76	336.93	0.166	0	0.5	0.5	0.02	0.00	1472.07	0.00	298.93	1771.00	0.00%	83.12%	0.00%	16.88%	1771	1.0
n-butyl Benzene	484.77			1.67			1.022			0.1227	810.30	495.61	59.50	0.166	0	0.5	0.5	0.02	0.00	41.14	67.25	1.61	110.00	0.00%	37.40%	61.14%	1.46%	110	1.0
Tetrachloroethylene	15.95						1.018			0.0390		16.23	0.62	0.166	0	0.5	0.5	0.02	0.00	1.35	0.00	0.05	1.40	0.00%	96.22%	0.00%	3.78%	1.4	1.0
Toluene	594.37						1.014			0.0430		602.73	25.58	0.166	0	0.5	0.5	0.02	0.00	50.03	0.00	1.97	52.00	0.00%	96.21%	0.00%	3.79%	52	1.0
Trans-1,2-dichloroethylene	518.11						1.011			0.0170		523.85	8.81	0.166	0	0.5	0.5	0.02	0.00	43.48	0.00	1.72	45.20	0.00%	96.19%	0.00%	3.81%	45.2	1.0
Trichloroethylene (TCE)	8.01						1.012			0.0410		8.11	0.33	0.166	0	0.5	0.5	0.02	0.00	0.67	0.00	0.03	0.70	0.00%	96.20%	0.00%	3.80%	0.7	1.0
Xylene	480.57			3.43			1.016			0.0619	1649.13	488.28	29.76	0.166	0	0.5	0.5	0.02	0.00	40.53	136.88	1.60	179.00	0.00%	22.64%	76.47%	0.89%	179	1.0
Acenaphthene	1396.31	-5.562	-0.8556				1.470			0	0.00	2052.58	0.00	0.166	0	0.5	0.5	0.02	0.00	170.36	0.00	4.64	175.00	0.00%	97.35%	0.00%	2.65%	175	1.0
Acenaphthylene	91.39	-1.144	0.791				22.9			0	11.33	2092.90	0.00	0.166	0	0.5	0.5	0.02	0.00	173.71	0.94	0.30	174.95	0.00%	99.29%	0.54%	0.17%	175	1.0
Anthracene	4783.60	-0.9887	0.7784				2.42			0	272.23	11576.30	0.00	0.166	0	0.5	0.5	0.02	0.00	960.83	22.59	15.88	999.31	0.00%	96.15%	2.26%	1.59%	1000	1.0
Benzo(a)pyrene	8.08	-2.0615	0.975				1.33			0	0.98	10.75	0.00	0.166	0	0.5	0.5	0.02	0.00	0.89	0.08	0.03	1.00	0.00%	89.21%	8.10%	2.68%	1	1.0
Benzo(a)anthracene	7.26	-2.7078	0.5944				1.59			0	0.22	11.54	0.00	0.166	0	0.5	0.5	0.02	0.00	0.96	0.02	0.02	1.00	0.00%	95.79%	1.80%	2.41%	1	1.0
Benzo(b)fluoranthene	4.08			0.31			2.6			0	1.27	10.62	0.00	0.166	0	0.5	0.5	0.02	0.00	0.88	0.11	0.01	1.00	0.00%	88.14%	10.51%	1.36%	1	1.0
Benzo(ghi)perylene	3.47	-0.9313	1.1829				2.94			0	1.72	10.19	0.00	0.166	0	0.5	0.5	0.02	0.00	0.85	0.14	0.01	1.00	0.00%	84.61%	14.24%	1.15%	1	1.0
Benzo[k]fluoranthene	4.56	-4.6482	0.1668				2.6			0	0.01	11.85	0.00	0.166	0	0.5	0.5	0.02	0.00	0.98	0.00	0.02	1.00	0.00%	98.38%	0.10%	1.51%	1	1.0
Chrysene	5.09	-2.7078	0.5944				2.29			0	0.18	11.67	0.00	0.166	0	0.5	0.5	0.02	0.00	0.97	0.01	0.02	1.00	0.00%	96.85%	1.46%	1.69%	1	1.0
Dibenz(ah)anthracene	4.86			0.13			2.31			0	0.63	11.22	0.00	0.166	0	0.5	0.5	0.02	0.00	0.93	0.05	0.02	1.00	0.00%	93.15%	5.24%	1.61%	1	1.0
Fluoranthene	420.68			0.5			3.04			0	210.34	1278.86	0.00	0.166	0	0.5	0.5	0.02	0.00	106.15	17.46	1.40	125.00	0.00%	84.92%	13.97%	1.12%	125	1.0
Fluorene	156.71	-5.562	-0.8556				9.57			0	0.00	1499.76	0.00	0.166	0	0.5	0.5	0.02	0.00	124.48	0.00	0.52	125.00	0.00%	99.58%	0.00%	0.42%	125	1.0
Indeno[1,2,3-cd]pyrene	4.00			0.11			2.86			0	0.44	11.45	0.00	0.166	0	0.5	0.5	0.02	0.00	0.95	0.04	0.01	1.00	0.00%	95.02%	3.65%	1.33%	1	1.0
2-Methylnaphthalene	5.47	-1.3205	4.544				1.020			0	600.10	5.57	0.00	0.166	0	0.5	0.5	0.02	0.00	0.46	49.81	0.02	50.29	0.00%	0.92%	99.04%	0.04%	50.3	1.0
Naphthalene	36.20			12.2			4.4			0	441.67	159.29	0.00	0.166	0	0.5	0.5	0.02	0.00	13.22	36.66	0.12	50.00	0.00%	26.44%	73.32%	0.24%	50	1.0
Phenanthrene	6731.36	-0.1665	0.6203				1.72			0	200.57	11577.94	0.00	0.166	0	0.5	0.5	0.02	0.00	960.97	16.65	22.35	999.96	0.00%	96.10%	1.66%	2.23%	1000	1.0
Pyrene	360.01			0.72			1.75			0	259.20	630.01	0.00	0.166	0	0.5	0.5	0.02	0.00	52.29	21.51	1.20	75.00	0.00%	69.72%	28.69%	1.59%	75	1.0
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	0.166	0	0.5	0.5	0.02	0.00	0.00	0.09	0.00	0.09	0.00%	0.00%	96.45%	3.55%		---

Table A-6. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Deer Mouse

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Low MW PAHs	19169.51	-1.3205	0.4544							0	23.58		0.00	0.166	0	0.5	0.5	0.02	0.00	0.00	1.96	63.64	65.60	0.00%	0.00%	2.98%	97.02%	65.6	1.0
High MW PAHs	39.00	-1.7026	0.9469							0	5.85		0.00	0.166	0	0.5	0.5	0.02	0.00	0.00	0.49	0.13	0.61	0.00%	0.00%	78.95%	21.05%	0.615	1.0
Gasoline Range Organics																												1000	---
TPH - Diesel	301204.82									0			0.00	0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0
TPH - Kerosene	301204.82									0			0.00	0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0
Normal paraffin hydrocarbons	301204.82									0			0.00	0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0
Phenol	526.11						0.235			0.0064		123.53	3.37	0.166	0	0.5	0.5	0.02	0.00	10.25	0.00	1.75	12.00	0.00%	85.44%	0.00%	14.56%	12	1.0
2-methylphenol (ocresol)	10037.62						0.336			0.0150		3369.58	150.97	0.166	0	0.5	0.5	0.02	0.00	279.68	0.00	33.32	313.00	0.00%	89.35%	0.00%	10.65%	313	1.0
4-methylphenol (pcresol)	10101.66						0.333			0.0141		3367.02	142.71	0.166	0	0.5	0.5	0.02	0.00	279.46	0.00	33.54	313.00	0.00%	89.29%	0.00%	10.71%	313	1.0
2,4-dinitrotoluene	13.46	1.873	-0.3768	0.376			0.184			0.0155	5.06	2.47	0.21	0.166	0	0.5	0.5	0.02	0.00	0.21	0.42	0.04	0.67	0.00%	30.63%	62.70%	6.67%	0.67	1.0
Bis[2-ethylhexyl] phthalate	5.35			0.07			41.144			0.0945	0.35	220.20	0.51	0.166	0	0.5	0.5	0.02	0.00	18.28	0.03	0.02	18.32	0.00%	99.74%	0.16%	0.10%	18.3	1.0
Total PCBs	0.30			0.17	1.41	1.36				0.1792	0.05	0.80	0.05	0.166	0	0.5	0.5	0.02	0.00	0.07	0.00	0.00	0.07	0.00%	92.69%	5.92%	1.40%	0.068	1.0
Aroclor 1016	2.75			0.30	1.41	1.36				0.2104	0.82	16.23	0.58	0.166	0	0.5	0.5	0.02	0.00	1.35	0.07	0.01	1.42	0.00%	94.60%	4.76%	0.64%	1.37	1.0
Aroclor 1221	0.25			0.78	1.41	1.36				0.1883	0.19	0.61	0.05	0.166	0	0.5	0.5	0.02	0.00	0.05	0.02	0.00	0.07	0.00%	75.05%	23.74%	1.21%	0.068	1.0
Aroclor 1232	0.24			0.99	1.41	1.36				0.1704	0.23	0.58	0.04	0.166	0	0.5	0.5	0.02	0.00	0.05	0.02	0.00	0.07	0.00%	70.28%	28.57%	1.15%	0.068	1.0
Aroclor 1242	0.30			0.16	1.41	1.36				0.1756	0.05	0.81	0.05	0.166	0	0.5	0.5	0.02	0.00	0.07	0.00	0.00	0.07	0.00%	92.97%	5.64%	1.39%	0.069	1.0
Aroclor 1248	0.06			0.18	1.41	1.36				0.1855	0.01	0.09	0.01	0.166	0	0.5	0.5	0.02	0.00	0.01	0.00	0.00	0.01	0.00%	86.96%	10.71%	2.32%	0.0087	1.0
Aroclor 1254	0.30			0.14	1.41	1.36				0.1630	0.04	0.80	0.05	0.166	0	0.5	0.5	0.02	0.00	0.07	0.00	0.00	0.07	0.00%	93.68%	4.91%	1.41%	0.068	1.0
Aroclor 1260	0.30			0.05	1.41	1.36				0.0750	0.02	0.80	0.02	0.166	0	0.5	0.5	0.02	0.00	0.07	0.00	0.00	0.07	0.00%	96.65%	1.90%	1.45%	0.068	1.0
Aroclor-1262	20.48													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	0.07	0.07	0.00%	0.00%	0.00%	100.00%	0.068	1.0
Dichloroprop	1.00													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Aldrin	1.99			0.14			1.033			0.1630	0.28	2.05	0.32	0.166	0	0.5	0.5	0.02	0.00	0.17	0.02	0.01	0.20	0.00%	85.21%	11.49%	3.30%	0.2	1.0
beta-1,2,3,4,5,6-Hexachlorocyclohexane	1.73			1.72			1.021			0.1201	2.98	1.77	0.21	0.166	0	0.5	0.5	0.02	0.00	0.15	0.25	0.01	0.40	0.00%	36.73%	61.83%	1.44%	0.4	1.0
alpha-Chlordane	20.47			0.16			1.031			0.1771	3.37	21.11	3.62	0.166	0	0.5	0.5	0.02	0.00	1.75	0.28	0.07	2.10	0.00%	83.43%	13.33%	3.24%	2.1	1.0
gamma-Chlordane	20.40			0.16			1.036			0.1771	3.36	21.12	3.61	0.166	0	0.5	0.5	0.02	0.00	1.75	0.28	0.07	2.10	0.00%	83.49%	13.29%	3.22%	2.1	1.0
Dichlorodiphenyldichloroethylene	0.11	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		0.02	1.75	9.44	0.166	0	0.5	0.5	0.02	0.00	0.15	0.00	0.00	0.15	0.00%	98.85%	0.89%	0.26%	0.147	1.0
Dichlorodiphenyltrichloroethane	0.16	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		0.02	1.74	0.88	0.166	0	0.5	0.5	0.02	0.00	0.14	0.00	0.00	0.15	0.00%	98.45%	1.18%	0.37%	0.147	1.0
Dieldrin	0.01			0.41			14.70			1.20	0.00	0.18	0.01	0.166	0	0.5	0.5	0.02	0.00	0.01	0.00	0.00	0.01	0.00%	97.03%	2.71%	0.26%	0.015	1.0
Endosulfan I	0.71			1.31			1.184			0.1455	0.93	0.84	0.10	0.166	0	0.5	0.5	0.02	0.00	0.07	0.08	0.00	0.15	0.00%	46.70%	51.72%	1.58%	0.15	1.0
Endosulfan II	0.71			1.31			1.184			0.1455	0.93	0.84	0.10	0.166	0	0.5	0.5	0.02	0.00	0.07	0.08	0.00	0.15	0.00%	46.70%	51.72%	1.58%	0.15	1.0
Endosulfan sulfate	0.56			1.98			1.184			0.1072	1.12	0.67	0.06	0.166	0	0.5	0.5	0.02	0.00	0.06	0.09	0.00	0.15	0.00%	36.98%	61.77%	1.25%	0.15	1.0
Endrin aldehyde	0.14			1.44			6.686			0.1368	0.20	0.91	0.02	0.166	0	0.5	0.5	0.02	0.00	0.08	0.02	0.00	0.09	0.00%	81.88%	17.63%	0.49%	0.092	1.0
Methoxychlor	11.20			0.52			3.739			0.2093	5.88	41.87	2.34	0.166	0	0.5	0.5	0.02	0.00	3.48	0.49	0.04	4.00	0.00%	86.88%	12.19%	0.93%	4	1.0

Notes:

It has been conservatively assumed that all chemical intake is absorbed by the receptor.

1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.

Acronyms:

BAF = Bioaccumulation factor

DW = Dry weight

FIR = Food ingestion rate

mg/kg = Miligrams per kilogram

mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight

mg/kg/d = Miligrams per kilogram per day

NOAEL = No observed adverse effect level

PRGs = Preliminary remediation goals

TRV = Toxicity reference value

Equations:

Total Estimated Exposure = Food Intake + Incidental Soil Intake

Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)

Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)

Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0

where: B1 = slope and B0 = intercept

Estimated Concentrations in Biota (method 2) = soil concentration X BAF

Hazard Quotient = Total Estimated Exposure (Dose) / TRV

Therefore, when the HQ = 1, soil concentration = PRG

where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Table A-7. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Grasshopper Mouse

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Aluminum	380.00			0.00287			0.043			0.0263	1.09	16.34	9.99	0.098	0	1	0	0.009	0.00	1.60	0.00	0.33	1.93	0.00%	82.69%	0.00%	17.31%	1.93	1.0
Antimony	0.60	-3.233	0.938				1			0.001 * 50 * Cdiet	0.02	0.60	0.03	0.098	0	1	0	0.009	0.00	0.06	0.00	0.00	0.06	0.00%	99.11%	0.00%	0.89%	0.059	1.0
Arsenic, Total all valence states	170.75	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		2.48	9.10	0.53	0.098	0	1	0	0.009	0.00	0.89	0.00	0.15	1.04	0.00%	85.55%	0.00%	14.45%	1.04	1.0
Arsenic (III)	170.75	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		2.48	9.10	0.53	0.098	0	1	0	0.009	0.00	0.89	0.00	0.15	1.04	0.00%	85.55%	0.00%	14.45%	1.04	1.0
Arsenic (V)	170.75	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		2.48	9.10	0.53	0.098	0	1	0	0.009	0.00	0.89	0.00	0.15	1.04	0.00%	85.55%	0.00%	14.45%	1.04	1.0
Barium	4605.48			0.156			0.091			0.0168	718.45	419.10	77.37	0.098	0	1	0	0.009	0.00	40.95	0.00	4.05	45.00	0.00%	91.00%	0.00%	9.00%	45	1.0
Beryllium	100.83	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	17.33	4.54	0.23	0.098	0	1	0	0.009	0.00	0.44	0.00	0.09	0.53	0.00%	83.33%	0.00%	16.67%	0.532	1.0
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	0.098	0	1	0	0.009	0.00	0.10	0.00	0.00	0.10	0.00%	99.11%	0.00%	0.89%	---	---
Boron	284.01			5.714			1			1	1622.82	284.01	284.01	0.098	0	1	0	0.009	0.00	27.75	0.00	0.25	28.00	0.00%	99.11%	0.00%	0.89%	28	1.0
Cadmium	1.30	-0.476	0.546		2.114	0.795		-1.2571	0.4723		0.72	10.22	0.32	0.098	0	1	0	0.009	0.00	1.00	0.00	0.00	1.00	0.00%	99.89%	0.00%	0.11%	1	1.0
Chromium (total)	77.98			0.041			0.306	-1.4599	0.7338		3.20	23.86	5.68	0.098	0	1	0	0.009	0.00	2.33	0.00	0.07	2.40	0.00%	97.14%	0.00%	2.86%	2.4	1.0
Chromium (+3)	77.98			0.041			0.306	-1.4599	0.7338		3.20	23.86	5.68	0.098	0	1	0	0.009	0.00	2.33	0.00	0.07	2.40	0.00%	97.14%	0.00%	2.86%	2.4	1.0
Chromium (+6)	300.21			0.041			0.306	-1.4599	0.7338		12.31	91.86	15.27	0.098	0	1	0	0.009	0.00	8.98	0.00	0.26	9.24	0.00%	97.14%	0.00%	2.86%	9.24	1.0
Cobalt	250.06			0.00745			0.291	-4.4669	1.307		1.86	72.77	15.64	0.098	0	1	0	0.009	0.00	7.11	0.00	0.22	7.33	0.00%	97.00%	0.00%	3.00%	7.33	1.0
Copper	109.38	0.669	0.394				0.515	2.042	0.1444		12.41	56.33	15.18	0.098	0	1	0	0.009	0.00	5.50	0.00	0.10	5.60	0.00%	98.28%	0.00%	1.72%	5.6	1.0
Lead	153.49	-1.328	0.561		-0.218	0.807		0.0761	0.4422		4.46	46.72	9.99	0.098	0	1	0	0.009	0.00	4.56	0.00	0.13	4.70	0.00%	97.13%	0.00%	2.87%	4.7	1.0
Lithium	1749.15			0.004			0.046			1	7.00	80.46	1749.15	0.098	0	1	0	0.009	0.00	7.86	0.00	1.54	9.40	0.00%	83.64%	0.00%	16.36%	9.4	1.0
Manganese	18430.08			0.0792	-0.809	0.682				0.0205	1459.66	361.20	377.82	0.098	0	1	0	0.009	0.00	35.29	0.00	16.21	51.50	0.00%	68.53%	0.00%	31.47%	51.5	1.0
Mercury (methyl)	0.03	-0.996	0.544		0.0781	0.3369				0.054	0.05	0.33	0.00	0.098	0	1	0	0.009	0.00	0.03	0.00	0.00	0.03	0.00%	99.92%	0.00%	0.08%	0.032	1.0
Mercury (inorganic)	1.00	-0.996	0.544		0.0781	0.3369				0.054	0.37	1.08	0.05	0.098	0	1	0	0.009	0.00	0.11	0.00	0.00	0.11	0.00%	99.17%	0.00%	0.83%		
Molybdenum	2.77			1.2504			0.953			1	3.46	2.64	2.77	0.098	0	1	0	0.009	0.00	0.26	0.00	0.00	0.26	0.00%	99.06%	0.00%	0.94%	--- 0.26	--- 1.0
Nickel	16.29	-2.224	0.748				1.059	-0.2462	0.4658		0.87	17.25	2.87	0.098	0	1	0	0.009	0.00	1.69	0.00	0.01	1.70	0.00%	99.16%	0.00%	0.84%	1.7	1.0
Selenium	1.83	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		0.99	1.45	0.83	0.098	0	1	0	0.009	0.00	0.14	0.00	0.00	0.14	0.00%	98.87%	0.00%	1.13%	0.143	1.0
Silver	30.00			0.014			2.045			0.0040	0.42	61.34	0.12	0.098	0	1	0	0.009	0.00	5.99	0.00	0.03	6.02	0.00%	99.56%	0.00%	0.44%	6.02	1.0
Strontium	6476.09			0.207			0.4066			1.74	1339.33	2633.36	11269.90	0.098	0	1	0	0.009	0.00	257.31	0.00	5.69	263.00	0.00%	97.83%	0.00%	2.17%	263	1.0
Thallium	2.43			0.004			0.0541			0.1124	0.01	0.13	0.27	0.098	0	1	0	0.009	0.00	0.01	0.00	0.00	0.02	0.00%	85.74%	0.00%	14.26%	0.015	1.0
Tin	2690.84			1			0.08			0.08	2690.84	215.27	215.27	0.098	0	1	0	0.009	0.00	21.03	0.00	2.37	23.40	0.00%	89.89%	0.00%	10.11%	23.4	1.0
Uranium	68.23			0.021			0.033			0.0002	1.43	2.25	0.01	0.098	0	1	0	0.009	0.00	0.22	0.00	0.06	0.28	0.00%	78.57%	0.00%	21.43%	0.28	1.0
Vanadium	834.81			0.00485			0.042			0.0123	4.05	35.06	10.27	0.098	0	1	0	0.009	0.00	3.43	0.00	0.73	4.16	0.00%	82.35%	0.00%	17.65%	4.16	1.0
Zinc	794.24	1.575	0.555		4.449	0.328		4.3632	0.0706		196.56	764.47	125.79	0.098	0	1	0	0.009	0.00	74.70	0.00	0.70	75.39	0.00%	99.07%	0.00%	0.93%	75.4	1.0
Ammonia/Ammonium	1.00													0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Chloride	1.00													0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Cyanide	78122.51													0.098	0	1	0	0.009	0.00	0.00	0.00	68.70	68.70	0.00%	0.00%	0.00%	100.00%	68.7	1.0
Fluoride	35672.53			0.006							214.04			0.098	0	1	0	0.009	0.00	0.00	0.00	31.37	31.37	0.00%	0.00%	0.00%	100.00%	31.37	1.0
Iodine	1557.90			0.05							77.90			0.098	0	1	0	0.009	0.00	0.00	0.00	1.37	1.37	0.00%	0.00%	0.00%	100.00%	1.37	1.0
Nitrate/Nitrite	576537.26													0.098	0	1	0	0.009	0.00	0.00	0.00	507.00	507.00	0.00%	0.00%	0.00%	100.00%	507	1.0
Phosphate	1.00													0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Sulfate/Sulfite	1.00													0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Total Organic Carbon	1.00													0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
1,1-dichloroethane	502.38						1.010			0.0109		507.20	5.48	0.098	0	1	0	0.009	0.00	49.56	0.00	0.44	50.00	0.00%	99.12%	0.00%	0.88%	50	1.0
1,1-dichloroethene	300.94						1.011			0.0186		304.32	5.60	0.098	0	1	0	0.009	0.00	29.74	0.00	0.26	30.00	0.00%	99.12%	0.00%	0.88%	30	1.0
1,1,1-trichloroethane	10015.86						1.013			0.0305		10144.25	305.77	0.098	0	1	0	0.009	0.00	991.19	0.00	8.81	1000.00	0.00%	99.12%	0.00%	0.88%	1000	1.0
1,1,2-trichloroethane	10041.41						1.010			0.0165		10144.02	165.67	0.098	0	1	0	0.009	0.00	991.17	0.00	8.83	1000.00	0.00%	99.12%	0.00%	0.88%	1000	1.0

Table A-7. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Grasshopper Mouse

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
1,1,2,2-tetrachloroethane	89.43						1.013			0.0270		90.59	2.42	0.098	0	1	0	0.009	0.00	8.85	0.00	0.08	8.93	0.00%	99.12%	0.00%	0.88%	8.93	1.0
1,2-dichlorobenzene	854.29			2.45			1.018			0.0882	2094.38	869.40	75.33	0.098	0	1	0	0.009	0.00	84.95	0.00	0.75	85.70	0.00%	99.12%	0.00%	0.88%	85.7	1.0
1,2-dichloroethane (DCA)	513.07						0.988			0.0063		507.10	3.23	0.098	0	1	0	0.009	0.00	49.55	0.00	0.45	50.00	0.00%	99.10%	0.00%	0.90%	50	1.0
1,3-dichlorobenzene	853.99			2.23			1.018			0.0963	1906.92	869.40	82.21	0.098	0	1	0	0.009	0.00	84.95	0.00	0.75	85.70	0.00%	99.12%	0.00%	0.88%	85.7	1.0
2-butanone (Methyl Ethyl Ketone/MEK)	176661.35						0.094			0.0006		16535.15	97.52	0.098	0	1	0	0.009	0.00	1615.65	0.00	155.35	1771.00	0.00%	91.23%	0.00%	8.77%	1771	1.0
2-hexanone	236.58						0.207			0.0053		49.04	1.26	0.098	0	1	0	0.009	0.00	4.79	0.00	0.21	5.00	0.00%	95.84%	0.00%	4.16%	5	1.0
Benzene	7.02						1.011			0.0186		7.10	0.13	0.098	0	1	0	0.009	0.00	0.69	0.00	0.01	0.70	0.00%	99.12%	0.00%	0.88%	0.7	1.0
Butanol	2625.73						0.478			0.0017		1255.67	4.49	0.098	0	1	0	0.009	0.00	122.69	0.00	2.31	125.00	0.00%	98.15%	0.00%	1.85%	125	1.0
Carbon Tetrachloride	159.96						1.015			0.0420		162.31	6.72	0.098	0	1	0	0.009	0.00	15.86	0.00	0.14	16.00	0.00%	99.12%	0.00%	0.88%	16	1.0
Chlorobenzene	194.96						1.015			0.0490		197.82	9.56	0.098	0	1	0	0.009	0.00	19.33	0.00	0.17	19.50	0.00%	99.12%	0.00%	0.88%	19.5	1.0
Chloroform	150.58						1.011			0.0135		152.16	2.03	0.098	0	1	0	0.009	0.00	14.87	0.00	0.13	15.00	0.00%	99.12%	0.00%	0.88%	15	1.0
Cis-1,2-dichloroethylene	453.49						1.011			0.0122		458.51	5.55	0.098	0	1	0	0.009	0.00	44.80	0.00	0.40	45.20	0.00%	99.12%	0.00%	0.88%	45.2	1.0
Dichloromethane (Methylene Chloride)	58.94						1.007			0.0042		59.34	0.25	0.098	0	1	0	0.009	0.00	5.80	0.00	0.05	5.85	0.00%	99.11%	0.00%	0.89%	5.85	1.0
Ethyl Benzene	1357.66			3.21			1.016			0.0666	4364.07	1379.66	90.47	0.098	0	1	0	0.009	0.00	134.81	0.00	1.19	136.00	0.00%	99.12%	0.00%	0.88%	136	1.0
Methyl Isobutyl Ketone	87995.70						0.197			0.0037		17333.14	329.28	0.098	0	1	0	0.009	0.00	1693.62	0.00	77.38	1771.00	0.00%	95.63%	0.00%	4.37%	1771	1.0
n-butyl Benzene	1091.54			1.67			1.022			0.1227	1824.53	1115.96	133.98	0.098	0	1	0	0.009	0.00	109.04	0.00	0.96	110.00	0.00%	99.13%	0.00%	0.87%	110	1.0
Tetrachloroethylene	13.96						1.018			0.0390		14.20	0.54	0.098	0	1	0	0.009	0.00	1.39	0.00	0.01	1.40	0.00%	99.12%	0.00%	0.88%	1.4	1.0
Toluene	520.19						1.014			0.0430		527.51	22.39	0.098	0	1	0	0.009	0.00	51.54	0.00	0.46	52.00	0.00%	99.12%	0.00%	0.88%	52	1.0
Trans-1,2-dichloroethylene	453.49						1.011			0.0170		458.51	7.71	0.098	0	1	0	0.009	0.00	44.80	0.00	0.40	45.20	0.00%	99.12%	0.00%	0.88%	45.2	1.0
Trichloroethylene (TCE)	7.01						1.012			0.0410		7.10	0.29	0.098	0	1	0	0.009	0.00	0.69	0.00	0.01	0.70	0.00%	99.12%	0.00%	0.88%	0.7	1.0
Xylene	1787.19			3.43			1.016			0.0619	6132.97	1815.87	110.66	0.098	0	1	0	0.009	0.00	177.43	0.00	1.57	179.00	0.00%	99.12%	0.00%	0.88%	179	1.0
Acenaphthene	1210.97	-5.562	-0.8556				1.470			0	0.00	1780.12	0.00	0.098	0	1	0	0.009	0.00	173.94	0.00	1.06	175.00	0.00%	99.39%	0.00%	0.61%	175	1.0
Acenaphthylene	77.90	-1.144	0.791				22.9			0	9.99	1784.01	0.00	0.098	0	1	0	0.009	0.00	174.31	0.00	0.07	174.38	0.00%	99.96%	0.00%	0.04%	175	1.0
Anthracene	4213.42	-0.9887	0.7784				2.42			0	246.62	10196.47	0.00	0.098	0	1	0	0.009	0.00	996.29	0.00	3.71	1000.00	0.00%	99.63%	0.00%	0.37%	1000	1.0
Benzo(a)pyrene	7.64	-2.0615	0.975				1.33			0	0.92	10.17	0.00	0.098	0	1	0	0.009	0.00	0.99	0.00	0.01	1.00	0.00%	99.33%	0.00%	0.67%	1	1.0
Benzo(a)anthracene	6.40	-2.7078	0.5944				1.59			0	0.20	10.18	0.00	0.098	0	1	0	0.009	0.00	0.99	0.00	0.01	1.00	0.00%	99.44%	0.00%	0.56%	1	1.0
Benzo(b)fluoranthene	3.92			0.31			2.6			0	1.22	10.20	0.00	0.098	0	1	0	0.009	0.00	1.00	0.00	0.00	1.00	0.00%	99.66%	0.00%	0.34%	1	1.0
Benzo(ghi)perylene	3.47	-0.9313	1.1829				2.94			0	1.72	10.20	0.00	0.098	0	1	0	0.009	0.00	1.00	0.00	0.00	1.00	0.00%	99.69%	0.00%	0.31%	1	1.0
Benzo[k]fluoranthene	3.92	-4.6482	0.1668				2.6			0	0.01	10.20	0.00	0.098	0	1	0	0.009	0.00	1.00	0.00	0.00	1.00	0.00%	99.66%	0.00%	0.34%	1	1.0
Chrysene	4.45	-2.7078	0.5944				2.29			0	0.16	10.19	0.00	0.098	0	1	0	0.009	0.00	1.00	0.00	0.00	1.00	0.00%	99.61%	0.00%	0.39%	1	1.0
Dibenz(ah)anthracene	4.41			0.13			2.31			0	0.57	10.19	0.00	0.098	0	1	0	0.009	0.00	1.00	0.00	0.00	1.00	0.00%	99.61%	0.00%	0.39%	1	1.0
Fluoranthene	419.58			0.5			3.04			0	209.79	1275.52	0.00	0.098	0	1	0	0.009	0.00	124.63	0.00	0.37	125.00	0.00%	99.70%	0.00%	0.30%	125	1.0
Fluorene	133.55	-5.562	-0.8556				9.57			0	0.00	1278.10	0.00	0.098	0	1	0	0.009	0.00	124.88	0.00	0.12	125.00	0.00%	99.91%	0.00%	0.09%	125	1.0
Indeno[1,2,3-cd]pyrene	3.57			0.11			2.86			0	0.39	10.20	0.00	0.098	0	1	0	0.009	0.00	1.00	0.00	0.00	1.00	0.00%	99.69%	0.00%	0.31%	1	1.0
2-Methylnaphthalene	500.36	-1.3205	4.544				1.020			0	492088262936.27	510.29	0.00	0.098	0	1	0	0.009	0.00	49.86	0.00	0.44	50.30	0.00%	99.13%	0.00%	0.87%	50.3	1.0
Naphthalene	116.06			12.2			4.4			0	1415.96	510.67	0.00	0.098	0	1	0	0.009	0.00	49.90	0.00	0.10	50.00	0.00%	99.80%	0.00%	0.20%	50	1.0
Phenanthrene	5919.25	-0.1665	0.6203				1.72			0	185.19	10181.12	0.00	0.098	0	1	0	0.009	0.00	994.79	0.00	5.21	1000.00	0.00%	99.48%	0.00%	0.52%	1000	1.0
Pyrene	436.37			0.72			1.75			0	314.19	763.65	0.00	0.098	0	1	0	0.009	0.00	74.62	0.00	0.38	75.00	0.00%	99.49%	0.00%	0.51%	75	1.0
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%		---
Low MW PAHs	74597.33	-1.3205	0.4544							0	43.72		0.00	0.098	0	1	0	0.009	0.00	0.00	0.00	65.60	65.60	0.00%	0.00%	0.00%	100.00%	65.6	1.0
High MW PAHs	699.35	-1.7026	0.9469							0	89.99		0.00	0.098	0	1	0	0.009	0.00	0.00	0.00	0.62	0.62	0.00%	0.00%	0.00%	100.00%	0.615	1.0
Gasoline Range Organics																		0.009										1000	---
TPH - Diesel	1137154.37									0			0.00	0.098	0	1	0	0.009	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0

Table A-7. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Grasshopper Mouse

Analyte	Soil PRG (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
TPH - Kerosene	1137154.37									0			0.00	0.098	0	1	0	0.009	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0
Normal paraffin hydrocarbons	1137154.37									0			0.00	0.098	0	1	0	0.009	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0
Phenol	503.73						0.235			0.0064		118.28	3.23	0.098	0	1	0	0.009	0.00	11.56	0.00	0.44	12.00	0.00%	96.31%	0.00%	3.69%	12	1.0
2-methylphenol (ocresol)	9293.33						0.336			0.0150		3119.72	139.77	0.098	0	1	0	0.009	0.00	304.83	0.00	8.17	313.00	0.00%	97.39%	0.00%	2.61%	313	1.0
4-methylphenol (pcresol)	9357.99						0.333			0.0141		3119.14	132.20	0.098	0	1	0	0.009	0.00	304.77	0.00	8.23	313.00	0.00%	97.37%	0.00%	2.63%	313	1.0
2,4-dinitrotoluene	35.58	1.873	-0.3768	0.376			0.184			0.0155	13.38	6.54	0.55	0.098	0	1	0	0.009	0.00	0.64	0.00	0.03	0.67	0.00%	95.33%	0.00%	4.67%	0.67	1.0
Bis[2-ethylhexyl] phthalate	4.55			0.07			41.144			0.0945	0.30	187.25	0.43	0.098	0	1	0	0.009	0.00	18.30	0.00	0.00	18.30	0.00%	99.98%	0.00%	0.02%	18.3	1.0
Total PCBs	0.27			0.17	1.41	1.36				0.1792	0.05	0.69	0.05	0.098	0	1	0	0.009	0.00	0.07	0.00	0.00	0.07	0.00%	99.65%	0.00%	0.35%	0.068	1.0
Aroclor 1016	2.47			0.30	1.41	1.36				0.2104	0.73	13.99	0.52	0.098	0	1	0	0.009	0.00	1.37	0.00	0.00	1.37	0.00%	99.84%	0.00%	0.16%	1.37	1.0
Aroclor 1221	0.27			0.78	1.41	1.36				0.1883	0.21	0.69	0.05	0.098	0	1	0	0.009	0.00	0.07	0.00	0.00	0.07	0.00%	99.65%	0.00%	0.35%	0.068	1.0
Aroclor 1232	0.27			0.99	1.41	1.36				0.1704	0.27	0.69	0.05	0.098	0	1	0	0.009	0.00	0.07	0.00	0.00	0.07	0.00%	99.65%	0.00%	0.35%	0.068	1.0
Aroclor 1242	0.27			0.16	1.41	1.36				0.1756	0.04	0.70	0.05	0.098	0	1	0	0.009	0.00	0.07	0.00	0.00	0.07	0.00%	99.65%	0.00%	0.35%	0.069	1.0
Aroclor 1248	0.06			0.18	1.41	1.36				0.1855	0.01	0.09	0.01	0.098	0	1	0	0.009	0.00	0.01	0.00	0.00	0.01	0.00%	99.40%	0.00%	0.60%	0.0087	1.0
Aroclor 1254	0.27			0.14	1.41	1.36				0.1630	0.04	0.69	0.04	0.098	0	1	0	0.009	0.00	0.07	0.00	0.00	0.07	0.00%	99.65%	0.00%	0.35%	0.068	1.0
Aroclor 1260	0.27			0.05	1.41	1.36				0.0750	0.01	0.69	0.02	0.098	0	1	0	0.009	0.00	0.07	0.00	0.00	0.07	0.00%	99.65%	0.00%	0.35%	0.068	1.0
Aroclor-1262	77.33													0.098	0	1	0	0.009	0.00	0.00	0.00	0.07	0.07	0.00%	0.00%	0.00%	100.00%	0.068	1.0
Dichloroprop	1.00													0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Aldrin	1.96			0.14			1.033			0.1630	0.27	2.03	0.32	0.098	0	1	0	0.009	0.00	0.20	0.00	0.00	0.20	0.00%	99.14%	0.00%	0.86%	0.2	1.0
beta-1,2,3,4,5,6-Hexachlorocyclohexane	3.97			1.72			1.021			0.1201	6.83	4.06	0.48	0.098	0	1	0	0.009	0.00	0.40	0.00	0.00	0.40	0.00%	99.13%	0.00%	0.87%	0.4	1.0
alpha-Chlordane	20.66			0.16			1.031			0.1771	3.40	21.31	3.66	0.098	0	1	0	0.009	0.00	2.08	0.00	0.02	2.10	0.00%	99.14%	0.00%	0.86%	2.1	1.0
gamma-Chlordane	20.57			0.16			1.036			0.1771	3.39	21.31	3.64	0.098	0	1	0	0.009	0.00	2.08	0.00	0.02	2.10	0.00%	99.14%	0.00%	0.86%	2.1	1.0
Dichlorodiphenyldichloroethylene	0.09	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		0.01	1.50	8.42	0.098	0	1	0	0.009	0.00	0.15	0.00	0.00	0.15	0.00%	99.94%	0.00%	0.06%	0.147	1.0
Dichlorodiphenyltrichloroethane	0.14	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		0.02	1.50	0.78	0.098	0	1	0	0.009	0.00	0.15	0.00	0.00	0.15	0.00%	99.92%	0.00%	0.08%	0.147	1.0
Dieldrin	0.01			0.41			14.70			1.20	0.00	0.15	0.01	0.098	0	1	0	0.009	0.00	0.01	0.00	0.00	0.02	0.00%	99.94%	0.00%	0.06%	0.015	1.0
Endosulfan I	1.29			1.31			1.184			0.1455	1.69	1.52	0.19	0.098	0	1	0	0.009	0.00	0.15	0.00	0.00	0.15	0.00%	99.25%	0.00%	0.75%	0.15	1.0
Endosulfan II	1.29			1.31			1.184			0.1455	1.69	1.52	0.19	0.098	0	1	0	0.009	0.00	0.15	0.00	0.00	0.15	0.00%	99.25%	0.00%	0.75%	0.15	1.0
Endosulfan sulfate	1.29			1.98			1.184			0.1072	2.55	1.52	0.14	0.098	0	1	0	0.009	0.00	0.15	0.00	0.00	0.15	0.00%	99.25%	0.00%	0.75%	0.15	1.0
Endrin aldehyde	0.14			1.44			6.686			0.1368	0.20	0.94	0.02	0.098	0	1	0	0.009	0.00	0.09	0.00	0.00	0.09	0.00%	99.87%	0.00%	0.13%	0.092	1.0
Methoxychlor	10.92			0.52			3.739			0.2093	5.73	40.84	2.29	0.098	0	1	0	0.009	0.00	3.99	0.00	0.01	4.00	0.00%	99.76%	0.00%	0.24%	4	1.0

Notes:

It has been conservatively assumed that all chemical intake is absorbed by the receptor.

1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.

Acronyms:

BAF = Bioaccumulation factor

DW = Dry weight

FIR = Food ingestion rate

mg/kg = Miligrams per kilogram

mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight

mg/kg/d = Miligrams per kilogram per day

NOAEL = No observed adverse effect level

PRGs = Preliminary remediation goals

TRV = Toxicity reference value

Equations:

Total Estimated Exposure = Food Intake + Incidental Soil Intake

Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)

Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)

Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0

where: B1 = slope and B0 = intercept

Estimated Concentrations in Biota (method 2) = soil concentration X BAF

Hazard Quotient = Total Estimated Exposure (Dose) / TRV

Therefore, when the HQ = 1, soil concentration = PRG

where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Table A-8. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Badger

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Aluminum	710.10			0.00287			0.043			0.0263	2.04	30.53	18.68	0.035	1	0	0	0.052	0.65	0.00	0.00	1.28	1.93	33.59%	0.00%	0.00%	66.41%	1.93	1.0
Antimony	16.66	-3.233	0.938				1			0.001 * 50 * Cdiet	0.55	16.66	0.83	0.035	1	0	0	0.052	0.03	0.00	0.00	0.03	0.06	49.02%	0.00%	0.00%	50.98%	0.059	1.0
Arsenic, Total all valence states	549.25	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		4.79	20.76	1.37	0.035	1	0	0	0.052	0.05	0.00	0.00	0.99	1.04	4.59%	0.00%	0.00%	95.41%	1.04	1.0
Arsenic (III)	549.25	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		4.79	20.76	1.37	0.035	1	0	0	0.052	0.05	0.00	0.00	0.99	1.04	4.59%	0.00%	0.00%	95.41%	1.04	1.0
Arsenic (V)	549.25	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		4.79	20.76	1.37	0.035	1	0	0	0.052	0.05	0.00	0.00	0.99	1.04	4.59%	0.00%	0.00%	95.41%	1.04	1.0
Barium	18842.90			0.156			0.091			0.0168	2939.49	1714.70	316.56	0.035	1	0	0	0.052	10.99	0.00	0.00	34.01	45.00	24.42%	0.00%	0.00%	75.58%	45	1.0
Beryllium	282.51	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	36.94	12.71	0.64	0.035	1	0	0	0.052	0.02	0.00	0.00	0.51	0.53	4.15%	0.00%	0.00%	95.85%	0.532	1.0
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	0.035	1	0	0	0.052	0.03	0.00	0.00	0.00	0.04	95.06%	0.00%	0.00%	4.94%	---	---
Boron	766.77			5.714			1			1	4381.33	766.77	766.77	0.035	1	0	0	0.052	26.62	0.00	0.00	1.38	28.00	95.06%	0.00%	0.00%	4.94%	28	1.0
Cadmium	455.47	-0.476	0.546		2.114	0.795		-1.2571	0.4723		17.57	1075.40	5.12	0.035	1	0	0	0.052	0.18	0.00	0.00	0.82	1.00	17.79%	0.00%	0.00%	82.21%	1	1.0
Chromium (total)	752.34			0.041			0.306	-1.4599	0.7338		30.85	230.22	29.97	0.035	1	0	0	0.052	1.04	0.00	0.00	1.36	2.40	43.38%	0.00%	0.00%	56.62%	2.4	1.0
Chromium (+3)	752.34			0.041			0.306	-1.4599	0.7338		30.85	230.22	29.97	0.035	1	0	0	0.052	1.04	0.00	0.00	1.36	2.40	43.38%	0.00%	0.00%	56.62%	2.4	1.0
Chromium (+6)	3379.86			0.041			0.306	-1.4599	0.7338		138.57	1034.24	90.26	0.035	1	0	0	0.052	3.13	0.00	0.00	6.10	9.23	33.93%	0.00%	0.00%	66.07%	9.24	1.0
Cobalt	1346.06			0.00745			0.291	-4.4669	1.307		10.03	391.70	141.17	0.035	1	0	0	0.052	4.90	0.00	0.00	2.43	7.33	66.85%	0.00%	0.00%	33.15%	7.33	1.0
Copper	2640.09	0.669	0.394				0.515	2.042	0.1444		43.52	1359.65	24.04	0.035	1	0	0	0.052	0.83	0.00	0.00	4.77	5.60	14.90%	0.00%	0.00%	85.10%	5.6	1.0
Lead	2005.03	-1.328	0.561		-0.218	0.807		0.0761	0.4422		18.87	371.65	31.13	0.035	1	0	0	0.052	1.08	0.00	0.00	3.62	4.70	23.00%	0.00%	0.00%	77.00%	4.7	1.0
Lithium	257.42			0.004			0.046			1	1.03	11.84	257.42	0.035	1	0	0	0.052	8.94	0.00	0.00	0.46	9.40	95.06%	0.00%	0.00%	4.94%	9.4	1.0
Manganese	20464.11			0.0792	-0.809	0.682				0.0205	1620.76	387.93	419.51	0.035	1	0	0	0.052	14.56	0.00	0.00	36.94	51.50	28.28%	0.00%	0.00%	71.72%	51.5	1.0
Mercury (methyl)	8.67	-0.996	0.544		0.0781	0.3369				0.054	1.20	2.24	0.47	0.035	1	0	0	0.052	0.02	0.00	0.00	0.02	0.03	51.08%	0.00%	0.00%	48.92%	0.032	1.0
Mercury (inorganic)	1.00	-0.996	0.544		0.0781	0.3369				0.054	0.37	1.08	0.05	0.035	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	51.08%	0.00%	0.00%	48.92%	---	---
Molybdenum	7.12			1.2504			0.953			1	8.90	6.79	7.12	0.035	1	0	0	0.052	0.25	0.00	0.00	0.01	0.26	95.06%	0.00%	0.00%	4.94%	0.26	1.0
Nickel	637.16	-2.224	0.748				1.059	-0.2462	0.4658		13.54	674.75	15.82	0.035	1	0	0	0.052	0.55	0.00	0.00	1.15	1.70	32.32%	0.00%	0.00%	67.68%	1.7	1.0
Selenium	32.28	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		23.52	11.84	2.44	0.035	1	0	0	0.052	0.08	0.00	0.00	0.06	0.14	59.24%	0.00%	0.00%	40.76%	0.143	1.0
Silver	3096.93			0.014			2.045			0.0040	43.36	6333.23	12.39	0.035	1	0	0	0.052	0.43	0.00	0.00	5.59	6.02	7.14%	0.00%	0.00%	92.86%	6.02	1.0
Strontium	4227.51			0.207			0.4066			1.74	874.30	1719.03	7356.86	0.035	1	0	0	0.052	255.37	0.00	0.00	7.63	263.00	97.10%	0.00%	0.00%	2.90%	263	1.0
Thallium	2.63			0.004			0.0541			0.1124	0.01	0.14	0.30	0.035	1	0	0	0.052	0.01	0.00	0.00	0.00	0.02	68.37%	0.00%	0.00%	31.63%	0.015	1.0
Tin	5107.00			1			0.08			0.08	5107.00	408.56	408.56	0.035	1	0	0	0.052	14.18	0.00	0.00	9.22	23.40	60.61%	0.00%	0.00%	39.39%	23.4	1.0
Uranium	154.53			0.021			0.033			0.0002	3.25	5.10	0.03	0.035	1	0	0	0.052	0.00	0.00	0.00	0.28	0.28	0.38%	0.00%	0.00%	99.62%	0.28	1.0
Vanadium	1863.83			0.00485			0.042			0.0123	9.04	78.28	22.93	0.035	1	0	0	0.052	0.80	0.00	0.00	3.36	4.16	19.13%	0.00%	0.00%	80.87%	4.16	1.0
Zinc	38590.44	1.575	0.555		4.449	0.328		4.3632	0.0706		1696.33	2732.38	165.47	0.035	1	0	0	0.052	5.74	0.00	0.00	69.66	75.40	7.62%	0.00%	0.00%	92.38%	75.4	1.0
Ammonia/Ammonium	1.00													0.035	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Chloride	1.00													0.035	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Cyanide	38060.72													0.035	1	0	0	0.052	0.00	0.00	0.00	68.70	68.70	0.00%	0.00%	0.00%	100.00%	68.7	1.0
Fluoride	17379.40			0.006							104.28			0.035	1	0	0	0.052	0.00	0.00	0.00	31.37	31.37	0.00%	0.00%	0.00%	100.00%	31.37	1.0
Iodine	759.00			0.05							37.95			0.035	1	0	0	0.052	0.00	0.00	0.00	1.37	1.37	0.00%	0.00%	0.00%	100.00%	1.37	1.0
Nitrate/Nitrite	280884.80													0.035	1	0	0	0.052	0.00	0.00	0.00	507.00	507.00	0.00%	0.00%	0.00%	100.00%	507	1.0
Phosphate	1.00													0.035	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Sulfate/Sulfite	1.00													0.035	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Total Organic Carbon	1.00													0.035	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
1,1-dichloroethane	22894.29						1.010			0.0109		23113.87	249.93	0.035	1	0	0	0.052	8.68	0.00	0.00	41.32	50.00	17.35%	0.00%	0.00%	82.65%	50	1.0
1,1-dichloroethene	12238.43						1.011			0.0186		12375.85	227.86	0.035	1	0	0	0.052	7.91	0.00	0.00	22.09	30.00	26.37%	0.00%	0.00%	73.63%	30	1.0
1,1,1-trichloroethane	349074.28						1.013			0.0305		353548.73	10656.84	0.035	1	0	0	0.052	369.92	0.00	0.00	630.08	1000.00	36.99%	0.00%	0.00%	63.01%	1000	1.0
1,1,2-trichloroethane	420572.26						1.010			0.0165		424869.82	6938.94	0.035	1	0	0	0.052	240.86	0.00	0.00	759.14	1000.00	24.09%	0.00%	0.00%	75.91%	1000	1.0
1,1,2,2-tetrachloroethane	3255.35						1.013			0.0270		3297.46	87.98	0.035	1	0	0	0.052	3.05	0.00	0.00	5.88	8.93	34.20%	0.00%	0.00%	65.80%	8.93	1.0

Table A-8. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Badger

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
1,2-dichlorobenzene	17612.27			2.45			1.018			0.0882	43178.18	17923.71	1553.07	0.035	1	0	0	0.052	53.91	0.00	0.00	31.79	85.70	62.91%	0.00%	0.00%	37.09%	85.7	1.0
1,2-dichloroethane (DCA)	24709.56						0.988			0.0063		24422.25	155.54	0.035	1	0	0	0.052	5.40	0.00	0.00	44.60	50.00	10.80%	0.00%	0.00%	89.20%	50	1.0
1,3-dichlorobenzene	16651.92			2.23			1.018			0.0963	37182.89	16952.39	1603.01	0.035	1	0	0	0.052	55.64	0.00	0.00	30.06	85.70	64.93%	0.00%	0.00%	35.07%	85.7	1.0
2-butanone (Methyl Ethyl Ketone/MEK)	970850.97						0.094			0.0006		90869.72	535.95	0.035	1	0	0	0.052	18.60	0.00	0.00	1752.40	1771.00	1.05%	0.00%	0.00%	98.95%	1771	1.0
2-hexanone	2511.81						0.207			0.0053		520.70	13.43	0.035	1	0	0	0.052	0.47	0.00	0.00	4.53	5.00	9.32%	0.00%	0.00%	90.68%	5	1.0
Benzene	285.56						1.011			0.0186		288.77	5.32	0.035	1	0	0	0.052	0.18	0.00	0.00	0.52	0.70	26.37%	0.00%	0.00%	73.63%	0.7	1.0
Butanol	67048.62						0.478			0.0017		32063.80	114.56	0.035	1	0	0	0.052	3.98	0.00	0.00	121.02	125.00	3.18%	0.00%	0.00%	96.82%	125	1.0
Carbon Tetrachloride	4903.54						1.015			0.0420		4975.67	205.96	0.035	1	0	0	0.052	7.15	0.00	0.00	8.85	16.00	44.68%	0.00%	0.00%	55.32%	16	1.0
Chlorobenzene	5560.69						1.015			0.0490		5642.08	272.61	0.035	1	0	0	0.052	9.46	0.00	0.00	10.04	19.50	48.53%	0.00%	0.00%	51.47%	19.5	1.0
Chloroform	6600.19						1.011			0.0135		6669.63	88.92	0.035	1	0	0	0.052	3.09	0.00	0.00	11.91	15.00	20.58%	0.00%	0.00%	79.42%	15	1.0
Cis-1,2-dichloroethylene	20270.86						1.011			0.0122		20495.47	248.07	0.035	1	0	0	0.052	8.61	0.00	0.00	36.59	45.20	19.05%	0.00%	0.00%	80.95%	45.2	1.0
Dichloromethane (Methylene Chloride)	2999.00						1.007			0.0042		3019.25	12.58	0.035	1	0	0	0.052	0.44	0.00	0.00	5.41	5.85	7.47%	0.00%	0.00%	92.53%	5.85	1.0
Ethyl Benzene	33025.64			3.21			1.016			0.0666	106158.13	33560.86	2200.65	0.035	1	0	0	0.052	76.39	0.00	0.00	59.61	136.00	56.17%	0.00%	0.00%	43.83%	136	1.0
Methyl Isobutyl Ketone	915291.62						0.197			0.0037		180291.54	3425.04	0.035	1	0	0	0.052	118.89	0.00	0.00	1652.11	1771.00	6.71%	0.00%	0.00%	93.29%	1771	1.0
n-butyl Benzene	18135.28			1.67			1.022			0.1227	30313.52	18540.97	2225.92	0.035	1	0	0	0.052	77.27	0.00	0.00	32.73	110.00	70.24%	0.00%	0.00%	29.76%	110	1.0
Tetrachloroethylene	443.18						1.018			0.0390		450.94	17.29	0.035	1	0	0	0.052	0.60	0.00	0.00	0.80	1.40	42.86%	0.00%	0.00%	57.14%	1.4	1.0
Toluene	15763.32						1.014			0.0430		15985.17	678.36	0.035	1	0	0	0.052	23.55	0.00	0.00	28.45	52.00	45.28%	0.00%	0.00%	54.72%	52	1.0
Trans-1,2-dichloroethylene	18869.15						1.011			0.0170		19078.23	320.96	0.035	1	0	0	0.052	11.14	0.00	0.00	34.06	45.20	24.65%	0.00%	0.00%	75.35%	45.2	1.0
Trichloroethylene (TCE)	216.87						1.012			0.0410		219.57	8.89	0.035	1	0	0	0.052	0.31	0.00	0.00	0.39	0.70	44.08%	0.00%	0.00%	55.92%	0.7	1.0
Xylene	45266.25			3.43			1.016			0.0619	155337.22	45992.77	2802.91	0.035	1	0	0	0.052	97.29	0.00	0.00	81.71	179.00	54.35%	0.00%	0.00%	45.65%	179	1.0
Acenaphthene	96952.35	-5.562	-0.8556				1.470			0	0.00	142519.95	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	175.00	175.00	0.00%	0.00%	0.00%	100.00%	175	1.0
Acenaphthylene	96952.35	-1.144	0.791				22.9			0	2802.43	2220208.77	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	175.00	175.00	0.00%	0.00%	0.00%	100.00%	175	1.0
Anthracene	554013.42	-0.9887	0.7784				2.42			0	10999.41	1340712.47	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0
Benzo(a)pyrene	554.01	-2.0615	0.975				1.33			0	60.21	736.84	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	1.00	1.00	0.00%	0.00%	0.00%	100.00%	1	1.0
Benzo(a)anthracene	554.01	-2.7078	0.5944				1.59			0	2.85	880.88	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	1.00	1.00	0.00%	0.00%	0.00%	100.00%	1	1.0
Benzo(b)fluoranthene	554.01			0.31			2.6			0	171.74	1440.43	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	1.00	1.00	0.00%	0.00%	0.00%	100.00%	1	1.0
Benzo(ghi)perylene	554.01	-0.9313	1.1829				2.94			0	693.19	1628.80	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	1.00	1.00	0.00%	0.00%	0.00%	100.00%	1	1.0
Benzo[k]fluoranthene	554.01	-4.6482	0.1668				2.6			0	0.03	1440.43	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	1.00	1.00	0.00%	0.00%	0.00%	100.00%	1	1.0
Chrysene	554.01	-2.7078	0.5944				2.29			0	2.85	1268.69	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	1.00	1.00	0.00%	0.00%	0.00%	100.00%	1	1.0
Dibenz(ah)anthracene	554.01			0.13			2.31			0	72.02	1279.77	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	1.00	1.00	0.00%	0.00%	0.00%	100.00%	1	1.0
Fluoranthene	69251.68			0.5			3.04			0	34625.84	210525.10	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	125.00	125.00	0.00%	0.00%	0.00%	100.00%	125	1.0
Fluorene	69251.68	-5.562	-0.8556				9.57			0	0.00	662738.55	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	125.00	125.00	0.00%	0.00%	0.00%	100.00%	125	1.0
Indeno[1,2,3-cd]pyrene	554.01			0.11			2.86			0	60.94	1584.48	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	1.00	1.00	0.00%	0.00%	0.00%	100.00%	1	1.0
2-Methylnaphthalene	27866.87	-1.3205	4.544				1.020			0	42169186360821400000.00	28419.88	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	50.30	50.30	0.00%	0.00%	0.00%	100.00%	50.3	1.0
Naphthalene	27700.67			12.2			4.4			0	337948.18	121882.95	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	50.00	50.00	0.00%	0.00%	0.00%	100.00%	50	1.0
Phenanthrene	554013.42	-0.1665	0.6203				1.72			0	3093.11	952903.08	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0
Pyrene	41551.01			0.72			1.75			0	29916.72	72714.26	0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	75.00	75.00	0.00%	0.00%	0.00%	100.00%	75	1.0
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%		---
Low MW PAHs	36343.28	-1.3205	0.4544							0	31.53		0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	65.60	65.60	0.00%	0.00%	0.00%	100.00%	65.6	1.0
High MW PAHs	340.72	-1.7026	0.9469							0	45.55		0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	0.62	0.62	0.00%	0.00%	0.00%	100.00%	0.615	1.0
Gasoline Range Organics																												1000	---
TPH - Diesel	554013.42									0			0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0
TPH - Kerosene	554013.42									0			0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0
Normal paraffin hydrocarbons	554013.42									0			0.00	0.035	1	0	0	0.052	0.00	0.00	0.00	1000.00	1000.00	0.00%	0.00%	0.00%	100.00%	1000	1.0

Table A-8. Exposure Calculation Worksheet for Determining NOAEL-Based PRGs for Badger

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake Rate	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian NOAEL TRV (mg/kg/d)	NOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invertbrates	Small Mammals	(kg/kg-bw/d, dw)	Small Mammals	Soil Inverts	Plants	Soil	Small Mammals	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Phenol	5918.74						0.235			0.0064		1389.75	37.93	0.035	1	0	0	0.052	1.32	0.00	0.00	10.68	12.00	10.97%	0.00%	0.00%	89.03%	12	1.0
2-methylphenol (ocresol)	134503.46						0.336			0.0150		45152.15	2022.94	0.035	1	0	0	0.052	70.22	0.00	0.00	242.78	313.00	22.43%	0.00%	0.00%	77.57%	313	1.0
4-methylphenol (pcresol)	136360.50						0.333			0.0141		45450.77	1926.38	0.035	1	0	0	0.052	66.87	0.00	0.00	246.13	313.00	21.36%	0.00%	0.00%	78.64%	313	1.0
2,4-dinitrotoluene	285.89	1.873	-0.3768	0.376			0.184			0.0155	107.50	52.52	4.44	0.035	1	0	0	0.052	0.15	0.00	0.00	0.52	0.67	22.98%	0.00%	0.00%	77.02%	0.67	1.0
Bis[2-ethylhexyl] phthalate	3599.39			0.07			41.144			0.0945	237.48	148093.65	340.03	0.035	1	0	0	0.052	11.80	0.00	0.00	6.50	18.30	64.50%	0.00%	0.00%	35.50%	18.3	1.0
Total PCBs	8.47			0.17	1.41	1.36				0.1792	1.44	74.88	1.52	0.035	1	0	0	0.052	0.05	0.00	0.00	0.02	0.07	77.51%	0.00%	0.00%	22.49%	0.068	1.0
Aroclor 1016	150.41			0.30	1.41	1.36				0.2104	44.65	3744.85	31.65	0.035	1	0	0	0.052	1.10	0.00	0.00	0.27	1.37	80.18%	0.00%	0.00%	19.82%	1.37	1.0
Aroclor 1221	8.15			0.78	1.41	1.36				0.1883	6.39	71.07	1.54	0.035	1	0	0	0.052	0.05	0.00	0.00	0.01	0.07	78.36%	0.00%	0.00%	21.64%	0.068	1.0
Aroclor 1232	8.81			0.99	1.41	1.36				0.1704	8.73	78.98	1.50	0.035	1	0	0	0.052	0.05	0.00	0.00	0.02	0.07	76.61%	0.00%	0.00%	23.39%	0.068	1.0
Aroclor 1242	8.74			0.16	1.41	1.36				0.1756	1.41	78.07	1.53	0.035	1	0	0	0.052	0.05	0.00	0.00	0.02	0.07	77.15%	0.00%	0.00%	22.85%	0.069	1.0
Aroclor 1248	1.06			0.18	1.41	1.36				0.1855	0.19	4.41	0.20	0.035	1	0	0	0.052	0.01	0.00	0.00	0.00	0.01	78.11%	0.00%	0.00%	21.89%	0.0087	1.0
Aroclor 1254	9.11			0.14	1.41	1.36				0.1630	1.27	82.67	1.49	0.035	1	0	0	0.052	0.05	0.00	0.00	0.02	0.07	75.82%	0.00%	0.00%	24.18%	0.068	1.0
Aroclor 1260	15.42			0.05	1.41	1.36				0.0750	0.81	169.12	1.16	0.035	1	0	0	0.052	0.04	0.00	0.00	0.03	0.07	59.07%	0.00%	0.00%	40.93%	0.068	1.0
Aroclor-1262	37.67													0.035	1	0	0	0.052	0.00	0.00	0.00	0.07	0.07	0.00%	0.00%	0.00%	100.00%	0.068	1.0
Dichloroprop	1.00													0.035	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Aldrin	26.80			0.14			1.033			0.1630	3.73	27.68	4.37	0.035	1	0	0	0.052	0.15	0.00	0.00	0.05	0.20	75.82%	0.00%	0.00%	24.18%	0.2	1.0
beta-1,2,3,4,5,6-Hexachlorocyclohexane	66.95			1.72			1.021			0.1201	115.09	68.36	8.04	0.035	1	0	0	0.052	0.28	0.00	0.00	0.12	0.40	69.79%	0.00%	0.00%	30.21%	0.4	1.0
alpha-Chlordane	264.12			0.16			1.031			0.1771	43.53	272.44	46.76	0.035	1	0	0	0.052	1.62	0.00	0.00	0.48	2.10	77.30%	0.00%	0.00%	22.70%	2.1	1.0
gamma-Chlordane	264.12			0.16			1.036			0.1771	43.53	273.52	46.76	0.035	1	0	0	0.052	1.62	0.00	0.00	0.48	2.10	77.30%	0.00%	0.00%	22.70%	2.1	1.0
Dichlorodiphenyldichloroethylene	0.03	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		0.01	0.58	4.23	0.035	1	0	0	0.052	0.15	0.00	0.00	0.00	0.15	99.96%	0.00%	0.00%	0.04%	0.147	1.0
Dichlorodiphenyltrichloroethane	1.41	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		0.10	11.25	4.16	0.035	1	0	0	0.052	0.14	0.00	0.00	0.00	0.15	98.27%	0.00%	0.00%	1.73%	0.147	1.0
Dieldrin	0.35			0.41			14.70			1.20	0.14	5.07	0.41	0.035	1	0	0	0.052	0.01	0.00	0.00	0.00	0.02	95.85%	0.00%	0.00%	4.15%	0.015	1.0
Endosulfan I	21.88			1.31			1.184			0.1455	28.69	25.90	3.18	0.035	1	0	0	0.052	0.11	0.00	0.00	0.04	0.15	73.67%	0.00%	0.00%	26.33%	0.15	1.0
Endosulfan II	21.88			1.31			1.184			0.1455	28.69	25.90	3.18	0.035	1	0	0	0.052	0.11	0.00	0.00	0.04	0.15	73.67%	0.00%	0.00%	26.33%	0.15	1.0
Endosulfan sulfate	27.15			1.98			1.184			0.1072	53.69	32.14	2.91	0.035	1	0	0	0.052	0.10	0.00	0.00	0.05	0.15	67.33%	0.00%	0.00%	32.67%	0.15	1.0
Endrin aldehyde	14.04			1.44			6.686			0.1368	20.21	93.87	1.92	0.035	1	0	0	0.052	0.07	0.00	0.00	0.03	0.09	72.45%	0.00%	0.00%	27.55%	0.092	1.0
Methoxychlor	441.01			0.52			3.739			0.2093	231.47	1648.98	92.30	0.035	1	0	0	0.052	3.20	0.00	0.00	0.80	4.00	80.10%	0.00%	0.00%	19.90%	4	1.0

Notes:

It has been conservatively assumed that all chemical intake is absorbed by the receptor.

1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.

Acronyms:

BAF = Bioaccumulation factor

DW = Dry weight

FIR = Food ingestion rate

mg/kg = Miligrams per kilogram

mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight

mg/kg/d = Miligrams per kilogram per day

NOAEL = No observed adverse effect level

PRGs = Preliminary remediation goals

TRV = Toxicity reference value

Equations:

Total Estimated Exposure = Food Intake + Incidental Soil Intake

Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)

Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)

Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0

where: B1 = slope and B0 = intercept

Estimated Concentrations in Biota (method 2) = soil concentration X BAF

Hazard Quotient = Total Estimated Exposure (Dose) / TRV

Therefore, when the HQ = 1, soil concentration = PRG

where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Table A-9. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for California Quail

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)				Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway					
		Plants			Soil Inverts			Small Mammals																						
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invert.	Small Mam.	Species	(kg/kg-bw/d, dw)	Small Mam.	Soil Invert	Plants	Soil	Small Mam.	Soil Invert.	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
Aluminum	1.00			0.00287			0.043			0.0263	0.00	0.04	0.03	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	4.49%	95.51%	---	---
Antimony	1.00	-3.233	0.938				1			0.001 * 50 * Cdiet	0.04	1.00	0.05	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.01	0.00%	0.00%	39.27%	60.73%	---	---
Arsenic, Total all valence states	8103.60	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		21.85	138.80	12.46	California Quail	0.078	0	0	1	0.061	0.00	0.00	1.70	38.56	40.26	0.00%	0.00%	4.23%	95.77%	40.30	1.00
Arsenic (III)	8103.60	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		21.85	138.80	12.46	California Quail	0.078	0	0	1	0.061	0.00	0.00	1.70	38.56	40.26	0.00%	0.00%	4.23%	95.77%	40.30	1.00
Arsenic (V)	8103.60	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		21.85	138.80	12.46	California Quail	0.078	0	0	1	0.061	0.00	0.00	1.70	38.56	40.26	0.00%	0.00%	4.23%	95.77%	40.30	1.00
Barium	2463.67			0.156			0.091			0.0168	384.33	224.19	41.39	California Quail	0.078	0	0	1	0.061	0.00	0.00	29.98	11.72	41.70	0.00%	0.00%	71.89%	28.11%	41.70	1.00
Beryllium	1.00	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	0.59	0.05	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.05	0.00	0.05	0.00%	0.00%	90.56%	9.44%	---	---
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.01	0.00%	0.00%	7.58%	92.42%	---	---
Boron	222.00			5.714			1			1	1268.51	222.00	222.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	98.94	1.06	100.00	0.00%	0.00%	98.94%	1.06%	100.00	1.00
Cadmium	277.98	-0.476	0.546		2.114	0.795		-1.2571	0.4723		13.42	726.26	4.06	California Quail	0.078	0	0	1	0.061	0.00	0.00	1.05	1.32	2.37	0.00%	0.00%	44.18%	55.82%	2.37	1.00
Chromium (total)	349.42			0.041			0.306	-1.4599	0.7338		14.33	106.92	17.07	California Quail	0.078	0	0	1	0.061	0.00	0.00	1.12	1.66	2.78	0.00%	0.00%	40.20%	59.80%	2.78	1.00
Chromium (+3)	349.42			0.041			0.306	-1.4599	0.7338		14.33	106.92	17.07	California Quail	0.078	0	0	1	0.061	0.00	0.00	1.12	1.66	2.78	0.00%	0.00%	40.20%	59.80%	2.78	1.00
Chromium (+6)	1.00			0.041			0.306	-1.4599	0.7338		0.04	0.31	0.23	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.01	0.00%	0.00%	40.20%	59.80%		---
Cobalt	1460.92			0.00745			0.291	-4.4669	1.307		10.88	425.13	157.11	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.85	6.95	7.80	0.00%	0.00%	10.88%	89.12%	7.80	1.00
Copper	1914.48	0.669	0.394				0.515	2.042	0.1444		38.34	985.96	22.95	California Quail	0.078	0	0	1	0.061	0.00	0.00	2.99	9.11	12.10	0.00%	0.00%	24.72%	75.28%	12.10	1.00
Lead	537.35	-1.328	0.561		-0.218	0.807		0.0761	0.4422		9.01	128.42	17.39	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.70	2.56	3.26	0.00%	0.00%	21.57%	78.43%	3.26	1.00
Lithium	1.00			0.004			0.046			1	0.00	0.05	1.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.01	0.00%	0.00%	6.15%	93.85%	---	---
Manganese	31822.67			0.0792	-0.809	0.682				0.0205	2520.36	524.23	652.36	California Quail	0.078	0	0	1	0.061	0.00	0.00	196.59	151.41	348.00	0.00%	0.00%	56.49%	43.51%	348.00	1.00
Mercury (methyl)	35.51	-0.996	0.544		0.0781	0.3369				0.054	2.58	3.60	1.93	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.20	0.17	0.37	0.00%	0.00%	54.31%	45.69%	0.37	1.00
Mercury (inorganic)	110.75	-0.996	0.544		0.0781	0.3369				0.054	4.78	5.28	6.01	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.37	0.53	0.90	0.00%	0.00%	41.44%	58.56%	0.90	1.00
Molybdenum	345.10			1.2504			0.953			1	431.51	328.88	345.10	California Quail	0.078	0	0	1	0.061	0.00	0.00	33.66	1.64	35.30	0.00%	0.00%	95.35%	4.65%	35.30	1.00
Nickel	1911.91	-2.224	0.748				1.059	-0.2462	0.4658		30.81	2024.71	26.40	California Quail	0.078	0	0	1	0.061	0.00	0.00	2.40	9.10	11.50	0.00%	0.00%	20.90%	79.10%	11.50	1.00
Selenium	10.47	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		6.78	5.19	1.60	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.53	0.05	0.58	0.00%	0.00%	91.40%	8.60%	0.58	1.00
Silver	3452.99			0.014			2.045			0.0040	48.34	7061.37	13.81	California Quail	0.078	0	0	1	0.061	0.00	0.00	3.77	16.43	20.20	0.00%	0.00%	18.67%	81.33%	20.20	1.00
Strontium	1.00			0.207			0.4066			1.74	0.21	0.41	1.74	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.02	0.00	0.02	0.00%	0.00%	77.22%	22.78%	---	---
Thallium	1.00			0.004			0.0541			0.1124	0.00	0.05	0.11	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.01	0.00%	0.00%	6.15%	93.85%	---	---
Tin	204.21			1			0.08			0.08	204.21	16.34	16.34	California Quail	0.078	0	0	1	0.061	0.00	0.00	15.93	0.97	16.90	0.00%	0.00%	94.25%	5.75%	16.90	1.00
Uranium	1.00			0.021			0.033			0.0002	0.02	0.03	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.01	0.00%	0.00%	25.61%	74.39%	---	---
Vanadium	133.95			0.00485			0.042			0.0123	0.65	5.63	1.65	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.05	0.64	0.69	0.00%	0.00%	7.37%	92.63%	0.69	1.00
Zinc	5015.41	1.575	0.555		4.449	0.328		4.3632	0.0706		546.62	1399.19	143.27	California Quail	0.078	0	0	1	0.061	0.00	0.00	42.64	23.86	66.50	0.00%	0.00%	64.12%	35.88%	66.50	1.00
Ammonia/Ammonium	1.00													California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---

Table A-9. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for California Quail

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Species	Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
		Plants			Soil Inverts			Small Mammals																						
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invert.	Small Mam.		(kg/kg-bw/d, dw)	Small Mam.	Soil Invert	Plants	Soil	Small Mam.	Soil Invert.	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Chloride	1.00													California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Cyanide	1.00													California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Fluoride	6123.23			0.006							36.74			California Quail	0.078	0	0	1	0.061	0.00	0.00	2.87	29.13	32.00	0.00%	0.00%	8.96%	91.04%	32.00	1.00
Iodine	1.00			0.05							0.05			California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.01	0.00%	0.00%	45.05%	54.95%	---	---
Nitrate/Nitrite	1.00													California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Phosphate	1.00													California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Sulfate/Sulfite	1.00													California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Total Organic Carbon	1.00													California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
1,1-dichloroethane	7229.93						1.010			0.0109		7299.27	78.93	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	34.40	34.40	0.00%	0.00%	0.00%	100.00%	34.40	1.00
1,1-dichloroethene	7229.93						1.011			0.0186		7311.11	134.61	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	34.40	34.40	0.00%	0.00%	0.00%	100.00%	34.40	1.00
1,1,1-trichloroethane	7229.93						1.013			0.0305		7322.60	220.72	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	34.40	34.40	0.00%	0.00%	0.00%	100.00%	34.40	1.00
1,1,2-trichloroethane	7229.93						1.010			0.0165		7303.81	119.29	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	34.40	34.40	0.00%	0.00%	0.00%	100.00%	34.40	1.00
1,1,2,2-tetrachloroethane	7229.93						1.013			0.0270		7323.45	195.41	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	34.40	34.40	0.00%	0.00%	0.00%	100.00%	34.40	1.00
1,2-dichlorobenzene	175.53			2.45			1.018			0.0882	430.32	178.63	15.48	California Quail	0.078	0	0	1	0.061	0.00	0.00	33.56	0.84	34.40	0.00%	0.00%	97.57%	2.43%	34.40	1.00
1,2-dichloroethane (DCA)	7229.93						0.988			0.0063		7145.86	45.51	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	34.40	34.40	0.00%	0.00%	0.00%	100.00%	34.40	1.00
1,3-dichlorobenzene	192.26			2.23			1.018			0.0963	429.30	195.73	18.51	California Quail	0.078	0	0	1	0.061	0.00	0.00	33.49	0.91	34.40	0.00%	0.00%	97.34%	2.66%	34.40	1.00
2-butanone (Methyl Ethyl Ketone/MEK)	21017.23						0.094			0.0006		1967.17	11.60	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	100.00	100.00	0.00%	0.00%	0.00%	100.00%	100.00	1.00
2-hexanone	21017.23						0.207			0.0053		4356.86	112.37	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	100.00	100.00	0.00%	0.00%	0.00%	100.00%	100.00	1.00
Benzene	1.00						1.011			0.0186		1.01	0.02	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Butanol	1.00						0.478			0.0017		0.48	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Carbon Tetrachloride	7229.93						1.015			0.0420		7336.28	303.67	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	34.40	34.40	0.00%	0.00%	0.00%	100.00%	34.40	1.00
Chlorobenzene	7229.93						1.015			0.0490		7335.75	354.45	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	34.40	34.40	0.00%	0.00%	0.00%	100.00%	34.40	1.00
Chloroform	7229.93						1.011			0.0135		7305.99	97.40	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	34.40	34.40	0.00%	0.00%	0.00%	100.00%	34.40	1.00
Cis-1,2-dichloroethylene	7229.93						1.011			0.0122		7310.04	88.48	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	34.40	34.40	0.00%	0.00%	0.00%	100.00%	34.40	1.00
Dichloromethane (Methylene Chloride)	7229.93						1.007			0.0042		7278.77	30.34	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	34.40	34.40	0.00%	0.00%	0.00%	100.00%	34.40	1.00
Ethyl Benzene	1.00			3.21			1.016			0.0666	3.21	1.02	0.07	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.25	0.00	0.26	0.00%	0.00%	98.14%	1.86%	---	---
Methyl Isobutyl Ketone	21017.23						0.197			0.0037		4139.92	78.65	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	100.00	100.00	0.00%	0.00%	0.00%	100.00%	100.00	1.00
n-butyl Benzene	1.00			1.67			1.022			0.1227	1.67	1.02	0.12	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.13	0.00	0.14	0.00%	0.00%	96.48%	3.52%	---	---
Tetrachloroethylene	7229.93						1.018			0.0390		7356.51	282.02	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	34.40	34.40	0.00%	0.00%	0.00%	100.00%	34.40	1.00
Toluene	7229.93						1.014			0.0430		7331.68	311.13	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	34.40	34.40	0.00%	0.00%	0.00%	100.00%	---	---
Trans-1,2-dichloroethylene	7229.93						1.011			0.0170		7310.04	122.98	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	34.40	34.40	0.00%	0.00%	0.00%	100.00%	34.40	1.00

Table A-9. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for California Quail

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)				Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway					
		Plants			Soil Inverts			Small Mammals																						
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invert.	Small Mam.	Species	(kg/kg-bw/d, dw)	Small Mam.	Soil Invert	Plants	Soil	Small Mam.	Soil Invert.	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
Trichloroethylene (TCE)	7229.93						1.012			0.0410		7319.95	296.32	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	34.40	34.40	0.00%	0.00%	0.00%	100.00%	34.40	1.00
Xylene	7229.93			3.43			1.016			0.0619	24810.47	7345.97	447.68	California Quail	0.078	0	0	1	0.061	0.00	0.00	1935.22	34.40	1969.62	0.00%	0.00%	98.25%	1.75%	---	---
Acenaphthene	68306.01	-5.562	-0.8556				1.470			0	0.00	100409.84	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	325.00	325.00	0.00%	0.00%	0.00%	100.00%	325.00	1.00
Acenaphthylene	43765.65	-1.144	0.791				22.9			0	1493.84	1002233.31	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	116.52	208.24	324.76	0.00%	0.00%	35.88%	64.12%	325.00	1.00
Anthracene	43404.77	-0.9887	0.7784				2.42			0	1515.21	105039.54	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	118.19	206.52	324.71	0.00%	0.00%	36.40%	63.60%	325.00	1.00
Benzo(a)pyrene	1.00	-2.0615	0.975				1.33			0	0.13	1.33	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.01	0.00	0.01	0.00%	0.00%	67.60%	32.40%	---	---
Benzo(a)anthracene	1.00	-2.7078	0.5944				1.59			0	0.07	1.59	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.01	0.00	0.01	0.00%	0.00%	52.23%	47.77%	---	---
Benzo(b)fluoranthene	1.00			0.31			2.6			0	0.31	2.60	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.02	0.00	0.03	0.00%	0.00%	83.56%	16.44%	---	---
Benzo(ghi)perylene	1.00	-0.9313	1.1829				2.94			0	0.39	2.94	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.03	0.00	0.04	0.00%	0.00%	86.59%	13.41%	---	---
Benzo[k]fluoranthene	1.00	-4.6482	0.1668				2.6			0	0.01	2.60	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.01	0.00%	0.00%	13.57%	86.43%	---	---
Chrysene	1.00	-2.7078	0.5944				2.29			0	0.07	2.29	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.01	0.00	0.01	0.00%	0.00%	52.23%	47.77%	---	---
Dibenz(ah)anthracene	1.00			0.13			2.31			0	0.13	2.31	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.01	0.00	0.01	0.00%	0.00%	68.06%	31.94%	---	---
Fluoranthene	1.00			0.5			3.04			0	0.50	3.04	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.04	0.00	0.04	0.00%	0.00%	89.13%	10.87%	---	---
Fluorene	68306.01	-5.562	-0.8556				9.57			0	0.00	653688.52	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	325.00	325.00	0.00%	0.00%	0.00%	100.00%	325.00	1.00
Indeno[1,2,3-cd]pyrene	1.00			0.11			2.86			0	0.11	2.86	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.01	0.00	0.01	0.00%	0.00%	64.33%	35.67%	---	---
2-Methylnaphthalene	8.37	-1.3205	4.544				1.020			0	4165.52	8.54	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	324.91	0.04	324.95	0.00%	0.00%	99.99%	0.01%	325.00	1.00
Naphthalene	339.83			12.2			4.4			0	4145.94	1495.26	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	323.38	1.62	325.00	0.00%	0.00%	99.50%	0.50%	325.00	1.00
Phenanthrene	56061.03	-0.1665	0.6203				1.72			0	746.94	96424.96	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	58.26	266.74	325.00	0.00%	0.00%	17.93%	82.07%	325.00	1.00
Pyrene	1.00			0.72			1.75			0	0.72	1.75	0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.06	0.00	0.06	0.00%	0.00%	92.19%	7.81%	---	---
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.08	0.00	0.09	0.00%	0.00%	94.68%	5.32%		---
Low MW PAHs	67599.94	-1.3205	0.4544							0	41.81		0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	3.26	321.64	324.90	0.00%	0.00%	1.00%	99.00%	325.00	1.00
High MW PAHs	1.00	-1.7026	0.9469							0	0.18		0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.01	0.00	0.02	0.00%	0.00%	74.92%	25.08%	---	---
Gasoline Range Organics																													5000.00	0.00
TPH - Diesel	1050861.71									0			0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	5000.00	5000.00	0.00%	0.00%	0.00%	100.00%	5000.00	1.00
TPH - Kerosene	1050861.71									0			0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	5000.00	5000.00	0.00%	0.00%	0.00%	100.00%	5000.00	1.00
Normal paraffin hydrocarbons	1.00									0			0.00	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Phenol	1.00						0.235			0.0064		0.23	0.01	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
2-methylphenol (ocresol)	1.00						0.336			0.0150		0.34	0.02	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
4-methylphenol (pcresol)	1.00						0.333			0.0141		0.33	0.01	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
2,4-dinitrotoluene	38.14	1.873	-0.3768	0.376			0.184			0.0155	14.34	7.01	0.59	California Quail	0.078	0	0	1	0.061	0.00	0.00	1.12	0.18	1.30	0.00%	0.00%	86.04%	13.96%	1.30	1.00
Bis[2-ethylhexyl] phthalate	1.00			0.07			41.144			0.0945	0.07	41.14	0.09	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.01	0.00	0.01	0.00%	0.00%	51.96%	48.04%	---	---

Table A-9. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for California Quail

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Species	Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
		Plants			Soil Inverts			Small Mammals																						
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invert.	Small Mam.		(kg/kg-bw/d, dw)	Small Mam.	Soil Invert	Plants	Soil	Small Mam.	Soil Invert.	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Total PCBs	100.12			0.17	1.41	1.36				0.1792	16.97	2153.12	17.95	California Quail	0.078	0	0	1	0.061	0.00	0.00	1.32	0.48	1.80	0.00%	0.00%	73.53%	26.47%	1.80	1.00
Aroclor 1016	64.48			0.30	1.41	1.36				0.2104	19.14	1183.61	13.57	California Quail	0.078	0	0	1	0.061	0.00	0.00	1.49	0.31	1.80	0.00%	0.00%	82.95%	17.05%	1.80	1.00
Aroclor 1221	27.30			0.78	1.41	1.36				0.1883	21.41	367.73	5.14	California Quail	0.078	0	0	1	0.061	0.00	0.00	1.67	0.13	1.80	0.00%	0.00%	92.78%	7.22%	1.80	1.00
Aroclor 1232	21.94			0.99	1.41	1.36				0.1704	21.74	273.23	3.74	California Quail	0.078	0	0	1	0.061	0.00	0.00	1.70	0.10	1.80	0.00%	0.00%	94.20%	5.80%	1.80	1.00
Aroclor 1242	103.60			0.16	1.41	1.36				0.1756	16.76	2255.42	18.19	California Quail	0.078	0	0	1	0.061	0.00	0.00	1.31	0.49	1.80	0.00%	0.00%	72.62%	27.38%	1.80	1.00
Aroclor 1248	94.05			0.18	1.41	1.36				0.1855	17.34	1977.66	17.45	California Quail	0.078	0	0	1	0.061	0.00	0.00	1.35	0.45	1.80	0.00%	0.00%	75.14%	24.86%	1.80	1.00
Aroclor 1254	115.21			0.14	1.41	1.36				0.1630	16.05	2606.11	18.78	California Quail	0.078	0	0	1	0.061	0.00	0.00	1.25	0.55	1.80	0.00%	0.00%	69.55%	30.45%	1.80	1.00
Aroclor 1260	203.80			0.05	1.41	1.36				0.0750	10.65	5660.58	15.29	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.83	0.97	1.80	0.00%	0.00%	46.13%	53.87%	1.80	1.00
Aroclor-1262	378.31													California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	1.80	1.80	0.00%	0.00%	0.00%	100.00%	1.80	1.00
Dichloroprop	1.00													California Quail	0.078	0	0	1	0.061	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Aldrin	2.24			0.14			1.033			0.1630	0.31	2.31	0.37	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.02	0.01	0.04	0.00%	0.00%	69.55%	30.45%	0.04	1.00
beta-1,2,3,4,5,6-Hexachlorocyclohexane	6.17			1.72			1.021			0.1201	10.61	6.30	0.74	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.83	0.03	0.86	0.00%	0.00%	96.57%	3.43%	0.86	1.00
alpha-Chlordane	607.51			0.16			1.031			0.1771	100.12	626.63	107.56	California Quail	0.078	0	0	1	0.061	0.00	0.00	7.81	2.89	10.70	0.00%	0.00%	72.99%	27.01%	10.70	1.00
gamma-Chlordane	607.51			0.16			1.036			0.1771	100.12	629.12	107.56	California Quail	0.078	0	0	1	0.061	0.00	0.00	7.81	2.89	10.70	0.00%	0.00%	72.99%	27.01%	10.70	1.00
Dichlorodiphenyldichloroethylene	300.36	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		5.93	1807.60	1475.85	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.46	1.43	1.89	0.00%	0.00%	24.46%	75.54%	1.89	1.00
Dichlorodiphenyltrichloroethane	300.36	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		5.93	1190.05	203.81	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.46	1.43	1.89	0.00%	0.00%	24.46%	75.54%	1.89	1.00
Dieldrin	6.07			0.41			14.70			1.20	2.49	89.23	7.28	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.19	0.03	0.22	0.00%	0.00%	87.05%	12.95%	0.22	1.00
Endosulfan I	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.10	0.00	0.11	0.00%	0.00%	95.55%	4.45%	---	---
Endosulfan II	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.10	0.00	0.11	0.00%	0.00%	95.55%	4.45%	---	---
Endosulfan sulfate	1.00			1.98			1.184			0.1072	1.98	1.18	0.11	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.15	0.00	0.16	0.00%	0.00%	97.01%	2.99%	---	---
Endrin aldehyde	1.00			1.44			6.686			0.1368	1.44	6.69	0.14	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.11	0.00	0.12	0.00%	0.00%	95.93%	4.07%	---	---
Methoxychlor	1.00			0.52			3.739			0.2093	0.52	3.74	0.21	California Quail	0.078	0	0	1	0.061	0.00	0.00	0.04	0.00	0.05	0.00%	0.00%	89.59%	10.41%	---	---

Notes:

It has been conservatively assumed that all chemical intake is absorbed by the receptor.

1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.

Acronyms:

BAF = Bioaccumulation factor

DW = Dry weight

FIR = Food ingestion rate

mg/kg = Miligrams per kilogram

mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight

mg/kg/d = Miligrams per kilogram per day

NOAEL = No observed adverse effect level

PRGs = Preliminary remediation goals

TRV = Toxicity reference value

Equations:

Total Estimated Exposure = Food Intake + Incidental Soil Intake

Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)

Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)

Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0

Table A-9. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for California Quail

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Species	Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
		Plants			Soil Inverts			Small Mammals																						
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invert.	Small Mam.		(kg/kg-bw/d, dw)	Small Mam.	Soil Invert	Plants	Soil	Small Mam.	Soil Invert.	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		

where: B1 = slope and B0 = intercept

Estimated Concentrations in Biota (method 2) = soil concentration X BAF

Hazard Quotient = Total Estimated Exposure (Dose) / TRV

Therefore, when the HQ = 1, soil concentration = PRG

where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Table A-10. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Western Meadowlark

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway					
		Plants			Soil Inverts			Small Mammals																					
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
Aluminum	1.00			0.00287			0.043			0.0263	0.00	0.04	0.03	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.01	0.00%	55.34%	2.17%	42.49%	---	---
Antimony	1.00	-3.233	0.938				1			0.001 * 50 * Cdiet	0.04	1.00	0.05	0.12	0	0.63	0.37	0.0208	0.00	0.08	0.00	0.00	0.08	0.00%	94.68%	2.19%	3.13%	---	---
Arsenic, Total all valence states	10558.64	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		25.36	167.31	15.47	0.12	0	0.63	0.37	0.0208	0.00	12.70	1.13	26.46	40.29	0.00%	31.52%	2.81%	65.67%	**40.30**	**1.00**
Arsenic (III)	10558.64	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		25.36	167.31	15.47	0.12	0	0.63	0.37	0.0208	0.00	12.70	1.13	26.46	40.29	0.00%	31.52%	2.81%	65.67%	**40.30**	**1.00**
Arsenic (V)	10558.64	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		25.36	167.31	15.47	0.12	0	0.63	0.37	0.0208	0.00	12.70	1.13	26.46	40.29	0.00%	31.52%	2.81%	65.67%	**40.30**	**1.00**
Barium	2547.94			0.156			0.091			0.0168	397.48	231.86	42.81	0.12	0	0.63	0.37	0.0208	0.00	17.60	17.72	6.38	41.70	0.00%	42.20%	42.49%	15.31%	**41.70**	**1.00**
Beryllium	1.00	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	0.59	0.05	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.03	0.00	0.03	0.00%	10.67%	81.50%	7.83%	---	---
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	0.12	0	0.63	0.37	0.0208	0.00	0.08	0.00	0.00	0.08	0.00%	96.53%	0.28%	3.19%	---	---
Boron	300.21			5.714			1			1	1715.38	300.21	300.21	0.12	0	0.63	0.37	0.0208	0.00	22.78	76.46	0.75	100.00	0.00%	22.78%	76.46%	0.75%	**100.00**	**1.00**
Cadmium	5.08	-0.476	0.546		2.114	0.795		-1.2571	0.4723		1.51	30.17	0.61	0.12	0	0.63	0.37	0.0208	0.00	2.29	0.07	0.01	2.37	0.00%	96.62%	2.84%	0.54%	**2.37**	**1.00**
Chromium (total)	100.88			0.041			0.306	-1.4599	0.7338		4.14	30.87	6.86	0.12	0	0.63	0.37	0.0208	0.00	2.34	0.18	0.25	2.78	0.00%	84.28%	6.63%	9.09%	**2.78**	**1.00**
Chromium (+3)	100.88			0.041			0.306	-1.4599	0.7338		4.14	30.87	6.86	0.12	0	0.63	0.37	0.0208	0.00	2.34	0.18	0.25	2.78	0.00%	84.28%	6.63%	9.09%	**2.78**	**1.00**
Chromium (+6)	1.00			0.041			0.306	-1.4599	0.7338		0.04	0.31	0.23	0.12	0	0.63	0.37	0.0208	0.00	0.02	0.00	0.00	0.03	0.00%	84.28%	6.63%	9.09%		---
Cobalt	312.95			0.00745			0.291	-4.4669	1.307		2.33	91.07	20.97	0.12	0	0.63	0.37	0.0208	0.00	6.91	0.10	0.78	7.80	0.00%	88.61%	1.33%	10.05%	**7.80**	**1.00**
Copper	271.87	0.669	0.394				0.515	2.042	0.1444		17.77	140.01	17.31	0.12	0	0.63	0.37	0.0208	0.00	10.63	0.79	0.68	12.10	0.00%	87.82%	6.55%	5.63%	**12.10**	**1.00**
Lead	114.72	-1.328	0.561		-0.218	0.807		0.0761	0.4422		3.79	36.94	8.79	0.12	0	0.63	0.37	0.0208	0.00	2.80	0.17	0.29	3.26	0.00%	86.00%	5.18%	8.82%	**3.26**	**1.00**
Lithium	1.00			0.004			0.046			1	0.00	0.05	1.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.01	0.00%	56.54%	2.89%	40.58%	---	---
Manganese	48820.09			0.0792	-0.809	0.682				0.0205	3866.55	701.91	1000.81	0.12	0	0.63	0.37	0.0208	0.00	53.27	172.35	122.33	347.96	0.00%	15.31%	49.53%	35.16%	**348.00**	**1.00**
Mercury (methyl)	21.26	-0.996	0.544		0.0781	0.3369				0.054	1.95	3.03	1.15	0.12	0	0.63	0.37	0.0208	0.00	0.23	0.09	0.05	0.37	0.00%	62.12%	23.47%	14.40%	**0.37**	**1.00**
Mercury (inorganic)	112.47	-0.996	0.544		0.0781	0.3369				0.054	4.82	5.31	6.11	0.12	0	0.63	0.37	0.0208	0.00	0.40	0.21	0.28	0.90	0.00%	44.78%	23.89%	31.33%	**0.90**	**1.00**
Molybdenum	270.35			1.2504			0.953			1	338.04	257.64	270.35	0.12	0	0.63	0.37	0.0208	0.00	19.55	15.07	0.68	35.30	0.00%	55.39%	42.69%	1.92%	**35.30**	**1.00**
Nickel	136.40	-2.224	0.748				1.059	-0.2462	0.4658		4.28	144.45	7.72	0.12	0	0.63	0.37	0.0208	0.00	10.96	0.19	0.34	11.50	0.00%	95.37%	1.66%	2.97%	**11.50**	**1.00**
Selenium	8.17	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		5.16	4.33	1.45	0.12	0	0.63	0.37	0.0208	0.00	0.33	0.23	0.02	0.58	0.00%	56.72%	39.74%	3.54%	**0.58**	**1.00**
Silver	127.57			0.014			2.045			0.0040	1.79	260.89	0.51	0.12	0	0.63	0.37	0.0208	0.00	19.80	0.08	0.32	20.20	0.00%	98.02%	0.39%	1.58%	**20.20**	**1.00**
Strontium	1.00			0.207			0.4066			1.74	0.21	0.41	1.74	0.12	0	0.63	0.37	0.0208	0.00	0.03	0.01	0.00	0.04	0.00%	72.47%	21.65%	5.88%	---	---
Thallium	1.00			0.004			0.0541			0.1124	0.00	0.05	0.11	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.01	0.00%	60.47%	2.63%	36.90%	---	---
Tin	317.95			1			0.08			0.08	317.95	25.44	25.44	0.12	0	0.63	0.37	0.0208	0.00	1.93	14.17	0.80	16.90	0.00%	11.42%	83.86%	4.71%	**16.90**	**1.00**
Uranium	1.00			0.021			0.033			0.0002	0.02	0.03	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.01	0.00%	42.12%	15.74%	42.14%	---	---
Vanadium	116.42			0.00485			0.042			0.0123	0.56	4.89	1.43	0.12	0	0.63	0.37	0.0208	0.00	0.37	0.03	0.29	0.69	0.00%	53.94%	3.66%	42.40%	**0.69**	**1.00**
Zinc	725.66	1.575	0.555		4.449	0.328		4.3632	0.0706		186.95	742.16	124.99	0.12	0	0.63	0.37	0.0208	0.00	56.33	8.33	1.82	66.48	0.00%	84.73%	12.53%	2.74%	**66.50**	**1.00**
Ammonia/Ammonium	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Chloride	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Cyanide	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Fluoride	11538.73			0.006							69.23			0.12	0	0.63	0.37	0.0208	0.00	0.00	3.09	28.91	32.00	0.00%	0.00%	9.64%	90.36%	**32.00**	**1.00**
Iodine	1.00			0.05							0.05			0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	47.07%	52.93%	---	---
Nitrate/Nitrite	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Phosphate	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Sulfate/Sulfite	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---

Table A-10. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Western Meadowlark

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway					
		Plants			Soil Inverts			Small Mammals																					
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
Total Organic Carbon	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
1,1-dichloroethane	434.72						1.010			0.0109		438.89	4.75	0.12	0	0.63	0.37	0.0208	0.00	33.31	0.00	1.09	34.40	0.00%	96.83%	0.00%	3.17%	**34.40**	**1.00**
1,1-dichloroethene	434.04						1.011			0.0186		438.91	8.08	0.12	0	0.63	0.37	0.0208	0.00	33.31	0.00	1.09	34.40	0.00%	96.84%	0.00%	3.16%	**34.40**	**1.00**
1,1,1-trichloroethane	433.38						1.013			0.0305		438.93	13.23	0.12	0	0.63	0.37	0.0208	0.00	33.31	0.00	1.09	34.40	0.00%	96.84%	0.00%	3.16%	**34.40**	**1.00**
1,1,2-trichloroethane	434.46						1.010			0.0165		438.90	7.17	0.12	0	0.63	0.37	0.0208	0.00	33.31	0.00	1.09	34.40	0.00%	96.84%	0.00%	3.16%	**34.40**	**1.00**
1,1,2,2-tetrachloroethane	433.33						1.013			0.0270		438.94	11.71	0.12	0	0.63	0.37	0.0208	0.00	33.31	0.00	1.09	34.40	0.00%	96.84%	0.00%	3.16%	**34.40**	**1.00**
1,2-dichlorobenzene	181.99			2.45			1.018			0.0882	446.16	185.20	16.05	0.12	0	0.63	0.37	0.0208	0.00	14.06	19.89	0.46	34.40	0.00%	40.86%	57.81%	1.33%	**34.40**	**1.00**
1,2-dichloroethane (DCA)	443.75						0.988			0.0063		438.59	2.79	0.12	0	0.63	0.37	0.0208	0.00	33.29	0.00	1.11	34.40	0.00%	96.77%	0.00%	3.23%	**34.40**	**1.00**
1,3-dichlorobenzene	191.85			2.23			1.018			0.0963	428.39	195.31	18.47	0.12	0	0.63	0.37	0.0208	0.00	14.82	19.10	0.48	34.40	0.00%	43.09%	55.51%	1.40%	**34.40**	**1.00**
2-butanone (Methyl Ethyl Ketone/MEK)	10406.18						0.094			0.0006		974.00	5.74	0.12	0	0.63	0.37	0.0208	0.00	73.92	0.00	26.08	100.00	0.00%	73.92%	0.00%	26.08%	**100.00**	**1.00**
2-hexanone	5482.66						0.207			0.0053		1136.55	29.31	0.12	0	0.63	0.37	0.0208	0.00	86.26	0.00	13.74	100.00	0.00%	86.26%	0.00%	13.74%	**100.00**	**1.00**
Benzene	1.00						1.011			0.0186		1.01	0.02	0.12	0	0.63	0.37	0.0208	0.00	0.08	0.00	0.00	0.08	0.00%	96.84%	0.00%	3.16%	---	---
Butanol	1.00						0.478			0.0017		0.48	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.04	0.00	0.00	0.04	0.00%	93.54%	0.00%	6.46%	---	---
Carbon Tetrachloride	432.60						1.015			0.0420		438.96	18.17	0.12	0	0.63	0.37	0.0208	0.00	33.32	0.00	1.08	34.40	0.00%	96.85%	0.00%	3.15%	**34.40**	**1.00**
Chlorobenzene	432.63						1.015			0.0490		438.96	21.21	0.12	0	0.63	0.37	0.0208	0.00	33.32	0.00	1.08	34.40	0.00%	96.85%	0.00%	3.15%	**34.40**	**1.00**
Chloroform	434.33						1.011			0.0135		438.90	5.85	0.12	0	0.63	0.37	0.0208	0.00	33.31	0.00	1.09	34.40	0.00%	96.84%	0.00%	3.16%	**34.40**	**1.00**
Cis-1,2-dichloroethylene	434.10						1.011			0.0122		438.91	5.31	0.12	0	0.63	0.37	0.0208	0.00	33.31	0.00	1.09	34.40	0.00%	96.84%	0.00%	3.16%	**34.40**	**1.00**
Dichloromethane (Methylene Chloride)	435.91						1.007			0.0042		438.85	1.83	0.12	0	0.63	0.37	0.0208	0.00	33.31	0.00	1.09	34.40	0.00%	96.82%	0.00%	3.18%	**34.40**	**1.00**
Ethyl Benzene	1.00			3.21			1.016			0.0666	3.21	1.02	0.07	0.12	0	0.63	0.37	0.0208	0.00	0.08	0.14	0.00	0.22	0.00%	34.60%	64.28%	1.12%	---	---
Methyl Isobutyl Ketone	5728.72						0.197			0.0037		1128.43	21.44	0.12	0	0.63	0.37	0.0208	0.00	85.64	0.00	14.36	100.00	0.00%	85.64%	0.00%	14.36%	**100.00**	**1.00**
n-butyl Benzene	1.00			1.67			1.022			0.1227	1.67	1.02	0.12	0.12	0	0.63	0.37	0.0208	0.00	0.08	0.07	0.00	0.15	0.00%	50.19%	48.19%	1.62%	---	---
Tetrachloroethylene	431.44						1.018			0.0390		439.00	16.83	0.12	0	0.63	0.37	0.0208	0.00	33.32	0.00	1.08	34.40	0.00%	96.86%	0.00%	3.14%	**34.40**	**1.00**
Toluene	1.00						1.014			0.0430		1.01	0.04	0.12	0	0.63	0.37	0.0208	0.00	0.08	0.00	0.00	0.08	0.00%	96.85%	0.00%	3.15%	---	---
Trans-1,2-dichloroethylene	434.10						1.011			0.0170		438.91	7.38	0.12	0	0.63	0.37	0.0208	0.00	33.31	0.00	1.09	34.40	0.00%	96.84%	0.00%	3.16%	**34.40**	**1.00**
Trichloroethylene (TCE)	433.53						1.012			0.0410		438.93	17.77	0.12	0	0.63	0.37	0.0208	0.00	33.31	0.00	1.09	34.40	0.00%	96.84%	0.00%	3.16%	**34.40**	**1.00**
Xylene	1.00			3.43			1.016			0.0619	3.43	1.02	0.06	0.12	0	0.63	0.37	0.0208	0.00	0.08	0.15	0.00	0.23	0.00%	33.16%	65.77%	1.08%	---	---
Acenaphthene	2849.00	-5.562	-0.8556				1.470			0	0.00	4188.03	0.00	0.12	0	0.63	0.37	0.0208	0.00	317.86	0.00	7.14	325.00	0.00%	97.80%	0.00%	2.20%	**325.00**	**1.00**
Acenaphthylene	186.19	-1.144	0.791				22.9			0	19.89	4263.65	0.00	0.12	0	0.63	0.37	0.0208	0.00	323.60	0.89	0.47	324.95	0.00%	99.58%	0.27%	0.14%	**325.00**	**1.00**
Anthracene	1716.22	-0.9887	0.7784				2.42			0	122.58	4153.25	0.00	0.12	0	0.63	0.37	0.0208	0.00	315.22	5.46	4.30	324.99	0.00%	97.00%	1.68%	1.32%	**325.00**	**1.00**
Benzo(a)pyrene	1.00	-2.0615	0.975				1.33			0	0.13	1.33	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.10	0.01	0.00	0.11	0.00%	92.51%	5.20%	2.30%	---	---
Benzo(a)anthracene	1.00	-2.7078	0.5944				1.59			0	0.07	1.59	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.12	0.00	0.00	0.13	0.00%	95.66%	2.36%	1.99%	---	---
Benzo(b)fluoranthene	1.00			0.31			2.6			0	0.31	2.60	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.20	0.01	0.00	0.21	0.00%	92.36%	6.47%	1.17%	---	---
Benzo(ghi)perylene	1.00	-0.9313	1.1829				2.94			0	0.39	2.94	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.22	0.02	0.00	0.24	0.00%	91.75%	7.22%	1.03%	---	---
Benzo[k]fluoranthene	1.00	-4.6482	0.1668				2.6			0	0.01	2.60	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.20	0.00	0.00	0.20	0.00%	98.54%	0.21%	1.25%	---	---
Chrysene	1.00	-2.7078	0.5944				2.29			0	0.07	2.29	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.17	0.00	0.00	0.18	0.00%	96.94%	1.66%	1.40%	---	---
Dibenz(ah)anthracene	1.00			0.13			2.31			0	0.13	2.31	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.18	0.01	0.00	0.18	0.00%	95.48%	3.16%	1.36%	---	---
Fluoranthene	1.00			0.5			3.04			0	0.50	3.04	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.23	0.02	0.00	0.26	0.00%	90.30%	8.72%	0.98%	---	---
Fluorene	445.91	-5.562	-0.8556				9.57			0	0.00	4267.37	0.00	0.12	0	0.63	0.37	0.0208	0.00	323.88	0.00	1.12	325.00	0.00%	99.66%	0.00%	0.34%	**325.00**	**1.00**

Table A-10. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Western Meadowlark

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway					
		Plants			Soil Inverts			Small Mammals																					
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
Indeno[1,2,3-cd]pyrene	1.00			0.11			2.86			0	0.11	2.86	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.22	0.00	0.00	0.22	0.00%	96.70%	2.18%	1.12%	---	---
2-Methylnaphthalene	9.46	-1.3205	4.544				1.020			0	7269.79	9.65	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.73	324.05	0.02	324.80	0.00%	0.23%	99.77%	0.01%	**325.00**	**1.00**
Naphthalene	369.21			12.2			4.4			0	4504.32	1624.51	0.00	0.12	0	0.63	0.37	0.0208	0.00	123.30	200.78	0.93	325.00	0.00%	37.94%	61.78%	0.28%	**325.00**	**1.00**
Phenanthrene	2405.58	-0.1665	0.6203				1.72			0	105.94	4137.60	0.00	0.12	0	0.63	0.37	0.0208	0.00	314.03	4.72	6.03	324.78	0.00%	96.69%	1.45%	1.86%	**325.00**	**1.00**
Pyrene	1.00			0.72			1.75			0	0.72	1.75	0.00	0.12	0	0.63	0.37	0.0208	0.00	0.13	0.03	0.00	0.17	0.00%	79.33%	19.17%	1.50%	---	---
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.05	0.00	0.05	0.00%	0.00%	95.08%	4.92%		---
Low MW PAHs	128678.69	-1.3205	0.4544							0	56.01		0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	2.50	322.45	324.94	0.00%	0.00%	0.77%	99.23%	**325.00**	**1.00**
High MW PAHs	1.00	-1.7026	0.9469							0	0.18		0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.01	0.00	0.01	0.00%	0.00%	76.42%	23.58%	---	---
Gasoline Range Organics																												**5000.00**	**0.00**
TPH - Diesel	1995353.63									0			0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	5000.00	5000.00	0.00%	0.00%	0.00%	100.00%	**5000.00**	**1.00**
TPH - Kerosene	1995353.63									0			0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	5000.00	5000.00	0.00%	0.00%	0.00%	100.00%	**5000.00**	**1.00**
Normal paraffin hydrocarbons	1.00									0			0.00	0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Phenol	1.00						0.235			0.0064		0.23	0.01	0.12	0	0.63	0.37	0.0208	0.00	0.02	0.00	0.00	0.02	0.00%	87.67%	0.00%	12.33%	---	---
2-methylphenol (ocresol)	1.00						0.336			0.0150		0.34	0.02	0.12	0	0.63	0.37	0.0208	0.00	0.03	0.00	0.00	0.03	0.00%	91.05%	0.00%	8.95%	---	---
4-methylphenol (pcresol)	1.00						0.333			0.0141		0.33	0.01	0.12	0	0.63	0.37	0.0208	0.00	0.03	0.00	0.00	0.03	0.00%	90.99%	0.00%	9.01%	---	---
2,4-dinitrotoluene	39.15	1.873	-0.3768	0.376			0.184			0.0155	14.72	7.19	0.61	0.12	0	0.63	0.37	0.0208	0.00	0.55	0.66	0.10	1.30	0.00%	41.98%	50.47%	7.55%	**1.30**	**1.00**
Bis[2-ethylhexyl] phthalate	1.00			0.07			41.144			0.0945	0.07	41.14	0.09	0.12	0	0.63	0.37	0.0208	0.00	3.12	0.00	0.00	3.13	0.00%	99.83%	0.09%	0.08%	---	---
Total PCBs	3.58			0.17	1.41	1.36				0.1792	0.61	23.24	0.64	0.12	0	0.63	0.37	0.0208	0.00	1.76	0.03	0.01	1.80	0.00%	98.00%	1.50%	0.50%	**1.80**	**1.00**
Aroclor 1016	3.55			0.30	1.41	1.36				0.2104	1.06	22.98	0.75	0.12	0	0.63	0.37	0.0208	0.00	1.74	0.05	0.01	1.80	0.00%	96.89%	2.61%	0.49%	**1.80**	**1.00**
Aroclor 1221	3.44			0.78	1.41	1.36				0.1883	2.70	22.02	0.65	0.12	0	0.63	0.37	0.0208	0.00	1.67	0.12	0.01	1.80	0.00%	92.83%	6.69%	0.48%	**1.80**	**1.00**
Aroclor 1232	3.40			0.99	1.41	1.36				0.1704	3.37	21.64	0.58	0.12	0	0.63	0.37	0.0208	0.00	1.64	0.15	0.01	1.80	0.00%	91.19%	8.34%	0.47%	**1.80**	**1.00**
Aroclor 1242	3.59			0.16	1.41	1.36				0.1756	0.58	23.26	0.63	0.12	0	0.63	0.37	0.0208	0.00	1.77	0.03	0.01	1.80	0.00%	98.06%	1.44%	0.50%	**1.80**	**1.00**
Aroclor 1248	3.58			0.18	1.41	1.36				0.1855	0.66	23.20	0.66	0.12	0	0.63	0.37	0.0208	0.00	1.76	0.03	0.01	1.80	0.00%	97.87%	1.63%	0.50%	**1.80**	**1.00**
Aroclor 1254	3.59			0.14	1.41	1.36				0.1630	0.50	23.30	0.59	0.12	0	0.63	0.37	0.0208	0.00	1.77	0.02	0.01	1.80	0.00%	98.26%	1.24%	0.50%	**1.80**	**1.00**
Aroclor 1260	3.62			0.05	1.41	1.36				0.0750	0.19	23.57	0.27	0.12	0	0.63	0.37	0.0208	0.00	1.79	0.01	0.01	1.81	0.00%	99.03%	0.47%	0.50%	**1.80**	**1.00**
Aroclor-1262	718.33													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	1.80	1.80	0.00%	0.00%	0.00%	100.00%	**1.80**	**1.00**
Dichloroprop	1.00													0.12	0	0.63	0.37	0.0208	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Aldrin	0.40			0.14			1.033			0.1630	0.06	0.42	0.07	0.12	0	0.63	0.37	0.0208	0.00	0.03	0.00	0.00	0.03	0.00%	89.99%	7.13%	2.88%	**0.04**	**1.00**
beta-1,2,3,4,5,6-Hexachlorocyclohexane	5.47			1.72			1.021			0.1201	9.41	5.59	0.66	0.12	0	0.63	0.37	0.0208	0.00	0.42	0.42	0.01	0.86	0.00%	49.48%	48.92%	1.60%	**0.86**	**1.00**
alpha-Chlordane	121.40			0.16			1.031			0.1771	20.01	125.22	21.49	0.12	0	0.63	0.37	0.0208	0.00	9.50	0.89	0.30	10.70	0.00%	88.82%	8.33%	2.84%	**10.70**	**1.00**
gamma-Chlordane	120.97			0.16			1.036			0.1771	19.94	125.28	21.42	0.12	0	0.63	0.37	0.0208	0.00	9.51	0.89	0.30	10.70	0.00%	88.86%	8.31%	2.83%	**10.70**	**1.00**
Dichlorodiphenyldichloroethylene	2.30	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		0.15	24.76	64.92	0.12	0	0.63	0.37	0.0208	0.00	1.88	0.01	0.01	1.89	0.00%	99.34%	0.36%	0.30%	**1.89**	**1.00**
Dichlorodiphenyltrichloroethane	3.47	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		0.21	24.69	8.02	0.12	0	0.63	0.37	0.0208	0.00	1.87	0.01	0.01	1.89	0.00%	99.05%	0.49%	0.46%	**1.89**	**1.00**
Dieldrin	0.20			0.41			14.70			1.20	0.08	2.88	0.24	0.12	0	0.63	0.37	0.0208	0.00	0.22	0.00	0.00	0.22	0.00%	98.17%	1.61%	0.22%	**0.22**	**1.00**
Endosulfan I	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	0.12	0	0.63	0.37	0.0208	0.00	0.09	0.06	0.00	0.15	0.00%	59.58%	38.76%	1.66%	---	---
Endosulfan II	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	0.12	0	0.63	0.37	0.0208	0.00	0.09	0.06	0.00	0.15	0.00%	59.58%	38.76%	1.66%	---	---
Endosulfan sulfate	1.00			1.98			1.184			0.1072	1.98	1.18	0.11	0.12	0	0.63	0.37	0.0208	0.00	0.09	0.09	0.00	0.18	0.00%	49.78%	48.84%	1.39%	---	---
Endrin aldehyde	1.00			1.44			6.686			0.1368	1.44	6.69	0.14	0.12	0	0.63	0.37	0.0208	0.00	0.51	0.06	0.00	0.57	0.00%	88.39%	11.18%	0.44%	---	---

Table A-10. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Western Meadowlark

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Methoxychlor	1.00			0.52			3.739			0.2093	0.52	3.74	0.21	0.12	0	0.63	0.37	0.0208	0.00	0.28	0.02	0.00	0.31	0.00%	91.64%	7.55%	0.81%	---	---

Notes:

It has been conservatively assumed that all chemical intake is absorbed by the receptor.

1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.

Acronyms:

BAF = Bioaccumulation factor

DW = Dry weight

FIR = Food ingestion rate

mg/kg = Miligrams per kilogram

mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight

mg/kg/d = Miligrams per kilogram per day

NOAEL = No observed adverse effect level

PRGs = Preliminary remediation goals

TRV = Toxicity reference value

Equations:

Total Estimated Exposure = Food Intake + Incidental Soil Intake

Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)

Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)

Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0

where: B1 = slope and B0 = intercept

Estimated Concentrations in Biota (method 2) = soil concentration X BAF

Hazard Quotient = Total Estimated Exposure (Dose) / TRV

Therefore, when the HQ = 1, soil concentration = PRG

where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Table A-11. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Killdeer

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway					
		Plants			Soil Inverts			Small Mammals																					
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
Aluminum	1.00			0.00287			0.043			0.0263	0.00	0.04	0.03	0.192	0	1	0	0.073	0.00	0.01	0.00	0.01	0.02	0.00%	37.07%	0.00%	62.93%	---	---
Antimony	1.00	-3.233	0.938				1			0.001 * 50 * Cdiet	0.04	1.00	0.05	0.192	0	1	0	0.073	0.00	0.19	0.00	0.01	0.21	0.00%	93.20%	0.00%	6.80%	---	---
Arsenic, Total all valence states	2131.65	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		10.29	54.07	4.17	0.192	0	1	0	0.073	0.00	10.39	0.00	29.91	40.30	0.00%	25.79%	0.00%	74.21%	**40.30**	**1.00**
Arsenic (III)	2131.65	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		10.29	54.07	4.17	0.192	0	1	0	0.073	0.00	10.39	0.00	29.91	40.30	0.00%	25.79%	0.00%	74.21%	**40.30**	**1.00**
Arsenic (V)	2131.65	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		10.29	54.07	4.17	0.192	0	1	0	0.073	0.00	10.39	0.00	29.91	40.30	0.00%	25.79%	0.00%	74.21%	**40.30**	**1.00**
Barium	1323.00			0.156			0.091			0.0168	206.39	120.39	22.23	0.192	0	1	0	0.073	0.00	23.14	0.00	18.56	41.70	0.00%	55.49%	0.00%	44.51%	**41.70**	**1.00**
Beryllium	1.00	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	0.59	0.05	0.00	0.192	0	1	0	0.073	0.00	0.01	0.00	0.01	0.02	0.00%	38.14%	0.00%	61.86%	---	---
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	0.192	0	1	0	0.073	0.00	0.19	0.00	0.01	0.21	0.00%	93.20%	0.00%	6.80%	---	---
Boron	484.92			5.714			1			1	2770.82	484.92	484.92	0.192	0	1	0	0.073	0.00	93.20	0.00	6.80	100.00	0.00%	93.20%	0.00%	6.80%	**100.00**	**1.00**
Cadmium	1.63	-0.476	0.546		2.114	0.795		-1.2571	0.4723		0.81	12.21	0.36	0.192	0	1	0	0.073	0.00	2.35	0.00	0.02	2.37	0.00%	99.04%	0.00%	0.96%	**2.37**	**1.00**
Chromium (total)	38.17			0.041			0.306	-1.4599	0.7338		1.56	11.68	3.36	0.192	0	1	0	0.073	0.00	2.24	0.00	0.54	2.78	0.00%	80.74%	0.00%	19.26%	**2.78**	**1.00**
Chromium (+3)	38.17			0.041			0.306	-1.4599	0.7338		1.56	11.68	3.36	0.192	0	1	0	0.073	0.00	2.24	0.00	0.54	2.78	0.00%	80.74%	0.00%	19.26%	**2.78**	**1.00**
Chromium (+6)	1.00			0.041			0.306	-1.4599	0.7338		0.04	0.31	0.23	0.192	0	1	0	0.073	0.00	0.06	0.00	0.01	0.07	0.00%	80.74%	0.00%	19.26%		---
Cobalt	111.50			0.00745			0.291	-4.4669	1.307		0.83	32.45	5.44	0.192	0	1	0	0.073	0.00	6.24	0.00	1.56	7.80	0.00%	79.95%	0.00%	20.05%	**7.80**	**1.00**
Copper	107.07	0.669	0.394				0.515	2.042	0.1444		12.31	55.14	15.13	0.192	0	1	0	0.073	0.00	10.60	0.00	1.50	12.10	0.00%	87.59%	0.00%	12.41%	**12.10**	**1.00**
Lead	35.58	-1.328	0.561		-0.218	0.807		0.0761	0.4422		1.97	14.36	5.24	0.192	0	1	0	0.073	0.00	2.76	0.00	0.50	3.26	0.00%	84.68%	0.00%	15.32%	**3.26**	**1.00**
Lithium	1.00			0.004			0.046			1	0.00	0.05	1.00	0.192	0	1	0	0.073	0.00	0.01	0.00	0.01	0.02	0.00%	38.66%	0.00%	61.34%	---	---
Manganese	19635.66			0.0792	-0.809	0.682				0.0205	1555.14	377.15	402.53	0.192	0	1	0	0.073	0.00	72.48	0.00	275.49	347.97	0.00%	20.83%	0.00%	79.17%	**348.00**	**1.00**
Mercury (methyl)	3.59	-0.996	0.544		0.0781	0.3369				0.054	0.74	1.66	0.19	0.192	0	1	0	0.073	0.00	0.32	0.00	0.05	0.37	0.00%	86.39%	0.00%	13.61%	**0.37**	**1.00**
Mercury (inorganic)	22.11	-0.996	0.544		0.0781	0.3369				0.054	1.99	3.07	1.20	0.192	0	1	0	0.073	0.00	0.59	0.00	0.31	0.90	0.00%	65.53%	0.00%	34.47%	**0.90**	**1.00**
Molybdenum	179.02			1.2504			0.953			1	223.84	170.60	179.02	0.192	0	1	0	0.073	0.00	32.79	0.00	2.51	35.30	0.00%	92.88%	0.00%	7.12%	**35.30**	**1.00**
Nickel	52.86	-2.224	0.748				1.059	-0.2462	0.4658		2.10	55.98	4.96	0.192	0	1	0	0.073	0.00	10.76	0.00	0.74	11.50	0.00%	93.55%	0.00%	6.45%	**11.50**	**1.00**
Selenium	4.29	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		2.54	2.70	1.14	0.192	0	1	0	0.073	0.00	0.52	0.00	0.06	0.58	0.00%	89.60%	0.00%	10.40%	**0.58**	**1.00**
Silver	49.62			0.014			2.045			0.0040	0.69	101.48	0.20	0.192	0	1	0	0.073	0.00	19.50	0.00	0.70	20.20	0.00%	96.55%	0.00%	3.45%	**20.20**	**1.00**
Strontium	1.00			0.207			0.4066			1.74	0.21	0.41	1.74	0.192	0	1	0	0.073	0.00	0.08	0.00	0.01	0.09	0.00%	84.78%	0.00%	15.22%	---	---
Thallium	1.00			0.004			0.0541			0.1124	0.00	0.05	0.11	0.192	0	1	0	0.073	0.00	0.01	0.00	0.01	0.02	0.00%	42.56%	0.00%	57.44%	---	---
Tin	574.73			1			0.08			0.08	574.73	45.98	45.98	0.192	0	1	0	0.073	0.00	8.84	0.00	8.06	16.90	0.00%	52.29%	0.00%	47.71%	**16.90**	**1.00**
Uranium	1.00			0.021			0.033			0.0002	0.02	0.03	0.00	0.192	0	1	0	0.073	0.00	0.01	0.00	0.01	0.02	0.00%	31.13%	0.00%	68.87%	---	---
Vanadium	31.13			0.00485			0.042			0.0123	0.15	1.31	0.38	0.192	0	1	0	0.073	0.00	0.25	0.00	0.44	0.69	0.00%	36.52%	0.00%	63.48%	**0.69**	**1.00**
Zinc	67.80	1.575	0.555		4.449	0.328		4.3632	0.0706		50.16	341.05	105.73	0.192	0	1	0	0.073	0.00	65.55	0.00	0.95	66.50	0.00%	98.57%	0.00%	1.43%	**66.50**	**1.00**
Ammonia/Ammonium	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Chloride	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Cyanide	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Fluoride	2280.84			0.006							13.69			0.192	0	1	0	0.073	0.00	0.00	0.00	32.00	32.00	0.00%	0.00%	0.00%	100.00%	**32.00**	**1.00**

Table A-11. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Killdeer

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Iodine	1.00			0.05							0.05			0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Nitrate/Nitrite	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Phosphate	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Sulfate/Sulfite	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Total Organic Carbon	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
1,1-dichloroethane	165.33						1.010			0.0109		166.92	1.80	0.192	0	1	0	0.073	0.00	32.08	0.00	2.32	34.40	0.00%	93.26%	0.00%	6.74%	**34.40**	**1.00**
1,1-dichloroethene	165.08						1.011			0.0186		166.94	3.07	0.192	0	1	0	0.073	0.00	32.08	0.00	2.32	34.40	0.00%	93.27%	0.00%	6.73%	**34.40**	**1.00**
1,1,1-trichloroethane	164.84						1.013			0.0305		166.96	5.03	0.192	0	1	0	0.073	0.00	32.09	0.00	2.31	34.40	0.00%	93.28%	0.00%	6.72%	**34.40**	**1.00**
1,1,2-trichloroethane	165.24						1.010			0.0165		166.93	2.73	0.192	0	1	0	0.073	0.00	32.08	0.00	2.32	34.40	0.00%	93.26%	0.00%	6.74%	**34.40**	**1.00**
1,1,2,2-tetrachloroethane	164.82						1.013			0.0270		166.96	4.45	0.192	0	1	0	0.073	0.00	32.09	0.00	2.31	34.40	0.00%	93.28%	0.00%	6.72%	**34.40**	**1.00**
1,2-dichlorobenzene	164.11			2.45			1.018			0.0882	402.32	167.01	14.47	0.192	0	1	0	0.073	0.00	32.10	0.00	2.30	34.40	0.00%	93.31%	0.00%	6.69%	**34.40**	**1.00**
1,2-dichloroethane (DCA)	168.64						0.988			0.0063		166.68	1.06	0.192	0	1	0	0.073	0.00	32.03	0.00	2.37	34.40	0.00%	93.12%	0.00%	6.88%	**34.40**	**1.00**
1,3-dichlorobenzene	164.05			2.23			1.018			0.0963	366.32	167.01	15.79	0.192	0	1	0	0.073	0.00	32.10	0.00	2.30	34.40	0.00%	93.31%	0.00%	6.69%	**34.40**	**1.00**
2-butanone (Methyl Ethyl Ketone/MEK)	3123.19						0.094			0.0006		292.32	1.72	0.192	0	1	0	0.073	0.00	56.18	0.00	43.82	100.00	0.00%	56.18%	0.00%	43.82%	**100.00**	**1.00**
2-hexanone	1856.29						0.207			0.0053		384.81	9.92	0.192	0	1	0	0.073	0.00	73.96	0.00	26.04	100.00	0.00%	73.96%	0.00%	26.04%	**100.00**	**1.00**
Benzene	1.00						1.011			0.0186		1.01	0.02	0.192	0	1	0	0.073	0.00	0.19	0.00	0.01	0.21	0.00%	93.27%	0.00%	6.73%	---	---
Butanol	1.00						0.478			0.0017		0.48	0.00	0.192	0	1	0	0.073	0.00	0.09	0.00	0.01	0.11	0.00%	86.76%	0.00%	13.24%	---	---
Carbon Tetrachloride	164.56						1.015			0.0420		166.98	6.91	0.192	0	1	0	0.073	0.00	32.09	0.00	2.31	34.40	0.00%	93.29%	0.00%	6.71%	**34.40**	**1.00**
Chlorobenzene	164.57						1.015			0.0490		166.98	8.07	0.192	0	1	0	0.073	0.00	32.09	0.00	2.31	34.40	0.00%	93.29%	0.00%	6.71%	**34.40**	**1.00**
Chloroform	165.19						1.011			0.0135		166.93	2.23	0.192	0	1	0	0.073	0.00	32.08	0.00	2.32	34.40	0.00%	93.26%	0.00%	6.74%	**34.40**	**1.00**
Cis-1,2-dichloroethylene	165.11						1.011			0.0122		166.94	2.02	0.192	0	1	0	0.073	0.00	32.08	0.00	2.32	34.40	0.00%	93.27%	0.00%	6.73%	**34.40**	**1.00**
Dichloromethane (Methylene Chloride)	165.77						1.007			0.0042		166.89	0.70	0.192	0	1	0	0.073	0.00	32.07	0.00	2.33	34.40	0.00%	93.24%	0.00%	6.76%	**34.40**	**1.00**
Ethyl Benzene	1.00			3.21			1.016			0.0666	3.21	1.02	0.07	0.192	0	1	0	0.073	0.00	0.20	0.00	0.01	0.21	0.00%	93.30%	0.00%	6.70%	---	---
Methyl Isobutyl Ketone	1927.26						0.197			0.0037		379.63	7.21	0.192	0	1	0	0.073	0.00	72.96	0.00	27.04	100.00	0.00%	72.96%	0.00%	27.04%	**100.00**	**1.00**
n-butyl Benzene	1.00			1.67			1.022			0.1227	1.67	1.02	0.12	0.192	0	1	0	0.073	0.00	0.20	0.00	0.01	0.21	0.00%	93.34%	0.00%	6.66%	---	---
Tetrachloroethylene	164.13						1.018			0.0390		167.01	6.40	0.192	0	1	0	0.073	0.00	32.10	0.00	2.30	34.40	0.00%	93.31%	0.00%	6.69%	**34.40**	**1.00**
Toluene							1.014			0.0430		0.00	0.00	0.192	0	1	0	0.073	0.00	0.00	0.00	0.00	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	---	---
Trans-1,2-dichloroethylene	165.11						1.011			0.0170		166.94	2.81	0.192	0	1	0	0.073	0.00	32.08	0.00	2.32	34.40	0.00%	93.27%	0.00%	6.73%	**34.40**	**1.00**
Trichloroethylene (TCE)	164.90						1.012			0.0410		166.95	6.76	0.192	0	1	0	0.073	0.00	32.09	0.00	2.31	34.40	0.00%	93.27%	0.00%	6.73%	**34.40**	**1.00**
Xylene				3.43			1.016			0.0619	0.00	0.00	0.00	0.192	0	1	0	0.073	0.00	0.00	0.00	0.00	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	---	---
Acenaphthene	1095.94	-5.562	-0.8556				1.470			0	0.00	1611.03	0.00	0.192	0	1	0	0.073	0.00	309.62	0.00	15.38	325.00	0.00%	95.27%	0.00%	4.73%	**325.00**	**1.00**
Acenaphthylene	73.61	-1.144	0.791				22.9			0	9.55	1685.66	0.00	0.192	0	1	0	0.073	0.00	323.97	0.00	1.03	325.00	0.00%	99.68%	0.00%	0.32%	**325.00**	**1.00**
Anthracene	678.31	-0.9887	0.7784				2.42			0	59.51	1641.51	0.00	0.192	0	1	0	0.073	0.00	315.48	0.00	9.52	325.00	0.00%	97.07%	0.00%	2.93%	**325.00**	**1.00**
Benzo(a)pyrene	1.00	-2.0615	0.975				1.33			0	0.13	1.33	0.00	0.192	0	1	0	0.073	0.00	0.26	0.00	0.01	0.27	0.00%	94.80%	0.00%	5.20%	---	---

Table A-11. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Killdeer

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway					
		Plants			Soil Inverts			Small Mammals																					
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
Benzo(a)anthracene	1.00	-2.7078	0.5944				1.59			0	0.07	1.59	0.00	0.192	0	1	0	0.073	0.00	0.31	0.00	0.01	0.32	0.00%	95.61%	0.00%	4.39%	---	---
Benzo(b)fluoranthene	1.00			0.31			2.6			0	0.31	2.60	0.00	0.192	0	1	0	0.073	0.00	0.50	0.00	0.01	0.51	0.00%	97.27%	0.00%	2.73%	---	---
Benzo(ghi)perylene	1.00	-0.9313	1.1829				2.94			0	0.39	2.94	0.00	0.192	0	1	0	0.073	0.00	0.57	0.00	0.01	0.58	0.00%	97.58%	0.00%	2.42%	---	---
Benzo[k]fluoranthene	1.00	-4.6482	0.1668				2.6			0	0.01	2.60	0.00	0.192	0	1	0	0.073	0.00	0.50	0.00	0.01	0.51	0.00%	97.27%	0.00%	2.73%	---	---
Chrysene	1.00	-2.7078	0.5944				2.29			0	0.07	2.29	0.00	0.192	0	1	0	0.073	0.00	0.44	0.00	0.01	0.45	0.00%	96.91%	0.00%	3.09%	---	---
Dibenz(ah)anthracene	1.00			0.13			2.31			0	0.13	2.31	0.00	0.192	0	1	0	0.073	0.00	0.44	0.00	0.01	0.46	0.00%	96.94%	0.00%	3.06%	---	---
Fluoranthene	1.00			0.5			3.04			0	0.50	3.04	0.00	0.192	0	1	0	0.073	0.00	0.58	0.00	0.01	0.60	0.00%	97.65%	0.00%	2.35%	---	---
Fluorene	175.36	-5.562	-0.8556				9.57			0	0.00	1678.23	0.00	0.192	0	1	0	0.073	0.00	322.54	0.00	2.46	325.00	0.00%	99.24%	0.00%	0.76%	**325.00**	**1.00**
Indeno[1,2,3-cd]pyrene	1.00			0.11			2.86			0	0.11	2.86	0.00	0.192	0	1	0	0.073	0.00	0.55	0.00	0.01	0.56	0.00%	97.51%	0.00%	2.49%	---	---
2-Methylnaphthalene	1547.37	-1.3205	4.544				1.020			0	83181085330306.80	1578.07	0.00	0.192	0	1	0	0.073	0.00	303.29	0.00	21.71	325.00	0.00%	93.32%	0.00%	6.68%	**325.00**	**1.00**
Naphthalene	378.05			12.2			4.4			0	4612.24	1663.43	0.00	0.192	0	1	0	0.073	0.00	319.70	0.00	5.30	325.00	0.00%	98.37%	0.00%	1.63%	**325.00**	**1.00**
Phenanthrene	943.13	-0.1665	0.6203				1.72			0	59.27	1622.18	0.00	0.192	0	1	0	0.073	0.00	311.77	0.00	13.23	325.00	0.00%	95.93%	0.00%	4.07%	**325.00**	**1.00**
Pyrene	1.00			0.72			1.75			0	0.72	1.75	0.00	0.192	0	1	0	0.073	0.00	0.34	0.00	0.01	0.35	0.00%	96.00%	0.00%	4.00%	---	---
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%		---
Low MW PAHs	23164.80	-1.3205	0.4544							0	25.70		0.00	0.192	0	1	0	0.073	0.00	0.00	0.00	325.00	325.00	0.00%	0.00%	0.00%	100.00%	**325.00**	**1.00**
High MW PAHs	1.00	-1.7026	0.9469							0	0.18		0.00	0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Gasoline Range Organics																												**5000.00**	**0.00**
TPH - Diesel	356381.52									0			0.00	0.192	0	1	0	0.073	0.00	0.00	0.00	5000.00	5000.00	0.00%	0.00%	0.00%	100.00%	**5000.00**	**1.00**
TPH - Kerosene	356381.52									0			0.00	0.192	0	1	0	0.073	0.00	0.00	0.00	5000.00	5000.00	0.00%	0.00%	0.00%	100.00%	**5000.00**	**1.00**
Normal paraffin hydrocarbons	1.00									0			0.00	0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Phenol	1.00						0.235			0.0064		0.23	0.01	0.192	0	1	0	0.073	0.00	0.05	0.00	0.01	0.06	0.00%	76.28%	0.00%	23.72%	---	---
2-methylphenol (ocresol)	1.00						0.336			0.0150		0.34	0.02	0.192	0	1	0	0.073	0.00	0.06	0.00	0.01	0.08	0.00%	82.14%	0.00%	17.86%	---	---
4-methylphenol (pcresol)	1.00						0.333			0.0141		0.33	0.01	0.192	0	1	0	0.073	0.00	0.06	0.00	0.01	0.08	0.00%	82.03%	0.00%	17.97%	---	---
2,4-dinitrotoluene	26.35	1.873	-0.3768	0.376			0.184			0.0155	9.91	4.84	0.41	0.192	0	1	0	0.073	0.00	0.93	0.00	0.37	1.30	0.00%	71.56%	0.00%	28.44%	**1.30**	**1.00**
Bis[2-ethylhexyl] phthalate	1.00			0.07			41.144			0.0945	0.07	41.14	0.09	0.192	0	1	0	0.073	0.00	7.91	0.00	0.01	7.92	0.00%	99.82%	0.00%	0.18%	---	---
Total PCBs	1.82			0.17	1.41	1.36				0.1792	0.31	9.23	0.33	0.192	0	1	0	0.073	0.00	1.77	0.00	0.03	1.80	0.00%	98.58%	0.00%	1.42%	**1.80**	**1.00**
Aroclor 1016	1.82			0.30	1.41	1.36				0.2104	0.54	9.23	0.38	0.192	0	1	0	0.073	0.00	1.77	0.00	0.03	1.80	0.00%	98.58%	0.00%	1.42%	**1.80**	**1.00**
Aroclor 1221	1.82			0.78	1.41	1.36				0.1883	1.43	9.23	0.34	0.192	0	1	0	0.073	0.00	1.77	0.00	0.03	1.80	0.00%	98.58%	0.00%	1.42%	**1.80**	**1.00**
Aroclor 1232	1.82			0.99	1.41	1.36				0.1704	1.80	9.23	0.31	0.192	0	1	0	0.073	0.00	1.77	0.00	0.03	1.80	0.00%	98.58%	0.00%	1.42%	**1.80**	**1.00**
Aroclor 1242	1.82			0.16	1.41	1.36				0.1756	0.29	9.23	0.32	0.192	0	1	0	0.073	0.00	1.77	0.00	0.03	1.80	0.00%	98.58%	0.00%	1.42%	**1.80**	**1.00**
Aroclor 1248	1.82			0.18	1.41	1.36				0.1855	0.34	9.23	0.34	0.192	0	1	0	0.073	0.00	1.77	0.00	0.03	1.80	0.00%	98.58%	0.00%	1.42%	**1.80**	**1.00**
Aroclor 1254	1.82			0.14	1.41	1.36				0.1630	0.25	9.23	0.30	0.192	0	1	0	0.073	0.00	1.77	0.00	0.03	1.80	0.00%	98.58%	0.00%	1.42%	**1.80**	**1.00**
Aroclor 1260	1.82			0.05	1.41	1.36				0.0750	0.09	9.23	0.14	0.192	0	1	0	0.073	0.00	1.77	0.00	0.03	1.80	0.00%	98.58%	0.00%	1.42%	**1.80**	**1.00**
Aroclor-1262	128.30													0.192	0	1	0	0.073	0.00	0.00	0.00	1.80	1.80	0.00%	0.00%	0.00%	100.00%	**1.80**	**1.00**

Table A-11. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Killdeer

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Dichloroprop	1.00													0.192	0	1	0	0.073	0.00	0.00	0.00	0.01	0.01	0.00%	0.00%	0.00%	100.00%	---	---
Aldrin	0.16			0.14			1.033			0.1630	0.02	0.17	0.03	0.192	0	1	0	0.073	0.00	0.03	0.00	0.00	0.04	0.00%	93.40%	0.00%	6.60%	**0.04**	**1.00**
beta-1,2,3,4,5,6-Hexachlorocyclohexane	4.08			1.72			1.021			0.1201	7.01	4.16	0.49	0.192	0	1	0	0.073	0.00	0.80	0.00	0.06	0.86	0.00%	93.33%	0.00%	6.67%	**0.86**	**1.00**
alpha-Chlordane	50.41			0.16			1.031			0.1771	8.31	51.99	8.92	0.192	0	1	0	0.073	0.00	9.99	0.00	0.71	10.70	0.00%	93.39%	0.00%	6.61%	**10.70**	**1.00**
gamma-Chlordane	50.22			0.16			1.036			0.1771	8.28	52.01	8.89	0.192	0	1	0	0.073	0.00	10.00	0.00	0.70	10.70	0.00%	93.41%	0.00%	6.59%	**10.70**	**1.00**
Dichlorodiphenyldichloroethylene	0.80	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		0.07	9.79	33.03	0.192	0	1	0	0.073	0.00	1.88	0.00	0.01	1.89	0.00%	99.41%	0.00%	0.59%	**1.89**	**1.00**
Dichlorodiphenyltrichloroethane	1.19	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		0.09	9.75	3.69	0.192	0	1	0	0.073	0.00	1.87	0.00	0.02	1.89	0.00%	99.12%	0.00%	0.88%	**1.89**	**1.00**
Dieldrin	0.08			0.41			14.70			1.20	0.03	1.15	0.09	0.192	0	1	0	0.073	0.00	0.22	0.00	0.00	0.22	0.00%	99.51%	0.00%	0.49%	**0.22**	**1.00**
Endosulfan I	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	0.192	0	1	0	0.073	0.00	0.23	0.00	0.01	0.24	0.00%	94.19%	0.00%	5.81%	---	---
Endosulfan II	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	0.192	0	1	0	0.073	0.00	0.23	0.00	0.01	0.24	0.00%	94.19%	0.00%	5.81%	---	---
Endosulfan sulfate	1.00			1.98			1.184			0.1072	1.98	1.18	0.11	0.192	0	1	0	0.073	0.00	0.23	0.00	0.01	0.24	0.00%	94.19%	0.00%	5.81%	---	---
Endrin aldehyde	1.00			1.44			6.686			0.1368	1.44	6.69	0.14	0.192	0	1	0	0.073	0.00	1.28	0.00	0.01	1.30	0.00%	98.92%	0.00%	1.08%	---	---
Methoxychlor	1.00			0.52			3.739			0.2093	0.52	3.74	0.21	0.192	0	1	0	0.073	0.00	0.72	0.00	0.01	0.73	0.00%	98.09%	0.00%	1.91%	---	---

Notes:
It has been conservatively assumed that all chemical intake is absorbed by the receptor.
1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.

Acronyms:
BAF = Bioaccumulation factor
DW = Dry weight
FIR = Food ingestion rate
mg/kg = Miligrams per kilogram
mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight
mg/kg/d = Miligrams per kilogram per day
NOAEL = No observed adverse effect level
PRGs = Preliminary remediation goals
TRV = Toxicity reference value

Equations:
Total Estimated Exposure = Food Intake + Incidental Soil Intake
Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)
Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)
Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0
where: B1 = slope and B0 = intercept
Estimated Concentrations in Biota (method 2) = soil concentration X BAF
Hazard Quotient = Total Estimated Exposure (Dose) / TRV
Therefore, when the HQ = 1, soil concentration = PRG
where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Table A-12. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Red-tailed Hawk

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway					
		Plants			Soil Inverts			Small Mammals																					
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
Aluminum	1.00			0.00287			0.043			0.0263	0.00	0.04	0.03	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	52.29%	0.00%	0.00%	47.71%	---	---
Antimony	1.00	-3.233	0.938				1			0.001 * 50 * Cdiet	0.04	1.00	0.05	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	67.57%	0.00%	0.00%	32.43%	---	---
Arsenic, Total all valence states	45439.07	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		57.77	468.83	51.10	0.035	1	0	0	0.024	1.80	0.00	0.00	38.50	40.30	4.48%	0.00%	0.00%	95.52%	**40.30**	**1.00**
Arsenic (III)	45439.07	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		57.77	468.83	51.10	0.035	1	0	0	0.024	1.80	0.00	0.00	38.50	40.30	4.48%	0.00%	0.00%	95.52%	**40.30**	**1.00**
Arsenic (V)	45439.07	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		57.77	468.83	51.10	0.035	1	0	0	0.024	1.80	0.00	0.00	38.50	40.30	4.48%	0.00%	0.00%	95.52%	**40.30**	**1.00**
Barium	28953.51			0.156			0.091			0.0168	4516.75	2634.77	486.42	0.035	1	0	0	0.024	17.17	0.00	0.00	24.53	41.70	41.18%	0.00%	0.00%	58.82%	**41.70**	**1.00**
Beryllium	1.00	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	0.59	0.05	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	8.57%	0.00%	0.00%	91.43%	---	---
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	0.035	1	0	0	0.024	0.04	0.00	0.00	0.00	0.04	97.66%	0.00%	0.00%	2.34%	---	---
Boron	2766.47			5.714			1			1	15807.59	2766.47	2766.47	0.035	1	0	0	0.024	97.66	0.00	FALSE	2.34	100.00	97.66%	0.00%	0.00%	2.34%	**100.00**	**1.00**
Cadmium	2335.22	-0.476	0.546		2.114	0.795		-1.2571	0.4723		42.89	3943.84	11.09	0.035	1	0	0	0.024	0.39	0.00	0.00	1.98	2.37	16.52%	0.00%	0.00%	83.48%	**2.37**	**1.00**
Chromium (total)	1355.27			0.041			0.306	-1.4599	0.7338		55.57	414.71	46.16	0.035	1	0	0	0.024	1.63	0.00	0.00	1.15	2.78	58.66%	0.00%	0.00%	41.34%	**2.78**	**1.00**
Chromium (+3)	1355.27			0.041			0.306	-1.4599	0.7338		55.57	414.71	46.16	0.035	1	0	0	0.024	1.63	0.00	0.00	1.15	2.78	58.66%	0.00%	0.00%	41.34%	**2.78**	**1.00**
Chromium (+6)	1.00			0.041			0.306	-1.4599	0.7338		0.04	0.31	0.23	0.035	1	0	0	0.024	0.01	0.00	0.00	0.00	0.01	90.63%	0.00%	0.00%	9.37%		---
Cobalt	1632.76			0.00745			0.291	-4.4669	1.307		12.16	475.13	181.69	0.035	1	0	0	0.024	6.41	0.00	0.00	1.38	7.80	82.26%	0.00%	0.00%	17.74%	**7.80**	**1.00**
Copper	13020.77	0.669	0.394				0.515	2.042	0.1444		81.60	6705.70	30.27	0.035	1	0	0	0.024	1.07	0.00	0.00	11.03	12.10	8.83%	0.00%	0.00%	91.17%	**12.10**	**1.00**
Lead	2433.19	-1.328	0.561		-0.218	0.807		0.0761	0.4422		21.03	434.48	33.92	0.035	1	0	0	0.024	1.20	0.00	0.00	2.06	3.26	36.74%	0.00%	0.00%	63.26%	**3.26**	**1.00**
Lithium	1.00			0.004			0.046			1	0.00	0.05	1.00	0.035	1	0	0	0.024	0.04	0.00	0.00	0.00	0.04	97.66%	0.00%	0.00%	2.34%	---	---
Manganese	221536.11			0.0792	-0.809	0.682				0.0205	17545.66	1969.01	4541.49	0.035	1	0	0	0.024	160.31	0.00	0.00	187.69	348.00	46.07%	0.00%	0.00%	53.93%	**348.00**	**1.00**
Mercury (methyl)	133.86	-0.996	0.544		0.0781	0.3369				0.054	5.30	5.63	7.27	0.035	1	0	0	0.024	0.26	0.00	0.00	0.11	0.37	69.35%	0.00%	0.00%	30.65%	**0.37**	**1.00**
Mercury (inorganic)	325.62	-0.996	0.544		0.0781	0.3369				0.054	8.60	7.59	17.68	0.035	1	0	0	0.024	0.62	0.00	0.00	0.28	0.90	69.35%	0.00%	0.00%	30.65%	**0.90**	**1.00**
Molybdenum	976.56			1.2504			0.953			1	1221.09	930.66	976.56	0.035	1	0	0	0.024	34.47	0.00	0.00	0.83	35.30	97.66%	0.00%	0.00%	2.34%	**35.30**	**1.00**
Nickel	11078.24	-2.224	0.748				1.059	-0.2462	0.4658		114.66	11731.86	59.84	0.035	1	0	0	0.024	2.11	0.00	0.00	9.39	11.50	18.37%	0.00%	0.00%	81.63%	**11.50**	**1.00**
Selenium	417.07	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		396.52	77.28	6.39	0.035	1	0	0	0.024	0.23	0.00	0.00	0.35	0.58	38.97%	0.00%	0.00%	61.03%	**0.58**	**1.00**
Silver	20437.07			0.014			2.045			0.0040	286.12	41793.81	81.75	0.035	1	0	0	0.024	2.89	0.00	0.00	17.31	20.20	14.29%	0.00%	0.00%	85.71%	**20.20**	**1.00**
Strontium	1.00			0.207			0.4066			1.74	0.21	0.41	1.74	0.035	1	0	0	0.024	0.06	0.00	0.00	0.00	0.06	98.64%	0.00%	0.00%	1.36%	---	---
Thallium	1.00			0.004			0.0541			0.1124	0.00	0.05	0.11	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	82.40%	0.00%	0.00%	17.60%	---	---
Tin	4603.40			1			0.08			0.08	4603.40	368.27	368.27	0.035	1	0	0	0.024	13.00	0.00	0.00	3.90	16.90	76.92%	0.00%	0.00%	23.08%	**16.90**	**1.00**
Uranium	1.00			0.021			0.033			0.0002	0.02	0.03	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.83%	0.00%	0.00%	99.17%	---	---
Vanadium	536.92			0.00485			0.042			0.0123	2.60	22.55	6.60	0.035	1	0	0	0.024	0.23	0.00	0.00	0.45	0.69	33.88%	0.00%	0.00%	66.12%	**0.69**	**1.00**
Zinc	71293.85	1.575	0.555		4.449	0.328		4.3632	0.0706		2384.83	3341.78	172.80	0.035	1	0	0	0.024	6.10	0.00	0.00	60.40	66.50	9.17%	0.00%	0.00%	90.83%	**66.50**	**1.00**
Ammonia/Ammonium	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Chloride	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Cyanide	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Fluoride	37771.48			0.006							226.63			0.035	1	0	0	0.024	0.00	0.00	0.00	32.00	32.00	0.00%	0.00%	0.00%	100.00%	**32.00**	**1.00**
Iodine	1.00			0.05							0.05			0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---

Table A-12. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Red-tailed Hawk

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Nitrate/Nitrite	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Phosphate	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Sulfate/Sulfite	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Total Organic Carbon	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
1,1-dichloroethane	27909.35						1.010			0.0109		28177.03	304.68	0.035	1	0	0	0.024	10.76	0.00	0.00	23.64	34.40	31.27%	0.00%	0.00%	68.73%	**34.40**	**1.00**
1,1-dichloroethene	22865.71						1.011			0.0186		23122.45	425.73	0.035	1	0	0	0.024	15.03	0.00	0.00	19.37	34.40	43.69%	0.00%	0.00%	56.31%	**34.40**	**1.00**
1,1,1-trichloroethane	17871.35						1.013			0.0305		18100.43	545.59	0.035	1	0	0	0.024	19.26	0.00	0.00	15.14	34.40	55.99%	0.00%	0.00%	44.01%	**34.40**	**1.00**
1,1,2-trichloroethane	24062.54						1.010			0.0165		24308.42	397.00	0.035	1	0	0	0.024	14.01	0.00	0.00	20.39	34.40	40.74%	0.00%	0.00%	59.26%	**34.40**	**1.00**
1,1,2,2-tetrachloroethane	19097.72						1.013			0.0270		19344.75	516.16	0.035	1	0	0	0.024	18.22	0.00	0.00	16.18	34.40	52.97%	0.00%	0.00%	47.03%	**34.40**	**1.00**
1,2-dichlorobenzene	8686.89			2.45			1.018			0.0882	21296.76	8840.50	766.02	0.035	1	0	0	0.024	27.04	0.00	0.00	7.36	34.40	78.61%	0.00%	0.00%	21.39%	**34.40**	**1.00**
1,2-dichloroethane (DCA)	32167.55						0.988			0.0063		31793.52	202.48	0.035	1	0	0	0.024	7.15	0.00	0.00	27.25	34.40	20.78%	0.00%	0.00%	79.22%	**34.40**	**1.00**
1,3-dichlorobenzene	8102.94			2.23			1.018			0.0963	18093.45	8249.15	780.03	0.035	1	0	0	0.024	27.54	0.00	0.00	6.86	34.40	80.04%	0.00%	0.00%	19.96%	**34.40**	**1.00**
2-butanone (Methyl Ethyl Ketone/MEK)	115381.89						0.094			0.0006		10799.52	63.70	0.035	1	0	0	0.024	2.25	0.00	0.00	97.75	100.00	2.25%	0.00%	0.00%	97.75%	**100.00**	**1.00**
2-hexanone	96531.69						0.207			0.0053		20010.96	516.10	0.035	1	0	0	0.024	18.22	0.00	0.00	81.78	100.00	18.22%	0.00%	0.00%	81.78%	**100.00**	**1.00**
Benzene	1.00						1.011			0.0186		1.01	0.02	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	43.69%	0.00%	0.00%	56.31%	---	---
Butanol	1.00						0.478			0.0017		0.48	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	6.65%	0.00%	0.00%	93.35%	---	---
Carbon Tetrachloride	14764.92						1.015			0.0420		14982.11	620.15	0.035	1	0	0	0.024	21.89	0.00	0.00	12.51	34.40	63.64%	0.00%	0.00%	36.36%	**34.40**	**1.00**
Chlorobenzene	13344.76						1.015			0.0490		13540.08	654.23	0.035	1	0	0	0.024	23.09	0.00	0.00	11.31	34.40	67.13%	0.00%	0.00%	32.87%	**34.40**	**1.00**
Chloroform	26005.89						1.011			0.0135		26279.49	350.36	0.035	1	0	0	0.024	12.37	0.00	0.00	22.03	34.40	35.95%	0.00%	0.00%	64.05%	**34.40**	**1.00**
Cis-1,2-dichloroethylene	26892.00						1.011			0.0122		27189.98	329.10	0.035	1	0	0	0.024	11.62	0.00	0.00	22.78	34.40	33.77%	0.00%	0.00%	66.23%	**34.40**	**1.00**
Dichloromethane (Methylene Chloride)	34562.06						1.007			0.0042		34795.52	145.01	0.035	1	0	0	0.024	5.12	0.00	0.00	29.28	34.40	14.88%	0.00%	0.00%	85.12%	**34.40**	**1.00**
Ethyl Benzene	1.00			3.21			1.016			0.0666	3.21	1.02	0.07	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	73.52%	0.00%	0.00%	26.48%	---	---
Methyl Isobutyl Ketone	102114.45						0.197			0.0037		20114.22	382.11	0.035	1	0	0	0.024	13.49	0.00	0.00	86.51	100.00	13.49%	0.00%	0.00%	86.51%	**100.00**	**1.00**
n-butyl Benzene	1.00			1.67			1.022			0.1227	1.67	1.02	0.12	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.01	83.64%	0.00%	0.00%	16.36%	---	---
Tetrachloroethylene	15466.68						1.018			0.0390		15737.47	603.30	0.035	1	0	0	0.024	21.30	0.00	0.00	13.10	34.40	61.91%	0.00%	0.00%	38.09%	**34.40**	**1.00**
Toluene	1.00						1.014			0.0430		1.01	0.04	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	64.20%	0.00%	0.00%	35.80%	---	---
Trans-1,2-dichloroethylene	23762.81						1.011			0.0170		24026.12	404.20	0.035	1	0	0	0.024	14.27	0.00	0.00	20.13	34.40	41.48%	0.00%	0.00%	58.52%	**34.40**	**1.00**
Trichloroethylene (TCE)	14995.63						1.012			0.0410		15182.35	614.61	0.035	1	0	0	0.024	21.70	0.00	0.00	12.70	34.40	63.07%	0.00%	0.00%	36.93%	**34.40**	**1.00**
Xylene	1.00			3.43			1.016			0.0619	3.43	1.02	0.06	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	72.07%	0.00%	0.00%	27.93%	---	---
Acenaphthene	383616.62	-5.562	-0.8556				1.470			0	0.00	563916.43	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	325.00	325.00	0.00%	0.00%	0.00%	100.00%	**325.00**	**1.00**
Acenaphthylene	383616.62	-1.144	0.791				22.9			0	8318.21	8784820.59	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	325.00	325.00	0.00%	0.00%	0.00%	100.00%	**325.00**	**1.00**
Anthracene	383616.62	-0.9887	0.7784				2.42			0	8262.64	928352.22	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	325.00	325.00	0.00%	0.00%	0.00%	100.00%	**325.00**	**1.00**
Benzo(a)pyrene	1.00	-2.0615	0.975				1.33			0	0.13	1.33	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Benzo(a)anthracene	1.00	-2.7078	0.5944				1.59			0	0.07	1.59	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Benzo(b)fluoranthene	1.00			0.31			2.6			0	0.31	2.60	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---

Table A-12. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Red-tailed Hawk

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway					
		Plants			Soil Inverts			Small Mammals																					
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
Benzo(ghi)perylene	1.00	-0.9313	1.1829				2.94			0	0.39	2.94	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Benzo[k]fluoranthene	1.00	-4.6482	0.1668				2.6			0	0.01	2.60	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Chrysene	1.00	-2.7078	0.5944				2.29			0	0.07	2.29	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Dibenz(ah)anthracene	1.00			0.13			2.31			0	0.13	2.31	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Fluoranthene	1.00			0.5			3.04			0	0.50	3.04	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Fluorene	383616.62	-5.562	-0.8556				9.57			0	0.00	3671211.05	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	325.00	325.00	0.00%	0.00%	0.00%	100.00%	**325.00**	**1.00**
Indeno[1,2,3-cd]pyrene	1.00			0.11			2.86			0	0.11	2.86	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
2-Methylnaphthalene	383616.62	-1.3205	4.544				1.020			0	630585507512385000000000.00	391229.35	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	325.00	325.00	0.00%	0.00%	0.00%	100.00%	**325.00**	**1.00**
Naphthalene	383616.62			12.2			4.4			0	4680122.76	1687913.13	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	325.00	325.00	0.00%	0.00%	0.00%	100.00%	**325.00**	**1.00**
Phenanthrene	383616.62	-0.1665	0.6203				1.72			0	2462.53	659820.59	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	325.00	325.00	0.00%	0.00%	0.00%	100.00%	**325.00**	**1.00**
Pyrene	1.00			0.72			1.75			0	0.72	1.75	0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%		---
Low MW PAHs	383616.62	-1.3205	0.4544							0	92.01		0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	325.00	325.00	0.00%	0.00%	0.00%	100.00%	**325.00**	**1.00**
High MW PAHs	1.00	-1.7026	0.9469							0	0.18		0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Gasoline Range Organics																												**5000.00**	**0.00**
TPH - Diesel	5901794.15									0			0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	5000.00	5000.00	0.00%	0.00%	0.00%	100.00%	**5000.00**	**1.00**
TPH - Kerosene	5901794.15									0			0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	5000.00	5000.00	0.00%	0.00%	0.00%	100.00%	**5000.00**	**1.00**
Normal paraffin hydrocarbons	1.00									0			0.00	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Phenol	1.00						0.235			0.0064		0.23	0.01	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	21.07%	0.00%	0.00%	78.93%	---	---
2-methylphenol (ocresol)	1.00						0.336			0.0150		0.34	0.02	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	38.52%	0.00%	0.00%	61.48%	---	---
4-methylphenol (pcresol)	1.00						0.333			0.0141		0.33	0.01	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	37.05%	0.00%	0.00%	62.95%	---	---
2,4-dinitrotoluene	932.00	1.873	-0.3768	0.376			0.184			0.0155	350.43	171.21	14.46	0.035	1	0	0	0.024	0.51	0.00	0.00	0.79	1.30	39.26%	0.00%	0.00%	60.74%	**1.30**	**1.00**
Bis[2-ethylhexyl] phthalate	1.00			0.07			41.144			0.0945	0.07	41.14	0.09	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	79.74%	0.00%	0.00%	20.26%	---	---
Total PCBs	250.88			0.17	1.41	1.36				0.1792	42.52	7509.94	44.97	0.035	1	0	0	0.024	1.59	0.00	0.00	0.21	1.80	88.19%	0.00%	0.00%	11.81%	**1.80**	**1.00**
Aroclor 1016	217.53			0.30	1.41	1.36				0.2104	64.58	6185.65	45.77	0.035	1	0	0	0.024	1.62	0.00	0.00	0.18	1.80	89.76%	0.00%	0.00%	10.24%	**1.80**	**1.00**
Aroclor 1221	240.18			0.78	1.41	1.36				0.1883	188.37	7077.40	45.23	0.035	1	0	0	0.024	1.60	0.00	0.00	0.20	1.80	88.70%	0.00%	0.00%	11.30%	**1.80**	**1.00**
Aroclor 1232	262.36			0.99	1.41	1.36				0.1704	259.91	7980.98	44.69	0.035	1	0	0	0.024	1.58	0.00	0.00	0.22	1.80	87.65%	0.00%	0.00%	12.35%	**1.80**	**1.00**
Aroclor 1242	255.51			0.16	1.41	1.36				0.1756	41.33	7699.11	44.86	0.035	1	0	0	0.024	1.58	0.00	0.00	0.22	1.80	87.97%	0.00%	0.00%	12.03%	**1.80**	**1.00**
Aroclor 1248	243.35			0.18	1.41	1.36				0.1855	44.86	7204.87	45.15	0.035	1	0	0	0.024	1.59	0.00	0.00	0.21	1.80	88.55%	0.00%	0.00%	11.45%	**1.80**	**1.00**
Aroclor 1254	272.65			0.14	1.41	1.36				0.1630	37.98	8409.57	44.45	0.035	1	0	0	0.024	1.57	0.00	0.00	0.23	1.80	87.17%	0.00%	0.00%	12.83%	**1.80**	**1.00**
Aroclor 1260	514.89			0.05	1.41	1.36				0.0750	26.90	19966.01	38.63	0.035	1	0	0	0.024	1.36	0.00	0.00	0.44	1.80	75.77%	0.00%	0.00%	24.23%	**1.80**	**1.00**
Aroclor-1262	2124.65													0.035	1	0	0	0.024	0.00	0.00	0.00	1.80	1.80	0.00%	0.00%	0.00%	100.00%	**1.80**	**1.00**
Dichloroprop	1.00													0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Aldrin	5.30			0.14			1.033			0.1630	0.74	5.48	0.86	0.035	1	0	0	0.024	0.03	0.00	0.00	0.00	0.04	87.17%	0.00%	0.00%	12.83%	**0.04**	**1.00**
beta-1,2,3,4,5,6-Hexachlorocyclohexane	168.46			1.72			1.021			0.1201	289.58	172.01	20.23	0.035	1	0	0	0.024	0.71	0.00	0.00	0.14	0.86	83.35%	0.00%	0.00%	16.65%	**0.86**	**1.00**

Table A-12. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Red-tailed Hawk

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway					
		Plants			Soil Inverts			Small Mammals																					
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Avian LOAEL TRV (mg/kg/d)	LOAEL HQ
alpha-Chlordane	1507.65			0.16			1.031			0.1771	248.47	1555.10	266.93	0.035	1	0	0	0.024	9.42	0.00	0.00	1.28	10.70	88.06%	0.00%	0.00%	11.94%	**10.70**	**1.00**
gamma-Chlordane	1507.65			0.16			1.036			0.1771	248.47	1561.29	266.93	0.035	1	0	0	0.024	9.42	0.00	0.00	1.28	10.70	88.06%	0.00%	0.00%	11.94%	**10.70**	**1.00**
Dichlorodiphenyldichloroethylene	1.70	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		0.12	19.00	53.53	0.035	1	0	0	0.024	1.89	0.00	0.00	0.00	1.89	99.92%	0.00%	0.00%	0.08%	**1.89**	**1.00**
Dichlorodiphenyltrichloroethane	46.28	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		1.45	234.33	52.49	0.035	1	0	0	0.024	1.85	0.00	0.00	0.04	1.89	97.93%	0.00%	0.00%	2.07%	**1.89**	**1.00**
Dieldrin	5.16			0.41			14.70			1.20	2.12	75.87	6.19	0.035	1	0	0	0.024	0.22	0.00	0.00	0.00	0.22	98.04%	0.00%	0.00%	1.96%	**0.22**	**1.00**
Endosulfan I	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	0.035	1	0	0	0.024	0.01	0.00	0.00	0.00	0.01	85.84%	0.00%	0.00%	14.16%	**---**	**---**
Endosulfan II	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	0.035	1	0	0	0.024	0.01	0.00	0.00	0.00	0.01	85.84%	0.00%	0.00%	14.16%	**---**	**---**
Endosulfan sulfate	1.00			1.98			1.184			0.1072	1.98	1.18	0.11	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.00	81.70%	0.00%	0.00%	18.30%	**---**	**---**
Endrin aldehyde	1.00			1.44			6.686			0.1368	1.44	6.69	0.14	0.035	1	0	0	0.024	0.00	0.00	0.00	0.00	0.01	85.07%	0.00%	0.00%	14.93%	**---**	**---**
Methoxychlor	1.00			0.52			3.739			0.2093	0.52	3.74	0.21	0.035	1	0	0	0.024	0.01	0.00	0.00	0.00	0.01	89.71%	0.00%	0.00%	10.29%	**---**	**---**

Notes:
It has been conservatively assumed that all chemical intake is absorbed by the receptor.
1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.
Acronyms:
BAF = Bioaccumulation factor
DW = Dry weight
FIR = Food ingestion rate
mg/kg = Miligrams per kilogram
mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight
mg/kg/d = Miligrams per kilogram per day
NOAEL = No observed adverse effect level
PRGs = Preliminary remediation goals
TRV = Toxicity reference value
Equations:
Total Estimated Exposure = Food Intake + Incidental Soil Intake
Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)
Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)
Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0
where: B1 = slope and B0 = intercept
Estimated Concentrations in Biota (method 2) = soil concentration X BAF
Hazard Quotient = Total Estimated Exposure (Dose) / TRV
Therefore, when the HQ = 1, soil concentration = PRG
where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Table A-13. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Great Basin Pocket Mouse

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway					
		Plants			Soil Inverts			Small Mammals																					
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invert.	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Mammalian LOAEL TRV (mg/kg/d)	LOAEL HQ
Aluminum	6871.78			0.00287			0.043			0.0263	19.72	295.49	180.73	0.123	0	0	1	0.02	0.00	0.00	2.42	16.88	19.30	0.00%	0.00%	12.55%	87.45%	**19.30**	**1.00**
Antimony	96.64	-3.233	0.938				1			0.001 * 50 * Cdiet	2.87	96.64	4.83	0.123	0	0	1	0.02	0.00	0.00	0.35	0.24	0.59	0.00%	0.00%	59.76%	40.24%	**0.59**	**1.00**
Arsenic, Total all valence states	459.41	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		4.33	18.30	1.19	0.123	0	0	1	0.02	0.00	0.00	0.53	1.13	1.66	0.00%	0.00%	32.02%	67.98%	**1.66**	**1.00**
Arsenic (III)	459.41	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		4.33	18.30	1.19	0.123	0	0	1	0.02	0.00	0.00	0.53	1.13	1.66	0.00%	0.00%	32.02%	67.98%	**1.66**	**1.00**
Arsenic (V)	459.41	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		4.33	18.30	1.19	0.123	0	0	1	0.02	0.00	0.00	0.53	1.13	1.66	0.00%	0.00%	32.02%	67.98%	**1.66**	**1.00**
Barium	3469.98			0.156			0.091			0.0168	541.32	315.77	58.30	0.123	0	0	1	0.02	0.00	0.00	66.48	8.52	75.00	0.00%	0.00%	88.64%	11.36%	**75.00**	**1.00**
Beryllium	1.00	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	0.59	0.05	0.00	0.123	0	0	1	0.02	0.00	0.00	0.07	0.00	0.07	0.00%	0.00%	96.69%	3.31%	**---**	**---**
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	20.00%	80.00%	**---**	**---**
Boron	132.92			5.714			1			1	759.51	132.92	132.92	0.123	0	0	1	0.02	0.00	0.00	93.27	0.33	93.60	0.00%	0.00%	99.65%	0.35%	**93.60**	**1.00**
Cadmium	2065.15	-0.476	0.546		2.114	0.795		-1.2571	0.4723		40.11	3576.73	10.46	0.123	0	0	1	0.02	0.00	0.00	4.93	5.07	10.00	0.00%	0.00%	49.27%	50.73%	**10.00**	**1.00**
Chromium (total)	1284.17			0.041			0.306	-1.4599	0.7338		52.65	392.96	44.37	0.123	0	0	1	0.02	0.00	0.00	6.47	3.15	9.62	0.00%	0.00%	67.21%	32.79%	**9.62**	**1.00**
Chromium (+3)	1284.17			0.041			0.306	-1.4599	0.7338		52.65	392.96	44.37	0.123	0	0	1	0.02	0.00	0.00	6.47	3.15	9.62	0.00%	0.00%	67.21%	32.79%	**9.62**	**1.00**
Chromium (+6)	5339.59			0.041			0.306	-1.4599	0.7338		218.92	1633.92	126.25	0.123	0	0	1	0.02	0.00	0.00	26.89	13.11	40.00	0.00%	0.00%	67.21%	32.79%	**40.00**	**1.00**
Cobalt	3233.42			0.00745			0.291	-4.4669	1.307		24.09	940.93	443.79	0.123	0	0	1	0.02	0.00	0.00	2.96	7.94	10.90	0.00%	0.00%	27.14%	72.86%	**10.90**	**1.00**
Copper	1893.59	0.669	0.394				0.515	2.042	0.1444		38.18	975.20	22.91	0.123	0	0	1	0.02	0.00	0.00	4.69	4.65	9.34	0.00%	0.00%	50.20%	49.80%	**9.34**	**1.00**
Lead	2544.20	-1.328	0.561		-0.218	0.807		0.0761	0.4422		21.57	450.40	34.59	0.123	0	0	1	0.02	0.00	0.00	2.65	6.25	8.90	0.00%	0.00%	29.77%	70.23%	**8.90**	**1.00**
Lithium	6378.59			0.004			0.046			1	25.51	293.42	6378.59	0.123	0	0	1	0.02	0.00	0.00	3.13	15.67	18.80	0.00%	0.00%	16.67%	83.33%	**18.80**	**1.00**
Manganese	5828.07			0.0792	-0.809	0.682				0.0205	461.58	164.72	119.48	0.123	0	0	1	0.02	0.00	0.00	56.69	14.31	71.00	0.00%	0.00%	79.84%	20.16%	**71.00**	**1.00**
Mercury (methyl)	7.98	-0.996	0.544		0.0781	0.3369				0.054	1.14	2.18	0.43	0.123	0	0	1	0.02	0.00	0.00	0.14	0.02	0.16	0.00%	0.00%	87.75%	12.25%	**0.16**	**1.00**
Mercury (inorganic)	31.00	-0.996	0.544		0.0781	0.3369				0.054	2.39	3.44	1.68	0.123	0	0	1	0.02	0.00	0.00	0.29	0.08	0.37	0.00%	0.00%	79.41%	20.59%	**0.37**	**1.00**
Molybdenum	16.67			1.2504			0.953			1	20.84	15.88	16.67	0.123	0	0	1	0.02	0.00	0.00	2.56	0.04	2.60	0.00%	0.00%	98.43%	1.57%	**2.60**	**1.00**
Nickel	675.83	-2.224	0.748				1.059	-0.2462	0.4658		14.15	715.70	16.26	0.123	0	0	1	0.02	0.00	0.00	1.74	1.66	3.40	0.00%	0.00%	51.15%	48.85%	**3.40**	**1.00**
Selenium	2.97	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		1.69	2.06	0.99	0.123	0	0	1	0.02	0.00	0.00	0.21	0.01	0.21	0.00%	0.00%	96.60%	3.40%	**0.22**	**1.00**
Silver	14417.68			0.014			2.045			0.0040	201.85	29484.16	57.67	0.123	0	0	1	0.02	0.00	0.00	24.79	35.41	60.20	0.00%	0.00%	41.18%	58.82%	**60.20**	**1.00**
Strontium	1.00			0.207			0.4066			1.74	0.21	0.41	1.74	0.123	0	0	1	0.02	0.00	0.00	0.03	0.00	0.03	0.00%	0.00%	91.18%	8.82%	**---**	**---**
Thallium	25.45			0.004			0.0541			0.1124	0.10	1.38	2.86	0.123	0	0	1	0.02	0.00	0.00	0.01	0.06	0.08	0.00%	0.00%	16.67%	83.33%	**0.08**	**1.00**
Tin	279.41			1			0.08			0.08	279.41	22.35	22.35	0.123	0	0	1	0.02	0.00	0.00	34.31	0.69	35.00	0.00%	0.00%	98.04%	1.96%	**35.00**	**1.00**
Uranium	556.10			0.021			0.033			0.0002	11.68	18.35	0.11	0.123	0	0	1	0.02	0.00	0.00	1.43	1.37	2.80	0.00%	0.00%	51.22%	48.78%	**2.80**	**1.00**
Vanadium	2723.03			0.00485			0.042			0.0123	13.21	114.37	33.49	0.123	0	0	1	0.02	0.00	0.00	1.62	6.69	8.31	0.00%	0.00%	19.52%	80.48%	**8.31**	**1.00**
Zinc	4660.81	1.575	0.555		4.449	0.328		4.3632	0.0706		524.82	1365.94	142.53	0.123	0	0	1	0.02	0.00	0.00	64.45	11.45	75.90	0.00%	0.00%	84.92%	15.08%	**75.90**	**1.00**
Ammonia/Ammonium	1.00													0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**

Table A-13. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Great Basin Pocket Mouse

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian LOAEL TRV (mg/kg/d)	LOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invert.	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Chloride	1.00													0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Cyanide	1.00													0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Fluoride	16520.65			0.006							99.12			0.123	0	0	1	0.02	0.00	0.00	12.17	40.58	52.75	0.00%	0.00%	23.08%	76.92%	**52.75**	**1.00**
Iodine	1593.68			0.05							79.68			0.123	0	0	1	0.02	0.00	0.00	9.79	3.91	13.70	0.00%	0.00%	71.43%	28.57%	**13.70**	**1.00**
Nitrate/Nitrite	460072.60													0.123	0	0	1	0.02	0.00	0.00	0.00	1130.00	1130.00	0.00%	0.00%	0.00%	100.00%	**1130.00**	**1.00**
Phosphate	1.00													0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Sulfate/Sulfite	1.00													0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Total Organic Carbon	1.00													0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
1,1-dichloroethane	1.00						1.010			0.0109		1.01	0.01	0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
1,1-dichloroethene	1.00						1.011			0.0186		1.01	0.02	0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
1,1,1-trichloroethane	1.00						1.013			0.0305		1.01	0.03	0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
1,1,2-trichloroethane	1.00						1.010			0.0165		1.01	0.02	0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
1,1,2,2-tetrachloroethane	36357.95						1.013			0.0270		36828.25	982.66	0.123	0	0	1	0.02	0.00	0.00	0.00	89.30	89.30	0.00%	0.00%	0.00%	100.00%	**89.30**	**1.00**
1,2-dichlorobenzene	1.00			2.45			1.018			0.0882	2.45	1.02	0.09	0.123	0	0	1	0.02	0.00	0.00	0.30	0.00	0.30	0.00%	0.00%	99.19%	0.81%	---	---
1,2-dichloroethane (DCA)	1.00						0.988			0.0063		0.99	0.01	0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
1,3-dichlorobenzene	1.00			2.23			1.018			0.0963	2.23	1.02	0.10	0.123	0	0	1	0.02	0.00	0.00	0.27	0.00	0.28	0.00%	0.00%	99.11%	0.89%	---	---
2-butanone (Methyl Ethyl Ketone/MEK)	1861054.73						0.094			0.0006		174191.03	1027.39	0.123	0	0	1	0.02	0.00	0.00	0.00	4571.00	4571.00	0.00%	0.00%	0.00%	100.00%	**4571.00**	**1.00**
2-hexanone	14697.89						0.207			0.0053		3046.86	78.58	0.123	0	0	1	0.02	0.00	0.00	0.00	36.10	36.10	0.00%	0.00%	0.00%	100.00%	**36.10**	**1.00**
Benzene	2850.01						1.011			0.0186		2882.01	53.06	0.123	0	0	1	0.02	0.00	0.00	0.00	7.00	7.00	0.00%	0.00%	0.00%	100.00%	**7.00**	**1.00**
Butanol	203571.95						0.478			0.0017		97351.61	347.82	0.123	0	0	1	0.02	0.00	0.00	0.00	500.00	500.00	0.00%	0.00%	0.00%	100.00%	**500.00**	**1.00**
Carbon Tetrachloride	1.00						1.015			0.0420		1.01	0.04	0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Chlorobenzene	15756.47						1.015			0.0490		15987.09	772.46	0.123	0	0	1	0.02	0.00	0.00	0.00	38.70	38.70	0.00%	0.00%	0.00%	100.00%	**38.70**	**1.00**
Chloroform	16692.90						1.011			0.0135		16868.52	224.89	0.123	0	0	1	0.02	0.00	0.00	0.00	41.00	41.00	0.00%	0.00%	0.00%	100.00%	**41.00**	**1.00**
Cis-1,2-dichloroethylene	1.00						1.011			0.0122		1.01	0.01	0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Dichloromethane (Methylene Chloride)	20357.19						1.007			0.0042		20494.70	85.41	0.123	0	0	1	0.02	0.00	0.00	0.00	50.00	50.00	0.00%	0.00%	0.00%	100.00%	**50.00**	**1.00**
Ethyl Benzene	1027.17			3.21			1.016			0.0666	3301.75	1043.82	68.45	0.123	0	0	1	0.02	0.00	0.00	405.48	2.52	408.00	0.00%	0.00%	99.38%	0.62%	**408.00**	**1.00**
Methyl Isobutyl Ketone	1861054.73						0.197			0.0037		366585.28	6964.10	0.123	0	0	1	0.02	0.00	0.00	0.00	4571.00	4571.00	0.00%	0.00%	0.00%	100.00%	**4571.00**	**1.00**
n-butyl Benzene	1588.60			1.67			1.022			0.1227	2655.38	1624.14	194.98	0.123	0	0	1	0.02	0.00	0.00	326.10	3.90	330.00	0.00%	0.00%	98.82%	1.18%	**330.00**	**1.00**
Tetrachloroethylene	2850.01						1.018			0.0390		2899.90	111.17	0.123	0	0	1	0.02	0.00	0.00	0.00	7.00	7.00	0.00%	0.00%	0.00%	100.00%	**7.00**	**1.00**
Toluene	211714.82						1.014			0.0430		214694.56	9110.95	0.123	0	0	1	0.02	0.00	0.00	0.00	520.00	520.00	0.00%	0.00%	0.00%	100.00%	**520.00**	**1.00**
Trans-1,2-dichloroethylene	1.00						1.011			0.0170		1.01	0.02	0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---

Table A-13. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Great Basin Pocket Mouse

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway					
		Plants			Soil Inverts			Small Mammals																					
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invert.	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Mammalian LOAEL TRV (mg/kg/d)	LOAEL HQ
Trichloroethylene (TCE)	2850.01						1.012			0.0410		2885.49	116.81	0.123	0	0	1	0.02	0.00	0.00	0.00	7.00	7.00	0.00%	0.00%	0.00%	100.00%	**7.00**	**1.00**
Xylene	825.70			3.43			1.016			0.0619	2833.49	838.95	51.13	0.123	0	0	1	0.02	0.00	0.00	347.97	2.03	350.00	0.00%	0.00%	99.42%	0.58%	**350.00**	**1.00**
Acenaphthene	142500.36	-5.562	-0.8556				1.470			0	0.00	209475.53	0.00	0.123	0	0	1	0.02	0.00	0.00	0.00	350.00	350.00	0.00%	0.00%	0.00%	100.00%	**350.00**	**1.00**
Acenaphthylene	54131.54	-1.144	0.791				22.9			0	1767.37	1239612.23	0.00	0.123	0	0	1	0.02	0.00	0.00	217.04	132.95	350.00	0.00%	0.00%	62.01%	37.99%	**350.00**	**1.00**
Anthracene	1.00	-0.9887	0.7784				2.42			0	0.37	2.42	0.00	0.123	0	0	1	0.02	0.00	0.00	0.05	0.00	0.05	0.00%	0.00%	94.90%	5.10%	**---**	**---**
Benzo(a)pyrene	634.65	-2.0615	0.975				1.33			0	68.73	844.09	0.00	0.123	0	0	1	0.02	0.00	0.00	8.44	1.56	10.00	0.00%	0.00%	84.41%	15.59%	**10.00**	**1.00**
Benzo(a)anthracene	3635.53	-2.7078	0.5944				1.59			0	8.72	5780.49	0.00	0.123	0	0	1	0.02	0.00	0.00	1.07	8.93	10.00	0.00%	0.00%	10.71%	89.29%	**10.00**	**1.00**
Benzo(b)fluoranthene	246.75			0.31			2.6			0	76.49	641.56	0.00	0.123	0	0	1	0.02	0.00	0.00	9.39	0.61	10.00	0.00%	0.00%	93.94%	6.06%	**10.00**	**1.00**
Benzo(ghi)perylene	88.95	-0.9313	1.1829				2.94			0	79.65	261.51	0.00	0.123	0	0	1	0.02	0.00	0.00	9.78	0.22	10.00	0.00%	0.00%	97.82%	2.18%	**10.00**	**1.00**
Benzo[k]fluoranthene	4069.49	-4.6482	0.1668				2.6			0	0.04	10580.68	0.00	0.123	0	0	1	0.02	0.00	0.00	0.00	10.00	10.00	0.00%	0.00%	0.05%	99.95%	**10.00**	**1.00**
Chrysene	3635.53	-2.7078	0.5944				2.29			0	8.72	8325.37	0.00	0.123	0	0	1	0.02	0.00	0.00	1.07	8.93	10.00	0.00%	0.00%	10.71%	89.29%	**10.00**	**1.00**
Dibenz(ah)anthracene	542.86			0.13			2.31			0	70.57	1254.00	0.00	0.123	0	0	1	0.02	0.00	0.00	8.67	1.33	10.00	0.00%	0.00%	86.67%	13.33%	**10.00**	**1.00**
Fluoranthene	3914.85			0.5			3.04			0	1957.42	11901.13	0.00	0.123	0	0	1	0.02	0.00	0.00	240.38	9.62	250.00	0.00%	0.00%	96.15%	3.85%	**250.00**	**1.00**
Fluorene	101785.97	-5.562	-0.8556				9.57			0	0.00	974091.76	0.00	0.123	0	0	1	0.02	0.00	0.00	0.00	250.00	250.00	0.00%	0.00%	0.00%	100.00%	**250.00**	**1.00**
Indeno[1,2,3-cd]pyrene	626.38			0.11			2.86			0	68.90	1791.43	0.00	0.123	0	0	1	0.02	0.00	0.00	8.46	1.54	10.00	0.00%	0.00%	84.62%	15.38%	**10.00**	**1.00**
2-Methylnaphthalene	6.01	-1.3205	4.544				1.020			0	926.48	6.13	0.00	0.123	0	0	1	0.02	0.00	0.00	113.78	0.01	113.79	0.00%	0.00%	99.99%	0.01%	**113.80**	**1.00**
Naphthalene	99.95			12.2			4.4			0	1219.43	439.80	0.00	0.123	0	0	1	0.02	0.00	0.00	149.75	0.25	150.00	0.00%	0.00%	99.84%	0.16%	**150.00**	**1.00**
Phenanthrene	1.00	-0.1665	0.6203				1.72			0	0.85	1.72	0.00	0.123	0	0	1	0.02	0.00	0.00	0.10	0.00	0.11	0.00%	0.00%	97.69%	2.31%	**---**	**---**
Pyrene	1375.49			0.72			1.75			0	990.35	2407.10	0.00	0.123	0	0	1	0.02	0.00	0.00	121.62	3.38	125.00	0.00%	0.00%	97.30%	2.70%	**125.00**	**1.00**
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	0.123	0	0	1	0.02	0.00	0.00	0.13	0.00	0.14	0.00%	0.00%	98.19%	1.81%	**---**	**---**
Low MW PAHs	130652.20	-1.3205	0.4544							0	56.40		0.00	0.123	0	0	1	0.02	0.00	0.00	6.93	320.90	327.83	0.00%	0.00%	2.11%	97.89%	**328.00**	**1.00**
High MW PAHs	156.91	-1.7026	0.9469							0	21.86		0.00	0.123	0	0	1	0.02	0.00	0.00	2.68	0.39	3.07	0.00%	0.00%	87.45%	12.55%	**3.07**	**1.00**
Gasoline Range Organics																												**1500.00**	**0.00**
TPH - Diesel	610715.84									0			0.00	0.123	0	0	1	0.02	0.00	0.00	0.00	1500.00	1500.00	0.00%	0.00%	0.00%	100.00%	**1500.00**	**1.00**
TPH - Kerosene	610715.84									0			0.00	0.123	0	0	1	0.02	0.00	0.00	0.00	1500.00	1500.00	0.00%	0.00%	0.00%	100.00%	**1500.00**	**1.00**
Normal paraffin hydrocarbons	610715.84									0			0.00	0.123	0	0	1	0.02	0.00	0.00	0.00	1500.00	1500.00	0.00%	0.00%	0.00%	100.00%	**1500.00**	**1.00**
Phenol	14657.18						0.235			0.0064		3441.58	93.93	0.123	0	0	1	0.02	0.00	0.00	0.00	36.00	36.00	0.00%	0.00%	0.00%	100.00%	**36.00**	**1.00**
2-methylphenol (ocresol)	1.00						0.336			0.0150		0.34	0.02	0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**
4-methylphenol (pcresol)	1.00						0.333			0.0141		0.33	0.01	0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**
2,4-dinitrotoluene	28.79	1.873	-0.3768	0.376			0.184			0.0155	10.82	5.29	0.45	0.123	0	0	1	0.02	0.00	0.00	1.33	0.07	1.40	0.00%	0.00%	94.95%	5.05%	**1.40**	**1.00**
Bis[2-ethylhexyl] phthalate	17332.00			0.07			41.144			0.0945	1143.51	713110.07	1637.34	0.123	0	0	1	0.02	0.00	0.00	140.43	42.57	183.00	0.00%	0.00%	76.74%	23.26%	**183.00**	**1.00**

Table A-13. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Great Basin Pocket Mouse

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian LOAEL TRV (mg/kg/d)	LOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invert.	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Total PCBs	29.22			0.17	1.41	1.36				0.1792	4.95	403.37	5.24	0.123	0	0	1	0.02	0.00	0.00	0.61	0.07	0.68	0.00%	0.00%	89.45%	10.55%	**0.68**	**1.00**
Aroclor 1016	88.14			0.30	1.41	1.36				0.2104	26.17	1810.56	18.55	0.123	0	0	1	0.02	0.00	0.00	3.21	0.22	3.43	0.00%	0.00%	93.69%	6.31%	**3.43**	**1.00**
Aroclor 1221	6.88			0.78	1.41	1.36				0.1883	5.40	56.47	1.30	0.123	0	0	1	0.02	0.00	0.00	0.66	0.02	0.68	0.00%	0.00%	97.51%	2.49%	**0.68**	**1.00**
Aroclor 1232	5.48			0.99	1.41	1.36				0.1704	5.43	41.40	0.93	0.123	0	0	1	0.02	0.00	0.00	0.67	0.01	0.68	0.00%	0.00%	98.02%	1.98%	**0.68**	**1.00**
Aroclor 1242	30.91			0.16	1.41	1.36				0.1756	5.00	435.45	5.43	0.123	0	0	1	0.02	0.00	0.00	0.61	0.08	0.69	0.00%	0.00%	89.00%	11.00%	**0.69**	**1.00**
Aroclor 1248	3.47			0.18	1.41	1.36				0.1855	0.64	22.21	0.64	0.123	0	0	1	0.02	0.00	0.00	0.08	0.01	0.09	0.00%	0.00%	90.21%	9.79%	**0.09**	**1.00**
Aroclor 1254	34.76			0.14	1.41	1.36				0.1630	4.84	510.76	5.67	0.123	0	0	1	0.02	0.00	0.00	0.59	0.09	0.68	0.00%	0.00%	87.45%	12.55%	**0.68**	**1.00**
Aroclor 1260	76.65			0.05	1.41	1.36				0.0750	4.00	1497.36	5.75	0.123	0	0	1	0.02	0.00	0.00	0.49	0.19	0.68	0.00%	0.00%	72.31%	27.69%	**0.68**	**1.00**
Aroclor-1262	276.86													0.123	0	0	1	0.02	0.00	0.00	0.00	0.68	0.68	0.00%	0.00%	0.00%	100.00%	**0.68**	**1.00**
Dichloroprop	1.00													0.123	0	0	1	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**
Aldrin	51.12			0.14			1.033			0.1630	7.12	52.79	8.33	0.123	0	0	1	0.02	0.00	0.00	0.87	0.13	1.00	0.00%	0.00%	87.45%	12.55%	**1.00**	**1.00**
beta-1,2,3,4,5,6-Hexachlorocyclohexane	9.36			1.72			1.021			0.1201	16.10	9.56	1.12	0.123	0	0	1	0.02	0.00	0.00	1.98	0.02	2.00	0.00%	0.00%	98.85%	1.15%	**2.00**	**1.00**
alpha-Chlordane	925.29			0.16			1.031			0.1771	152.49	954.42	163.83	0.123	0	0	1	0.02	0.00	0.00	18.73	2.27	21.00	0.00%	0.00%	89.18%	10.82%	**21.00**	**1.00**
gamma-Chlordane	925.29			0.16			1.036			0.1771	152.49	958.21	163.83	0.123	0	0	1	0.02	0.00	0.00	18.73	2.27	21.00	0.00%	0.00%	89.18%	10.82%	**21.00**	**1.00**
Dichlorodiphenyldi-chloroethylene	135.88	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		3.27	899.11	887.61	0.123	0	0	1	0.02	0.00	0.00	0.40	0.33	0.73	0.00%	0.00%	54.59%	45.41%	**0.74**	**1.00**
Dichlorodiphenyltrichloroeth	135.88	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		3.27	597.36	114.64	0.123	0	0	1	0.02	0.00	0.00	0.40	0.33	0.73	0.00%	0.00%	54.59%	45.41%	**0.74**	**1.00**
Dieldrin	0.57			0.41			14.70			1.20	0.23	8.35	0.68	0.123	0	0	1	0.02	0.00	0.00	0.03	0.00	0.03	0.00%	0.00%	95.35%	4.65%	**0.03**	**1.00**
Endosulfan I	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	0.123	0	0	1	0.02	0.00	0.00	0.16	0.00	0.16	0.00%	0.00%	98.50%	1.50%	**---**	**---**
Endosulfan II	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	0.123	0	0	1	0.02	0.00	0.00	0.16	0.00	0.16	0.00%	0.00%	98.50%	1.50%	**---**	**---**
Endosulfan sulfate	1.00			1.98			1.184			0.1072	1.98	1.18	0.11	0.123	0	0	1	0.02	0.00	0.00	0.24	0.00	0.25	0.00%	0.00%	99.00%	1.00%	**---**	**---**
Endrin aldehyde	5.13			1.44			6.686			0.1368	7.39	34.32	0.70	0.123	0	0	1	0.02	0.00	0.00	0.91	0.01	0.92	0.00%	0.00%	98.63%	1.37%	**0.92**	**1.00**
Methoxychlor	119.56			0.52			3.739			0.2093	62.75	447.04	25.02	0.123	0	0	1	0.02	0.00	0.00	7.71	0.29	8.00	0.00%	0.00%	96.33%	3.67%	**8.00**	**1.00**

Notes:

It has been conservatively assumed that all chemical intake is absorbed by the receptor.

1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.

Acronyms:

BAF = Bioaccumulation factor
DW = Dry weight
FIR = Food ingestion rate
mg/kg = Miligrams per kilogram
mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight
mg/kg/d = Miligrams per kilogram per day
NOAEL = No observed adverse effect level
PRGs = Preliminary remediation goals
TRV = Toxicity reference value

Equations:

Total Estimated Exposure = Food Intake + Incidental Soil Intake
Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)
Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)
Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0
where: B1 = slope and B0 = intercept
Estimated Concentrations in Biota (method 2) = soil concentration X BAF
Hazard Quotient = Total Estimated Exposure (Dose) / TRV
Therefore, when the HQ = 1, soil concentration = PRG
where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Table A-14. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Deer Mouse

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway						
		Plants			Soil Inverts			Small Mammals																						
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Mammalian LOAEL TRV (mg/kg/d)	NOAEL HQ	LOAEL HQ
Aluminum	2707.93			0.00287			0.043			0.0263	7.77	116.44	71.22	0.166	0	0.5	0.5	0.02	0.00	9.66	0.65	8.99	19.30	0.00%	50.08%	3.34%	46.58%	**19.30**	**10.00**	**1.00**
Antimony	6.61	-3.233	0.938				1			0.001 * 50 * Cdiet	0.23	6.61	0.33	0.166	0	0.5	0.5	0.02	0.00	0.55	0.02	0.02	0.59	0.00%	93.02%	3.26%	3.72%	**0.59**	**10.00**	**1.00**
Arsenic, Total all valence states	189.51	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		2.63	9.79	0.58	0.166	0	0.5	0.5	0.02	0.00	0.81	0.22	0.63	1.66	0.00%	48.96%	13.14%	37.90%	**1.66**	**1.60**	**1.00**
Arsenic (III)	189.51	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		2.63	9.79	0.58	0.166	0	0.5	0.5	0.02	0.00	0.81	0.22	0.63	1.66	0.00%	48.96%	13.14%	37.90%	**1.66**	**1.60**	**1.00**
Arsenic (V)	189.51	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		2.63	9.79	0.58	0.166	0	0.5	0.5	0.02	0.00	0.81	0.22	0.63	1.66	0.00%	48.96%	13.14%	37.90%	**1.66**	**1.60**	**1.00**
Barium	3148.48			0.156			0.091			0.0168	491.16	286.51	52.89	0.166	0	0.5	0.5	0.02	0.00	23.78	40.77	10.45	75.00	0.00%	31.71%	54.36%	13.94%	**75.00**	**1.67**	**1.00**
Beryllium	1.00	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	0.59	0.05	0.00	0.166	0	0.5	0.5	0.02	0.00	0.00	0.05	0.00	0.06	0.00%	6.72%	87.31%	5.97%	**---**	**0.10**	**---**
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	0.166	0	0.5	0.5	0.02	0.00	0.08	0.00	0.00	0.09	0.00%	95.69%	0.48%	3.83%	**---**	**---**	**---**
Boron	166.97			5.714			1			1	954.06	166.97	166.97	0.166	0	0.5	0.5	0.02	0.00	13.86	79.19	0.55	93.60	0.00%	14.81%	84.60%	0.59%	**93.60**	**3.34**	**1.00**
Cadmium	27.54	-0.476	0.546		2.114	0.795		-1.2571	0.4723		3.80	115.58	1.36	0.166	0	0.5	0.5	0.02	0.00	9.59	0.32	0.09	10.00	0.00%	95.93%	3.15%	0.91%	**10.00**	**10.00**	**1.00**
Chromium (total)	299.49			0.041			0.306	-1.4599	0.7338		12.28	91.64	15.25	0.166	0	0.5	0.5	0.02	0.00	7.61	1.02	0.99	9.62	0.00%	79.07%	10.59%	10.34%	**9.62**	**4.01**	**1.00**
Chromium (+3)	299.49			0.041			0.306	-1.4599	0.7338		12.28	91.64	15.25	0.166	0	0.5	0.5	0.02	0.00	7.61	1.02	0.99	9.62	0.00%	79.07%	10.59%	10.34%	**9.62**	**4.01**	**1.00**
Chromium (+6)	1245.29			0.041			0.306	-1.4599	0.7338		51.06	381.06	43.38	0.166	0	0.5	0.5	0.02	0.00	31.63	4.24	4.13	40.00	0.00%	79.07%	10.59%	10.34%	**40.00**	**4.33**	**1.00**
Cobalt	388.02			0.00745			0.291	-4.4669	1.307		2.89	112.91	27.78	0.166	0	0.5	0.5	0.02	0.00	9.37	0.24	1.29	10.90	0.00%	85.98%	2.20%	11.82%	**10.90**	**1.49**	**1.00**
Copper	175.77	0.669	0.394				0.515	2.042	0.1444		14.96	90.52	16.26	0.166	0	0.5	0.5	0.02	0.00	7.51	1.24	0.58	9.34	0.00%	80.45%	13.30%	6.25%	**9.34**	**1.67**	**1.00**
Lead	331.98	-1.328	0.561		-0.218	0.807		0.0761	0.4422		6.88	87.07	14.06	0.166	0	0.5	0.5	0.02	0.00	7.23	0.57	1.10	8.90	0.00%	81.20%	6.42%	12.38%	**8.90**	**1.89**	**1.00**
Lithium	2516.73			0.004			0.046			1	10.07	115.77	2516.73	0.166	0	0.5	0.5	0.02	0.00	9.61	0.84	8.36	18.80	0.00%	51.11%	4.44%	44.44%	**18.80**	**2.00**	**1.00**
Manganese	5798.20			0.0792	-0.809	0.682				0.0205	459.22	164.14	118.86	0.166	0	0.5	0.5	0.02	0.00	13.62	38.12	19.25	70.99	0.00%	19.19%	53.69%	27.12%	**71.00**	**1.38**	**1.00**
Mercury (methyl)	1.87	-0.996	0.544		0.0781	0.3369				0.054	0.52	1.33	0.10	0.166	0	0.5	0.5	0.02	0.00	0.11	0.04	0.01	0.16	0.00%	69.22%	26.91%	3.87%	**0.16**	**5.00**	**1.00**
Mercury (inorganic)	12.30	-0.996	0.544		0.0781	0.3369				0.054	1.45	2.52	0.67	0.166	0	0.5	0.5	0.02	0.00	0.21	0.12	0.04	0.37	0.00%	56.50%	32.46%	11.04%	**0.37**	**--**	**1.00**
Molybdenum	13.96			1.2504			0.953			1	17.46	13.31	13.96	0.166	0	0.5	0.5	0.02	0.00	1.10	1.45	0.05	2.60	0.00%	42.48%	55.74%	1.78%	**2.60**	**10.00**	**1.00**
Nickel	35.81	-2.224	0.748				1.059	-0.2462	0.4658		1.57	37.92	4.14	0.166	0	0.5	0.5	0.02	0.00	3.15	0.13	0.12	3.40	0.00%	92.66%	3.84%	3.50%	**3.40**	**2.00**	**1.00**
Selenium	1.90	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		1.03	1.48	0.84	0.166	0	0.5	0.5	0.02	0.00	0.12	0.09	0.01	0.21	0.00%	57.30%	39.77%	2.93%	**0.22**	**1.50**	**1.00**
Silver	345.55			0.014			2.045			0.0040	4.84	706.64	1.38	0.166	0	0.5	0.5	0.02	0.00	58.65	0.40	1.15	60.20	0.00%	97.43%	0.67%	1.91%	**60.20**	**10.00**	**1.00**
Strontium	1.00			0.207			0.4066			1.74	0.21	0.41	1.74	0.166	0	0.5	0.5	0.02	0.00	0.03	0.02	0.00	0.05	0.00%	62.23%	31.65%	6.12%	**---**	**0.00**	**---**
Thallium	9.21			0.004			0.0541			0.1124	0.04	0.50	1.04	0.166	0	0.5	0.5	0.02	0.00	0.04	0.00	0.03	0.08	0.00%	55.15%	4.08%	40.77%	**0.08**	**5.00**	**1.00**
Tin	376.51			1			0.08			0.08	376.51	30.12	30.12	0.166	0	0.5	0.5	0.02	0.00	2.50	31.25	1.25	35.00	0.00%	7.14%	89.29%	3.57%	**35.00**	**1.50**	**1.00**
Uranium	358.88			0.021			0.033			0.0002	7.54	11.84	0.07	0.166	0	0.5	0.5	0.02	0.00	0.98	0.63	1.19	2.80	0.00%	35.11%	22.34%	42.55%	**2.80**	**0.91**	**1.00**
Vanadium	1152.80			0.00485			0.042			0.0123	5.59	48.42	14.18	0.166	0	0.5	0.5	0.02	0.00	4.02	0.46	3.83	8.31	0.00%	48.36%	5.58%	46.06%	**8.31**	**2.00**	**1.00**
Zinc	643.92	1.575	0.555		4.449	0.328		4.3632	0.0706		174.95	713.63	123.94	0.166	0	0.5	0.5	0.02	0.00	59.23	14.52	2.14	75.89	0.00%	78.05%	19.13%	2.82%	**75.90**	**1.01**	**1.00**
Ammonia/Ammonium	1.00													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**	**---**

Table A-14. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Deer Mouse

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway						
		Plants			Soil Inverts			Small Mammals																						
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Mammalian LOAEL TRV (mg/kg/d)	NOAEL HQ	LOAEL HQ
Chloride	1.00													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---	---
Cyanide	1.00													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	**0.00**	---
Fluoride	13816.13			0.006							82.90			0.166	0	0.5	0.5	0.02	0.00	0.00	6.88	45.87	52.75	0.00%	0.00%	13.04%	86.96%	**52.75**	**1.68**	**1.00**
Iodine	1834.00			0.05							91.70			0.166	0	0.5	0.5	0.02	0.00	0.00	7.61	6.09	13.70	0.00%	0.00%	55.56%	44.44%	**13.70**	**10.00**	**1.00**
Nitrate/Nitrite	340361.45													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	1130.00	1130.00	0.00%	0.00%	0.00%	100.00%	**1130.00**	**2.23**	**1.00**
Phosphate	1.00													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---	---
Sulfate/Sulfite	1.00													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---	---
Total Organic Carbon	1.00													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---	---
1,1-dichloroethane	1.00						1.010			0.0109		1.01	0.01	0.166	0	0.5	0.5	0.02	0.00	0.08	0.00	0.00	0.09	0.00%	96.19%	0.00%	3.81%	---	**0.00**	---
1,1-dichloroethene	1.00						1.011			0.0186		1.01	0.02	0.166	0	0.5	0.5	0.02	0.00	0.08	0.00	0.00	0.09	0.00%	96.19%	0.00%	3.81%	---	**0.00**	---
1,1,1-trichloroethane	1.00						1.013			0.0305		1.01	0.03	0.166	0	0.5	0.5	0.02	0.00	0.08	0.00	0.00	0.09	0.00%	96.20%	0.00%	3.80%	---	**0.00**	---
1,1,2-trichloroethane	1.00						1.010			0.0165		1.01	0.02	0.166	0	0.5	0.5	0.02	0.00	0.08	0.00	0.00	0.09	0.00%	96.19%	0.00%	3.81%	---	**0.00**	---
1,1,2,2-tetrachloroethane	1021.81						1.013			0.0270		1035.03	27.62	0.166	0	0.5	0.5	0.02	0.00	85.91	0.00	3.39	89.30	0.00%	96.20%	0.00%	3.80%	**89.30**	**10.00**	**1.00**
1,2-dichlorobenzene	1.00			2.45			1.018			0.0882	2.45	1.02	0.09	0.166	0	0.5	0.5	0.02	0.00	0.08	0.20	0.00	0.29	0.00%	29.00%	69.86%	1.14%	---	**0.00**	---
1,2-dichloroethane (DCA)	1.00						0.988			0.0063		0.99	0.01	0.166	0	0.5	0.5	0.02	0.00	0.08	0.00	0.00	0.09	0.00%	96.11%	0.00%	3.89%	---	**0.00**	---
1,3-dichlorobenzene	1.00			2.23			1.018			0.0963	2.23	1.02	0.10	0.166	0	0.5	0.5	0.02	0.00	0.08	0.19	0.00	0.27	0.00%	30.93%	67.85%	1.22%	---	**0.00**	---
2-butanone (Methyl Ethyl Ketone/MEK)	412223.86						0.094			0.0006		38583.33	227.57	0.166	0	0.5	0.5	0.02	0.00	3202.42	0.00	1368.58	4571.00	0.00%	70.06%	0.00%	29.94%	**4571.00**	**2.58**	**1.00**
2-hexanone	1758.76						0.207			0.0053		364.59	9.40	0.166	0	0.5	0.5	0.02	0.00	30.26	0.00	5.84	36.10	0.00%	83.83%	0.00%	16.17%	**36.10**	**7.22**	**1.00**
Benzene	80.23						1.011			0.0186		81.13	1.49	0.166	0	0.5	0.5	0.02	0.00	6.73	0.00	0.27	7.00	0.00%	96.19%	0.00%	3.81%	**7.00**	**10.00**	**1.00**
Butanol	11624.66						0.478			0.0017		5559.11	19.86	0.166	0	0.5	0.5	0.02	0.00	461.41	0.00	38.59	500.00	0.00%	92.28%	0.00%	7.72%	**500.00**	**4.00**	**1.00**
Carbon Tetrachloride	1.00						1.015			0.0420		1.01	0.04	0.166	0	0.5	0.5	0.02	0.00	0.08	0.00	0.00	0.09	0.00%	96.21%	0.00%	3.79%	---	**0.01**	---
Chlorobenzene	442.11						1.015			0.0490		448.58	21.67	0.166	0	0.5	0.5	0.02	0.00	37.23	0.00	1.47	38.70	0.00%	96.21%	0.00%	3.79%	**38.70**	**1.98**	**1.00**
Chloroform	470.22						1.011			0.0135		475.17	6.34	0.166	0	0.5	0.5	0.02	0.00	39.44	0.00	1.56	41.00	0.00%	96.19%	0.00%	3.81%	**41.00**	**2.73**	**1.00**
Cis-1,2-dichloroethylene	1.00						1.011			0.0122		1.01	0.01	0.166	0	0.5	0.5	0.02	0.00	0.08	0.00	0.00	0.09	0.00%	96.19%	0.00%	3.81%	---	**0.00**	---
Dichloromethane (Methylene Chloride)	575.50						1.007			0.0042		579.39	2.41	0.166	0	0.5	0.5	0.02	0.00	48.09	0.00	1.91	50.00	0.00%	96.18%	0.00%	3.82%	**50.00**	**8.55**	**1.00**
Ethyl Benzene	1151.04			3.21			1.016			0.0666	3699.93	1169.70	76.70	0.166	0	0.5	0.5	0.02	0.00	97.08	307.09	3.82	408.00	0.00%	23.80%	75.27%	0.94%	**408.00**	**4.20**	**1.00**
Methyl Isobutyl Ketone	232394.92						0.197			0.0037		45776.49	869.63	0.166	0	0.5	0.5	0.02	0.00	3799.45	0.00	771.55	4571.00	0.00%	83.12%	0.00%	16.88%	**4571.00**	**2.58**	**1.00**
n-butyl Benzene	1454.30			1.67			1.022			0.1227	2430.90	1486.83	178.50	0.166	0	0.5	0.5	0.02	0.00	123.41	201.76	4.83	330.00	0.00%	37.40%	61.14%	1.46%	**330.00**	**3.00**	**1.00**
Tetrachloroethylene	79.75						1.018			0.0390		81.15	3.11	0.166	0	0.5	0.5	0.02	0.00	6.74	0.00	0.26	7.00	0.00%	96.22%	0.00%	3.78%	**7.00**	**5.00**	**1.00**
Toluene	5943.66						1.014			0.0430		6027.31	255.78	0.166	0	0.5	0.5	0.02	0.00	500.27	0.00	19.73	520.00	0.00%	96.21%	0.00%	3.79%	**520.00**	**10.00**	**1.00**
Trans-1,2-dichloroethylene	1.00						1.011			0.0170		1.01	0.02	0.166	0	0.5	0.5	0.02	0.00	0.08	0.00	0.00	0.09	0.00%	96.19%	0.00%	3.81%	---	**0.00**	---

Table A-14. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Deer Mouse

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway						
		Plants			Soil Inverts			Small Mammals																						
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Mammalian LOAEL TRV (mg/kg/d)	NOAEL HQ	LOAEL HQ
Trichloroethylene (TCE)	80.13						1.012			0.0410		81.13	3.28	0.166	0	0.5	0.5	0.02	0.00	6.73	0.00	0.27	7.00	0.00%	96.20%	0.00%	3.80%	**7.00**	**10.00**	**1.00**
Xylene	939.65			3.43			1.016			0.0619	3224.55	954.73	58.18	0.166	0	0.5	0.5	0.02	0.00	79.24	267.64	3.12	350.00	0.00%	22.64%	76.47%	0.89%	**350.00**	**1.96**	**1.00**
Acenaphthene	2792.63	-5.562	-0.856				1.470			0	0.00	4105.16	0.00	0.166	0	0.5	0.5	0.02	0.00	340.73	0.00	9.27	350.00	0.00%	97.35%	0.00%	2.65%	**350.00**	**2.00**	**1.00**
Acenaphthylene	182.92	-1.144	0.791				22.9			0	19.62	4188.95	0.00	0.166	0	0.5	0.5	0.02	0.00	347.68	1.63	0.61	349.92	0.00%	99.36%	0.47%	0.17%	**350.00**	**2.00**	**1.00**
Anthracene	1.00	-0.9887	0.7784				2.42			0	0.37	2.42	0.00	0.166	0	0.5	0.5	0.02	0.00	0.20	0.03	0.00	0.24	0.00%	85.45%	13.14%	1.41%	**---**	**0.00**	**---**
Benzo(a)pyrene	81.16	-2.0615	0.975				1.33			0	9.25	107.94	0.00	0.166	0	0.5	0.5	0.02	0.00	8.96	0.77	0.27	10.00	0.00%	89.62%	7.68%	2.70%	**10.00**	**10.00**	**1.00**
Benzo(a)anthracene	73.37	-2.7078	0.5944				1.59			0	0.86	116.66	0.00	0.166	0	0.5	0.5	0.02	0.00	9.68	0.07	0.24	10.00	0.00%	96.85%	0.71%	2.44%	**10.00**	**10.00**	**1.00**
Benzo(b)fluoranthene	40.84			0.31			2.6			0	12.66	106.19	0.00	0.166	0	0.5	0.5	0.02	0.00	8.81	1.05	0.14	10.00	0.00%	88.14%	10.51%	1.36%	**10.00**	**10.00**	**1.00**
Benzo(ghi)perylene	32.35	-0.9313	1.1829				2.94			0	24.08	95.11	0.00	0.166	0	0.5	0.5	0.02	0.00	7.89	2.00	0.11	10.00	0.00%	78.94%	19.98%	1.07%	**10.00**	**10.00**	**1.00**
Benzo[k]fluoranthene	45.63	-4.6482	0.1668				2.6			0	0.02	118.64	0.00	0.166	0	0.5	0.5	0.02	0.00	9.85	0.00	0.15	10.00	0.00%	98.47%	0.02%	1.51%	**10.00**	**10.00**	**1.00**
Chrysene	51.38	-2.7078	0.5944				2.29			0	0.69	117.66	0.00	0.166	0	0.5	0.5	0.02	0.00	9.77	0.06	0.17	9.99	0.00%	97.72%	0.58%	1.71%	**10.00**	**9.99**	**1.00**
Dibenz(ah)anthracene	48.58			0.13			2.31			0	6.32	112.22	0.00	0.166	0	0.5	0.5	0.02	0.00	9.31	0.52	0.16	10.00	0.00%	93.15%	5.24%	1.61%	**10.00**	**10.00**	**1.00**
Fluoranthene	841.35			0.5			3.04			0	420.68	2557.72	0.00	0.166	0	0.5	0.5	0.02	0.00	212.29	34.92	2.79	250.00	0.00%	84.92%	13.97%	1.12%	**250.00**	**2.00**	**1.00**
Fluorene	313.43	-5.562	-0.856				9.57			0	0.00	2999.51	0.00	0.166	0	0.5	0.5	0.02	0.00	248.96	0.00	1.04	250.00	0.00%	99.58%	0.00%	0.42%	**250.00**	**2.00**	**1.00**
Indeno[1,2,3-cd]pyrene	40.03			0.11			2.86			0	4.40	114.48	0.00	0.166	0	0.5	0.5	0.02	0.00	9.50	0.37	0.13	10.00	0.00%	95.02%	3.65%	1.33%	**10.00**	**10.00**	**1.00**
2-Methylnaphthalene	6.55	-1.3205	4.544				1.020			0	1363.49	6.68	0.00	0.166	0	0.5	0.5	0.02	0.00	0.55	113.17	0.02	113.75	0.00%	0.49%	99.49%	0.02%	**113.80**	**2.26**	**1.00**
Naphthalene	108.61			12.2			4.4			0	1325.01	477.87	0.00	0.166	0	0.5	0.5	0.02	0.00	39.66	109.98	0.36	150.00	0.00%	26.44%	73.32%	0.24%	**150.00**	**3.00**	**1.00**
Phenanthrene	1.00	-0.1665	0.6203				1.72			0	0.85	1.72	0.00	0.166	0	0.5	0.5	0.02	0.00	0.14	0.07	0.00	0.22	0.00%	65.99%	32.48%	1.53%	**---**	**0.00**	**---**
Pyrene	600.01			0.72			1.75			0	432.01	1050.02	0.00	0.166	0	0.5	0.5	0.02	0.00	87.15	35.86	1.99	125.00	0.00%	69.72%	28.69%	1.59%	**125.00**	**1.67**	**1.00**
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	0.166	0	0.5	0.5	0.02	0.00	0.00	0.09	0.00	0.09	0.00%	0.00%	96.45%	3.55%	**---**	**---**	**---**
Low MW PAHs	97560.30	-1.3205	0.4544							0	49.39		0.00	0.166	0	0.5	0.5	0.02	0.00	0.00	4.10	323.90	328.00	0.00%	0.00%	1.25%	98.75%	**328.00**	**5.00**	**1.00**
High MW PAHs	208.68	-1.7026	0.9469							0	28.63		0.00	0.166	0	0.5	0.5	0.02	0.00	0.00	2.38	0.69	3.07	0.00%	0.00%	77.43%	22.57%	**3.07**	**4.99**	**1.00**
Gasoline Range Organics																												**1500.00**	**0.00**	**0.00**
TPH - Diesel	451807.23									0			0.00	0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	1500.00	1500.00	0.00%	0.00%	0.00%	100.00%	**1500.00**	**1.50**	**1.00**
TPH - Kerosene	451807.23									0			0.00	0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	1500.00	1500.00	0.00%	0.00%	0.00%	100.00%	**1500.00**	**1.50**	**1.00**
Normal paraffin hydrocarbons	451807.23									0			0.00	0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	1500.00	1500.00	0.00%	0.00%	0.00%	100.00%	**1500.00**	**1.50**	**1.00**
Phenol	1578.34						0.235			0.0064		370.60	10.11	0.166	0	0.5	0.5	0.02	0.00	30.76	0.00	5.24	36.00	0.00%	85.44%	0.00%	14.56%	**36.00**	**3.00**	**1.00**
2-methylphenol (ocresol)	1.00						0.336			0.0150		0.34	0.02	0.166	0	0.5	0.5	0.02	0.00	0.03	0.00	0.00	0.03	0.00%	89.35%	0.00%	10.65%	**---**	**0.00**	**---**
4-methylphenol (pcresol)	1.00						0.333			0.0141		0.33	0.01	0.166	0	0.5	0.5	0.02	0.00	0.03	0.00	0.00	0.03	0.00%	89.29%	0.00%	10.71%	**---**	**0.00**	**---**
2,4-dinitrotoluene	28.13	1.873	-0.377	0.376			0.184			0.0155	10.58	5.17	0.44	0.166	0	0.5	0.5	0.02	0.00	0.43	0.88	0.09	1.40	0.00%	30.63%	62.70%	6.67%	**1.40**	**2.09**	**1.00**
Bis[2-ethylhexyl] phthalate	53.52			0.07			41.144			0.0945	3.53	2201.98	5.06	0.166	0	0.5	0.5	0.02	0.00	182.76	0.29	0.18	183.23	0.00%	99.74%	0.16%	0.10%	**183.00**	**10.01**	**1.00**

Table A-14. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Deer Mouse

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway						
		Plants			Soil Inverts			Small Mammals																						
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Mammalian LOAEL TRV (mg/kg/d)	NOAEL HQ	LOAEL HQ
Total PCBs	1.61			0.17	1.41	1.36				0.1792	0.27	7.85	0.29	0.166	0	0.5	0.5	0.02	0.00	0.65	0.02	0.01	0.68	0.00%	95.87%	3.34%	0.79%	**0.68**	**10.00**	**1.00**
Aroclor 1016	5.30			0.30	1.41	1.36				0.2104	1.57	39.54	1.11	0.166	0	0.5	0.5	0.02	0.00	3.28	0.13	0.02	3.43	0.00%	95.68%	3.81%	0.51%	**3.43**	**2.50**	**1.00**
Aroclor 1221	1.48			0.78	1.41	1.36				0.1883	1.16	6.97	0.28	0.166	0	0.5	0.5	0.02	0.00	0.58	0.10	0.00	0.68	0.00%	85.12%	14.16%	0.72%	**0.68**	**10.00**	**1.00**
Aroclor 1232	1.44			0.99	1.41	1.36				0.1704	1.42	6.71	0.24	0.166	0	0.5	0.5	0.02	0.00	0.56	0.12	0.00	0.68	0.00%	81.91%	17.38%	0.70%	**0.68**	**10.00**	**1.00**
Aroclor 1242	1.63			0.16	1.41	1.36				0.1756	0.26	7.98	0.29	0.166	0	0.5	0.5	0.02	0.00	0.66	0.02	0.01	0.69	0.00%	96.04%	3.18%	0.79%	**0.69**	**10.00**	**1.00**
Aroclor 1248	0.35			0.18	1.41	1.36				0.1855	0.06	0.97	0.06	0.166	0	0.5	0.5	0.02	0.00	0.08	0.01	0.00	0.09	0.00%	92.58%	6.10%	1.32%	**0.09**	**10.00**	**1.00**
Aroclor 1254	1.62			0.14	1.41	1.36				0.1630	0.23	7.90	0.26	0.166	0	0.5	0.5	0.02	0.00	0.66	0.02	0.01	0.68	0.00%	96.45%	2.76%	0.79%	**0.68**	**10.00**	**1.00**
Aroclor 1260	1.64			0.05	1.41	1.36				0.0750	0.09	8.04	0.12	0.166	0	0.5	0.5	0.02	0.00	0.67	0.01	0.01	0.68	0.00%	98.15%	1.05%	0.80%	**0.68**	**10.00**	**1.00**
Aroclor-1262	204.82													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	0.68	0.68	0.00%	0.00%	0.00%	100.00%	**0.68**	**10.00**	**1.00**
Dichloroprop	1.00													0.166	0	0.5	0.5	0.02	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**	**---**
Aldrin	9.94			0.14			1.033			0.1630	1.38	10.27	1.62	0.166	0	0.5	0.5	0.02	0.00	0.85	0.11	0.03	1.00	0.00%	85.21%	11.49%	3.30%	**1.00**	**5.00**	**1.00**
beta-1,2,3,4,5,6-Hexachlorocyclohexane	8.67			1.72			1.021			0.1201	14.90	8.85	1.04	0.166	0	0.5	0.5	0.02	0.00	0.73	1.24	0.03	2.00	0.00%	36.73%	61.83%	1.44%	**2.00**	**5.00**	**1.00**
alpha-Chlordane	204.66			0.16			1.031			0.1771	33.73	211.10	36.23	0.166	0	0.5	0.5	0.02	0.00	17.52	2.80	0.68	21.00	0.00%	83.43%	13.33%	3.24%	**21.00**	**10.00**	**1.00**
gamma-Chlordane	203.98			0.16			1.036			0.1771	33.62	211.24	36.11	0.166	0	0.5	0.5	0.02	0.00	17.53	2.79	0.68	21.00	0.00%	83.49%	13.29%	3.22%	**21.00**	**10.00**	**1.00**
Dichlorodiphenyldichloroethylene	0.71	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		0.06	8.77	30.48	0.166	0	0.5	0.5	0.02	0.00	0.73	0.01	0.00	0.74	0.00%	98.98%	0.70%	0.32%	**0.74**	**5.00**	**1.00**
Dichlorodiphenyltrichloroethane	1.05	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		0.08	8.73	3.37	0.166	0	0.5	0.5	0.02	0.00	0.72	0.01	0.00	0.73	0.00%	98.58%	0.95%	0.47%	**0.74**	**5.00**	**1.00**
Dieldrin	0.02			0.41			14.70			1.20	0.01	0.35	0.03	0.166	0	0.5	0.5	0.02	0.00	0.03	0.00	0.00	0.03	0.00%	97.03%	2.71%	0.26%	**0.03**	**2.00**	**1.00**
Endosulfan I	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	0.166	0	0.5	0.5	0.02	0.00	0.10	0.11	0.00	0.21	0.00%	46.70%	51.72%	1.58%	**---**	**1.40**	**---**
Endosulfan II	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	0.166	0	0.5	0.5	0.02	0.00	0.10	0.11	0.00	0.21	0.00%	46.70%	51.72%	1.58%	**---**	**1.40**	**---**
Endosulfan sulfate	1.00			1.98			1.184			0.1072	1.98	1.18	0.11	0.166	0	0.5	0.5	0.02	0.00	0.10	0.16	0.00	0.27	0.00%	36.98%	61.77%	1.25%	**---**	**1.77**	**---**
Endrin aldehyde	1.36			1.44			6.686			0.1368	1.95	9.08	0.19	0.166	0	0.5	0.5	0.02	0.00	0.75	0.16	0.00	0.92	0.00%	81.88%	17.63%	0.49%	**0.92**	**10.00**	**1.00**
Methoxychlor	22.39			0.52			3.739			0.2093	11.75	83.74	4.69	0.166	0	0.5	0.5	0.02	0.00	6.95	0.98	0.07	8.00	0.00%	86.88%	12.19%	0.93%	**8.00**	**2.00**	**1.00**

Notes:
It has been conservatively assumed that all chemical intake is absorbed by the receptor.
1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.

Acronyms:
BAF = Bioaccumulation factor
DW = Dry weight
FIR = Food ingestion rate
mg/kg = Miligrams per kilogram
mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight
mg/kg/d = Miligrams per kilogram per day
NOAEL = No observed adverse effect level
PRGs = Preliminary remediation goals
TRV = Toxicity reference value

Equations:
Total Estimated Exposure = Food Intake + Incidental Soil Intake
Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)
Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)
Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0
where: B1 = slope and B0 = intercept
Estimated Concentrations in Biota (method 2) = soil concentration X BAF
Hazard Quotient = Total Estimated Exposure (Dose) / TRV
Therefore, when the HQ = 1, soil concentration = PRG
where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Table A-15. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Grasshopper Mouse

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian LOAEL TRV (mg/kg/d)	LOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invert.	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Aluminum	3798.53			0.00287			0.043			0.0263	10.90	163.34	99.90	0.098	0	1	0	0.009	0.00	15.96	0.00	3.34	19.30	0.00%	82.69%	0.00%	17.31%	**19.30**	**1.00**
Antimony	5.98	-3.233	0.938				1			0.001 * 50 * Cdiet	0.21	5.98	0.30	0.098	0	1	0	0.009	0.00	0.58	0.00	0.01	0.59	0.00%	99.11%	0.00%	0.89%	**0.59**	**1.00**
Arsenic, Total all valence states	318.36	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		3.52	14.12	0.88	0.098	0	1	0	0.009	0.00	1.38	0.00	0.28	1.66	0.00%	83.13%	0.00%	16.87%	**1.66**	**1.00**
Arsenic (III)	318.36	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		3.52	14.12	0.88	0.098	0	1	0	0.009	0.00	1.38	0.00	0.28	1.66	0.00%	83.13%	0.00%	16.87%	**1.66**	**1.00**
Arsenic (V)	318.36	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		3.52	14.12	0.88	0.098	0	1	0	0.009	0.00	1.38	0.00	0.28	1.66	0.00%	83.13%	0.00%	16.87%	**1.66**	**1.00**
Barium	7675.79			0.156			0.091			0.0168	1197.42	698.50	128.95	0.098	0	1	0	0.009	0.00	68.25	0.00	6.75	75.00	0.00%	91.00%	0.00%	9.00%	**75.00**	**1.00**
Beryllium	1.00	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	0.59	0.05	0.00	0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.01	0.00%	83.33%	0.00%	16.67%	**---**	**---**
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	0.098	0	1	0	0.009	0.00	0.10	0.00	0.00	0.10	0.00%	99.11%	0.00%	0.89%	**---**	**---**
Boron	949.39			5.714			1			1	5424.84	949.39	949.39	0.098	0	1	0	0.009	0.00	92.77	0.00	0.83	93.60	0.00%	99.11%	0.00%	0.89%	**93.60**	**1.00**
Cadmium	23.57	-0.476	0.546		2.114	0.795		-1.2571	0.4723		3.49	102.13	1.27	0.098	0	1	0	0.009	0.00	9.98	0.00	0.02	10.00	0.00%	99.79%	0.00%	0.21%	**10.00**	**1.00**
Chromium (total)	312.56			0.041			0.306	-1.4599	0.7338		12.81	95.64	15.73	0.098	0	1	0	0.009	0.00	9.35	0.00	0.27	9.62	0.00%	97.14%	0.00%	2.86%	**9.62**	**1.00**
Chromium (+3)	312.56			0.041			0.306	-1.4599	0.7338		12.81	95.64	15.73	0.098	0	1	0	0.009	0.00	9.35	0.00	0.27	9.62	0.00%	97.14%	0.00%	2.86%	**9.62**	**1.00**
Chromium (+6)	1299.60			0.041			0.306	-1.4599	0.7338		53.28	397.68	44.76	0.098	0	1	0	0.009	0.00	38.86	0.00	1.14	40.00	0.00%	97.14%	0.00%	2.86%	**40.00**	**1.00**
Cobalt	371.85			0.00745			0.291	-4.4669	1.307		2.77	108.21	26.27	0.098	0	1	0	0.009	0.00	10.57	0.00	0.33	10.90	0.00%	97.00%	0.00%	3.00%	**10.90**	**1.00**
Copper	182.42	0.669	0.394				0.515	2.042	0.1444		15.18	93.95	16.34	0.098	0	1	0	0.009	0.00	9.18	0.00	0.16	9.34	0.00%	98.28%	0.00%	1.72%	**9.34**	**1.00**
Lead	336.43	-1.328	0.561		-0.218	0.807		0.0761	0.4422		6.93	88.01	14.14	0.098	0	1	0	0.009	0.00	8.60	0.00	0.30	8.90	0.00%	96.67%	0.00%	3.33%	**8.90**	**1.00**
Lithium	3498.30			0.004			0.046			1	13.99	160.92	3498.30	0.098	0	1	0	0.009	0.00	15.72	0.00	3.08	18.80	0.00%	83.64%	0.00%	16.36%	**18.80**	**1.00**
Manganese	27720.38			0.0792	-0.809	0.682				0.0205	2195.45	477.14	568.27	0.098	0	1	0	0.009	0.00	46.62	0.00	24.38	71.00	0.00%	65.67%	0.00%	34.33%	**71.00**	**1.00**
Mercury (methyl)	3.25	-0.996	0.544		0.0781	0.3369				0.054	0.70	1.61	0.18	0.098	0	1	0	0.009	0.00	0.16	0.00	0.00	0.16	0.00%	98.21%	0.00%	1.79%	**0.16**	**1.00**
Mercury (inorganic)	32.43	-0.996	0.544		0.0781	0.3369				0.054	2.45	3.49	1.76	0.098	0	1	0	0.009	0.00	0.34	0.00	0.03	0.37	0.00%	92.28%	0.00%	7.72%	**0.37**	**1.00**
Molybdenum	27.66			1.2504			0.953			1	34.59	26.36	27.66	0.098	0	1	0	0.009	0.00	2.58	0.00	0.02	2.60	0.00%	99.06%	0.00%	0.94%	**2.60**	**1.00**
Nickel	32.58	-2.224	0.748				1.059	-0.2462	0.4658		1.46	34.50	3.96	0.098	0	1	0	0.009	0.00	3.37	0.00	0.03	3.40	0.00%	99.16%	0.00%	0.84%	**3.40**	**1.00**
Selenium	3.19	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		1.83	2.17	1.02	0.098	0	1	0	0.009	0.00	0.21	0.00	0.00	0.21	0.00%	98.70%	0.00%	1.30%	**0.22**	**1.00**
Silver	299.96			0.014			2.045			0.0040	4.20	613.41	1.20	0.098	0	1	0	0.009	0.00	59.94	0.00	0.26	60.20	0.00%	99.56%	0.00%	0.44%	**60.20**	**1.00**
Strontium	1.00			0.207			0.4066			1.74	0.21	0.41	1.74	0.098	0	1	0	0.009	0.00	0.04	0.00	0.00	0.04	0.00%	97.83%	0.00%	2.17%	**---**	**---**
Thallium	12.16			0.004			0.0541			0.1124	0.05	0.66	1.37	0.098	0	1	0	0.009	0.00	0.06	0.00	0.01	0.08	0.00%	85.74%	0.00%	14.26%	**0.08**	**1.00**
Tin	4024.76			1			0.08			0.08	4024.76	321.98	321.98	0.098	0	1	0	0.009	0.00	31.46	0.00	3.54	35.00	0.00%	89.89%	0.00%	10.11%	**35.00**	**1.00**
Uranium	682.29			0.021			0.033			0.0002	14.33	22.52	0.14	0.098	0	1	0	0.009	0.00	2.20	0.00	0.60	2.80	0.00%	78.57%	0.00%	21.43%	**2.80**	**1.00**
Vanadium	1667.60			0.00485			0.042			0.0123	8.09	70.04	20.51	0.098	0	1	0	0.009	0.00	6.84	0.00	1.47	8.31	0.00%	82.35%	0.00%	17.65%	**8.31**	**1.00**
Zinc	810.09	1.575	0.555		4.449	0.328		4.3632	0.0706		198.72	769.44	125.97	0.098	0	1	0	0.009	0.00	75.18	0.00	0.71	75.89	0.00%	99.06%	0.00%	0.94%	**75.90**	**1.00**
Ammonia/Ammonium	1.00													0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**

Table A-15. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Grasshopper Mouse

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian LOAEL TRV (mg/kg/d)	LOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invert.	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Chloride	1.00													0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Cyanide	1.00													0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Fluoride	59984.89			0.006							359.91			0.098	0	1	0	0.009	0.00	0.00	0.00	52.75	52.75	0.00%	0.00%	0.00%	100.00%	**52.75**	**1.00**
Iodine	15579.01			0.05							778.95			0.098	0	1	0	0.009	0.00	0.00	0.00	13.70	13.70	0.00%	0.00%	0.00%	100.00%	**13.70**	**1.00**
Nitrate/Nitrite	1284984.44													0.098	0	1	0	0.009	0.00	0.00	0.00	1130.00	1130.00	0.00%	0.00%	0.00%	100.00%	**1130.00**	**1.00**
Phosphate	1.00													0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Sulfate/Sulfite	1.00													0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Total Organic Carbon	1.00													0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
1,1-dichloroethane	1.00						1.010			0.0109		1.01	0.01	0.098	0	1	0	0.009	0.00	0.10	0.00	0.00	0.10	0.00%	99.12%	0.00%	0.88%	---	---
1,1-dichloroethene	1.00						1.011			0.0186		1.01	0.02	0.098	0	1	0	0.009	0.00	0.10	0.00	0.00	0.10	0.00%	99.12%	0.00%	0.88%	---	---
1,1,1-trichloroethane	1.00						1.013			0.0305		1.01	0.03	0.098	0	1	0	0.009	0.00	0.10	0.00	0.00	0.10	0.00%	99.12%	0.00%	0.88%	---	---
1,1,2-trichloroethane	1.00						1.010			0.0165		1.01	0.02	0.098	0	1	0	0.009	0.00	0.10	0.00	0.00	0.10	0.00%	99.12%	0.00%	0.88%	---	---
1,1,2,2-tetrachloroethane	894.31						1.013			0.0270		905.88	24.17	0.098	0	1	0	0.009	0.00	88.51	0.00	0.79	89.30	0.00%	99.12%	0.00%	0.88%	**89.30**	**1.00**
1,2-dichlorobenzene	1.00			2.45			1.018			0.0882	2.45	1.02	0.09	0.098	0	1	0	0.009	0.00	0.10	0.00	0.00	0.10	0.00%	99.12%	0.00%	0.88%	---	---
1,2-dichloroethane (DCA)	1.00						0.988			0.0063		0.99	0.01	0.098	0	1	0	0.009	0.00	0.10	0.00	0.00	0.10	0.00%	99.10%	0.00%	0.90%	---	---
1,3-dichlorobenzene	1.00			2.23			1.018			0.0963	2.23	1.02	0.10	0.098	0	1	0	0.009	0.00	0.10	0.00	0.00	0.10	0.00%	99.12%	0.00%	0.88%	---	---
2-butanone (Methyl Ethyl Ketone/MEK)	455967.83						0.094			0.0006		42677.68	251.71	0.098	0	1	0	0.009	0.00	4170.03	0.00	400.97	4571.00	0.00%	91.23%	0.00%	8.77%	**4571.00**	**1.00**
2-hexanone	1708.10						0.207			0.0053		354.09	9.13	0.098	0	1	0	0.009	0.00	34.60	0.00	1.50	36.10	0.00%	95.84%	0.00%	4.16%	**36.10**	**1.00**
Benzene	70.22						1.011			0.0186		71.01	1.31	0.098	0	1	0	0.009	0.00	6.94	0.00	0.06	7.00	0.00%	99.12%	0.00%	0.88%	**7.00**	**1.00**
Butanol	10502.90						0.478			0.0017		5022.67	17.95	0.098	0	1	0	0.009	0.00	490.76	0.00	9.24	500.00	0.00%	98.15%	0.00%	1.85%	**500.00**	**1.00**
Carbon Tetrachloride	1.00						1.015			0.0420		1.01	0.04	0.098	0	1	0	0.009	0.00	0.10	0.00	0.00	0.10	0.00%	99.12%	0.00%	0.88%	---	---
Chlorobenzene	386.93						1.015			0.0490		392.59	18.97	0.098	0	1	0	0.009	0.00	38.36	0.00	0.34	38.70	0.00%	99.12%	0.00%	0.88%	**38.70**	**1.00**
Chloroform	411.58						1.011			0.0135		415.91	5.54	0.098	0	1	0	0.009	0.00	40.64	0.00	0.36	41.00	0.00%	99.12%	0.00%	0.88%	**41.00**	**1.00**
Cis-1,2-dichloroethylene	1.00						1.011			0.0122		1.01	0.01	0.098	0	1	0	0.009	0.00	0.10	0.00	0.00	0.10	0.00%	99.12%	0.00%	0.88%	---	---
Dichloromethane (Methylene Chloride)	503.78						1.007			0.0042		507.19	2.11	0.098	0	1	0	0.009	0.00	49.56	0.00	0.44	50.00	0.00%	99.11%	0.00%	0.89%	**50.00**	**1.00**
Ethyl Benzene	4072.97			3.21			1.016			0.0666	13092.21	4138.97	271.40	0.098	0	1	0	0.009	0.00	404.42	0.00	3.58	408.00	0.00%	99.12%	0.00%	0.88%	**408.00**	**1.00**
Methyl Isobutyl Ketone	227119.32						0.197			0.0037		44737.32	849.89	0.098	0	1	0	0.009	0.00	4371.27	0.00	199.73	4571.00	0.00%	95.63%	0.00%	4.37%	**4571.00**	**1.00**
n-butyl Benzene	3274.62			1.67			1.022			0.1227	5473.60	3347.88	401.93	0.098	0	1	0	0.009	0.00	327.12	0.00	2.88	330.00	0.00%	99.13%	0.00%	0.87%	**330.00**	**1.00**
Tetrachloroethylene	69.79						1.018			0.0390		71.01	2.72	0.098	0	1	0	0.009	0.00	6.94	0.00	0.06	7.00	0.00%	99.12%	0.00%	0.88%	**7.00**	**1.00**
Toluene	5201.85						1.014			0.0430		5275.07	223.86	0.098	0	1	0	0.009	0.00	515.43	0.00	4.57	520.00	0.00%	99.12%	0.00%	0.88%	**520.00**	**1.00**
Trans-1,2-dichloroethylene	1.00						1.011			0.0170		1.01	0.02	0.098	0	1	0	0.009	0.00	0.10	0.00	0.00	0.10	0.00%	99.12%	0.00%	0.88%	---	---
Trichloroethylene (TCE)	70.14						1.012			0.0410		71.01	2.87	0.098	0	1	0	0.009	0.00	6.94	0.00	0.06	7.00	0.00%	99.12%	0.00%	0.88%	**7.00**	**1.00**
Xylene	3494.50			3.43			1.016			0.0619	11991.85	3550.59	216.38	0.098	0	1	0	0.009	0.00	346.93	0.00	3.07	350.00	0.00%	99.12%	0.00%	0.88%	**350.00**	**1.00**

Table A-15. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Grasshopper Mouse

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian LOAEL TRV (mg/kg/d)	LOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invert.	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Acenaphthene	2421.93	-5.562	-0.8556				1.470			0	0.00	3560.24	0.00	0.098	0	1	0	0.009	0.00	347.87	0.00	2.13	350.00	0.00%	99.39%	0.00%	0.61%	**350.00**	**1.00**
Acenaphthylene	155.81	-1.144	0.791				22.9			0	17.28	3568.01	0.00	0.098	0	1	0	0.009	0.00	348.63	0.00	0.14	348.77	0.00%	99.96%	0.00%	0.04%	**350.00**	**1.00**
Anthracene	1.00	-0.9887	0.7784				2.42			0	0.37	2.42	0.00	0.098	0	1	0	0.009	0.00	0.24	0.00	0.00	0.24	0.00%	99.63%	0.00%	0.37%	**---**	**---**
Benzo(a)pyrene	76.43	-2.0615	0.975				1.33			0	8.73	101.66	0.00	0.098	0	1	0	0.009	0.00	9.93	0.00	0.07	10.00	0.00%	99.33%	0.00%	0.67%	**10.00**	**1.00**
Benzo(a)anthracene	64.00	-2.7078	0.5944				1.59			0	0.79	101.77	0.00	0.098	0	1	0	0.009	0.00	9.94	0.00	0.06	10.00	0.00%	99.44%	0.00%	0.56%	**10.00**	**1.00**
Benzo(b)fluoranthene	39.23			0.31			2.6			0	12.16	101.99	0.00	0.098	0	1	0	0.009	0.00	9.97	0.00	0.03	10.00	0.00%	99.66%	0.00%	0.34%	**10.00**	**1.00**
Benzo(ghi)perylene	34.70	-0.9313	1.1829				2.94			0	26.16	102.03	0.00	0.098	0	1	0	0.009	0.00	9.97	0.00	0.03	10.00	0.00%	99.69%	0.00%	0.31%	**10.00**	**1.00**
Benzo[k]fluoranthene	39.23	-4.6482	0.1668				2.6			0	0.02	101.99	0.00	0.098	0	1	0	0.009	0.00	9.97	0.00	0.03	10.00	0.00%	99.66%	0.00%	0.34%	**10.00**	**1.00**
Chrysene	44.52	-2.7078	0.5944				2.29			0	0.64	101.94	0.00	0.098	0	1	0	0.009	0.00	9.96	0.00	0.04	10.00	0.00%	99.61%	0.00%	0.39%	**10.00**	**1.00**
Dibenz(ah)anthracene	44.13			0.13			2.31			0	5.74	101.95	0.00	0.098	0	1	0	0.009	0.00	9.96	0.00	0.04	10.00	0.00%	99.61%	0.00%	0.39%	**10.00**	**1.00**
Fluoranthene	839.16			0.5			3.04			0	419.58	2551.04	0.00	0.098	0	1	0	0.009	0.00	249.26	0.00	0.74	250.00	0.00%	99.70%	0.00%	0.30%	**250.00**	**1.00**
Fluorene	267.10	-5.562	-0.8556				9.57			0	0.00	2556.19	0.00	0.098	0	1	0	0.009	0.00	249.77	0.00	0.23	250.00	0.00%	99.91%	0.00%	0.09%	**250.00**	**1.00**
Indeno[1,2,3-cd]pyrene	35.67			0.11			2.86			0	3.92	102.02	0.00	0.098	0	1	0	0.009	0.00	9.97	0.00	0.03	10.00	0.00%	99.69%	0.00%	0.31%	**10.00**	**1.00**
2-Methylnaphthalene	1132.02	-1.3205	4.544				1.020			0	20101502546608.90	1154.49	0.00	0.098	0	1	0	0.009	0.00	112.80	0.00	1.00	113.80	0.00%	99.13%	0.00%	0.87%	**113.80**	**1.00**
Naphthalene	348.19			12.2			4.4			0	4247.89	1532.02	0.00	0.098	0	1	0	0.009	0.00	149.69	0.00	0.31	150.00	0.00%	99.80%	0.00%	0.20%	**150.00**	**1.00**
Phenanthrene	1.00	-0.1665	0.6203				1.72			0	0.85	1.72	0.00	0.098	0	1	0	0.009	0.00	0.17	0.00	0.00	0.17	0.00%	99.48%	0.00%	0.52%	**---**	**---**
Pyrene	727.29			0.72			1.75			0	523.65	1272.75	0.00	0.098	0	1	0	0.009	0.00	124.36	0.00	0.64	125.00	0.00%	99.49%	0.00%	0.51%	**125.00**	**1.00**
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**
Low MW PAHs	372986.63	-1.3205	0.4544							0	90.84		0.00	0.098	0	1	0	0.009	0.00	0.00	0.00	328.00	328.00	0.00%	0.00%	0.00%	100.00%	**328.00**	**1.00**
High MW PAHs	3491.06	-1.7026	0.9469							0	412.47		0.00	0.098	0	1	0	0.009	0.00	0.00	0.00	3.07	3.07	0.00%	0.00%	0.00%	100.00%	**3.07**	**1.00**
Gasoline Range Organics																												**1500.00**	**0.00**
TPH - Diesel	1705731.55									0			0.00	0.098	0	1	0	0.009	0.00	0.00	0.00	1500.00	1500.00	0.00%	0.00%	0.00%	100.00%	**1500.00**	**1.00**
TPH - Kerosene	1705731.55									0			0.00	0.098	0	1	0	0.009	0.00	0.00	0.00	1500.00	1500.00	0.00%	0.00%	0.00%	100.00%	**1500.00**	**1.00**
Normal paraffin hydrocarbons	1705731.55									0			0.00	0.098	0	1	0	0.009	0.00	0.00	0.00	1500.00	1500.00	0.00%	0.00%	0.00%	100.00%	**1500.00**	**1.00**
Phenol	1511.20						0.235			0.0064		354.84	9.68	0.098	0	1	0	0.009	0.00	34.67	0.00	1.33	36.00	0.00%	96.31%	0.00%	3.69%	**36.00**	**1.00**
2-methylphenol (ocresol)	1.00						0.336			0.0150		0.34	0.02	0.098	0	1	0	0.009	0.00	0.03	0.00	0.00	0.03	0.00%	97.39%	0.00%	2.61%	**---**	**---**
4-methylphenol (pcresol)	1.00						0.333			0.0141		0.33	0.01	0.098	0	1	0	0.009	0.00	0.03	0.00	0.00	0.03	0.00%	97.37%	0.00%	2.63%	**---**	**---**
2,4-dinitrotoluene	74.35	1.873	-0.3768	0.376			0.184			0.0155	27.96	13.66	1.15	0.098	0	1	0	0.009	0.00	1.33	0.00	0.07	1.40	0.00%	95.33%	0.00%	4.67%	**1.40**	**1.00**
Bis[2-ethylhexyl] phthalate	45.42			0.07			41.144			0.0945	3.00	1868.81	4.29	0.098	0	1	0	0.009	0.00	182.60	0.00	0.04	182.64	0.00%	99.98%	0.00%	0.02%	**183.00**	**1.00**
Total PCBs	1.47			0.17	1.41	1.36				0.1792	0.25	6.95	0.26	0.098	0	1	0	0.009	0.00	0.68	0.00	0.00	0.68	0.00%	99.81%	0.00%	0.19%	**0.68**	**1.00**
Aroclor 1016	4.85			0.30	1.41	1.36				0.2104	1.44	35.06	1.02	0.098	0	1	0	0.009	0.00	3.43	0.00	0.00	3.43	0.00%	99.88%	0.00%	0.12%	**3.43**	**1.00**

Table A-15. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Grasshopper Mouse

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian LOAEL TRV (mg/kg/d)	LOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Invert.	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Aroclor 1221	1.47			0.78	1.41	1.36				0.1883	1.16	6.95	0.28	0.098	0	1	0	0.009	0.00	0.68	0.00	0.00	0.68	0.00%	99.81%	0.00%	0.19%	**0.68**	**1.00**
Aroclor 1232	1.47			0.99	1.41	1.36				0.1704	1.46	6.95	0.25	0.098	0	1	0	0.009	0.00	0.68	0.00	0.00	0.68	0.00%	99.81%	0.00%	0.19%	**0.68**	**1.00**
Aroclor 1242	1.49			0.16	1.41	1.36				0.1756	0.24	7.05	0.26	0.098	0	1	0	0.009	0.00	0.69	0.00	0.00	0.69	0.00%	99.81%	0.00%	0.19%	**0.69**	**1.00**
Aroclor 1248	0.32			0.18	1.41	1.36				0.1855	0.06	0.89	0.06	0.098	0	1	0	0.009	0.00	0.09	0.00	0.00	0.09	0.00%	99.67%	0.00%	0.33%	**0.09**	**1.00**
Aroclor 1254	1.47			0.14	1.41	1.36				0.1630	0.21	6.95	0.24	0.098	0	1	0	0.009	0.00	0.68	0.00	0.00	0.68	0.00%	99.81%	0.00%	0.19%	**0.68**	**1.00**
Aroclor 1260	1.47			0.05	1.41	1.36				0.0750	0.08	6.95	0.11	0.098	0	1	0	0.009	0.00	0.68	0.00	0.00	0.68	0.00%	99.81%	0.00%	0.19%	**0.68**	**1.00**
Aroclor-1262	773.26													0.098	0	1	0	0.009	0.00	0.00	0.00	0.68	0.68	0.00%	0.00%	0.00%	100.00%	**0.68**	**1.00**
Dichloroprop	1.00													0.098	0	1	0	0.009	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**
Aldrin	9.82			0.14			1.033			0.1630	1.37	10.15	1.60	0.098	0	1	0	0.009	0.00	0.99	0.00	0.01	1.00	0.00%	99.14%	0.00%	0.86%	**1.00**	**1.00**
beta-1,2,3,4,5,6-Hexachlorocyclohexane	19.87			1.72			1.021			0.1201	34.16	20.29	2.39	0.098	0	1	0	0.009	0.00	1.98	0.00	0.02	2.00	0.00%	99.13%	0.00%	0.87%	**2.00**	**1.00**
alpha-Chlordane	206.56			0.16			1.031			0.1771	34.04	213.06	36.57	0.098	0	1	0	0.009	0.00	20.82	0.00	0.18	21.00	0.00%	99.14%	0.00%	0.86%	**21.00**	**1.00**
gamma-Chlordane	205.75			0.16			1.036			0.1771	33.91	213.07	36.43	0.098	0	1	0	0.009	0.00	20.82	0.00	0.18	21.00	0.00%	99.14%	0.00%	0.86%	**21.00**	**1.00**
Dichlorodiphenyldichloroethylene	0.59	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		0.05	7.52	27.25	0.098	0	1	0	0.009	0.00	0.73	0.00	0.00	0.74	0.00%	99.93%	0.00%	0.07%	**0.74**	**1.00**
Dichlorodiphenyltrichloroethane	0.88	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		0.07	7.51	2.97	0.098	0	1	0	0.009	0.00	0.73	0.00	0.00	0.73	0.00%	99.89%	0.00%	0.11%	**0.74**	**1.00**
Dieldrin	0.02			0.41			14.70			1.20	0.01	0.31	0.03	0.098	0	1	0	0.009	0.00	0.03	0.00	0.00	0.03	0.00%	99.94%	0.00%	0.06%	**0.03**	**1.00**
Endosulfan I	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	0.098	0	1	0	0.009	0.00	0.12	0.00	0.00	0.12	0.00%	99.25%	0.00%	0.75%	**---**	**---**
Endosulfan II	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	0.098	0	1	0	0.009	0.00	0.12	0.00	0.00	0.12	0.00%	99.25%	0.00%	0.75%	**---**	**---**
Endosulfan sulfate	1.00			1.98			1.184			0.1072	1.98	1.18	0.11	0.098	0	1	0	0.009	0.00	0.12	0.00	0.00	0.12	0.00%	99.25%	0.00%	0.75%	**---**	**---**
Endrin aldehyde	1.41			1.44			6.686			0.1368	2.02	9.40	0.19	0.098	0	1	0	0.009	0.00	0.92	0.00	0.00	0.92	0.00%	99.87%	0.00%	0.13%	**0.92**	**1.00**
Methoxychlor	21.84			0.52			3.739			0.2093	11.47	81.68	4.57	0.098	0	1	0	0.009	0.00	7.98	0.00	0.02	8.00	0.00%	99.76%	0.00%	0.24%	**8.00**	**1.00**

Notes:
It has been conservatively assumed that all chemical intake is absorbed by the receptor.
1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.

Acronyms:
BAF = Bioaccumulation factor
DW = Dry weight
FIR = Food ingestion rate
mg/kg = Miligrams per kilogram
mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight
mg/kg/d = Miligrams per kilogram per day
NOAEL = No observed adverse effect level
PRGs = Preliminary remediation goals
TRV = Toxicity reference value

Equations:
Total Estimated Exposure = Food Intake + Incidental Soil Intake
Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)
Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)
Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0
where: B1 = slope and B0 = intercept
Estimated Concentrations in Biota (method 2) = soil concentration X BAF
Hazard Quotient = Total Estimated Exposure (Dose) / TRV
Therefore, when the HQ = 1, soil concentration = PRG
where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Table A-16. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Badger

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway					
		Plants			Soil Inverts			Small Mammals																					
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Mammalian LOAEL TRV (mg/kg/d)	LOAEL HQ
Aluminum	7100.99			0.00287			0.043			0.0263	20.38	305.34	186.76	0.0347	1	0	0	0.052	6.48	0.00	0.00	12.82	19.30	33.59%	0.00%	0.00%	66.41%	**19.30**	**1.00**
Antimony	166.64	-3.233	0.938				1			0.001 * 50 * Cdiet	4.79	166.64	8.33	0.0347	1	0	0	0.052	0.29	0.00	0.00	0.30	0.59	49.02%	0.00%	0.00%	50.98%	**0.59**	**1.00**
Arsenic, Total all valence states	880.60	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		6.25	28.97	2.02	0.0347	1	0	0	0.052	0.07	0.00	0.00	1.59	1.66	4.23%	0.00%	0.00%	95.77%	**1.66**	**1.00**
Arsenic (III)	880.60	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		6.25	28.97	2.02	0.0347	1	0	0	0.052	0.07	0.00	0.00	1.59	1.66	4.23%	0.00%	0.00%	95.77%	**1.66**	**1.00**
Arsenic (V)	880.60	-1.992	0.564		-1.421	0.706		-4.8471	0.8188		6.25	28.97	2.02	0.0347	1	0	0	0.052	0.07	0.00	0.00	1.59	1.66	4.23%	0.00%	0.00%	95.77%	**1.66**	**1.00**
Barium	31404.83			0.156			0.091			0.0168	4899.15	2857.84	527.60	0.0347	1	0	0	0.052	18.31	0.00	0.00	56.69	75.00	24.42%	0.00%	0.00%	75.58%	**75.00**	**1.00**
Beryllium	1.00	-0.5361	0.7345				0.045			0.001 * 50 * Cdiet	0.59	0.05	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	4.15%	0.00%	0.00%	95.85%	**---**	**---**
Bismuth	1.00			0.005			1			1	0.01	1.00	1.00	0.0347	1	0	0	0.052	0.03	0.00	0.00	0.00	0.04	95.06%	0.00%	0.00%	4.94%	**---**	**---**
Boron	2563.21			5.714			1			1	14646.17	2563.21	2563.21	0.0347	1	0	0	0.052	88.97	0.00	0.00	4.63	93.60	95.06%	0.00%	0.00%	4.94%	**93.60**	**1.00**
Cadmium	5228.02	-0.476	0.546		2.114	0.795		-1.2571	0.4723		66.60	7484.74	16.23	0.0347	1	0	0	0.052	0.56	0.00	0.00	9.44	10.00	5.63%	0.00%	0.00%	94.37%	**10.00**	**1.00**
Chromium (total)	3535.56			0.041			0.306	-1.4599	0.7338		144.96	1081.88	93.29	0.0347	1	0	0	0.052	3.24	0.00	0.00	6.38	9.62	33.66%	0.00%	0.00%	66.34%	**9.62**	**1.00**
Chromium (+3)	3535.56			0.041			0.306	-1.4599	0.7338		144.96	1081.88	93.29	0.0347	1	0	0	0.052	3.24	0.00	0.00	6.38	9.62	33.66%	0.00%	0.00%	66.34%	**9.62**	**1.00**
Chromium (+6)	16583.35			0.041			0.306	-1.4599	0.7338		679.92	5074.51	289.98	0.0347	1	0	0	0.052	10.07	0.00	0.00	29.93	40.00	25.17%	0.00%	0.00%	74.83%	**40.00**	**1.00**
Cobalt	1868.88			0.00745			0.291	-4.4669	1.307		13.92	543.84	216.77	0.0347	1	0	0	0.052	7.52	0.00	0.00	3.37	10.90	69.05%	0.00%	0.00%	30.95%	**10.90**	**1.00**
Copper	4672.45	0.669	0.394				0.515	2.042	0.1444		54.49	2406.31	26.10	0.0347	1	0	0	0.052	0.91	0.00	0.00	8.43	9.34	9.70%	0.00%	0.00%	90.30%	**9.34**	**1.00**
Lead	4108.35	-1.328	0.561		-0.218	0.807		0.0761	0.4422		28.22	663.06	42.76	0.0347	1	0	0	0.052	1.48	0.00	0.00	7.42	8.90	16.68%	0.00%	0.00%	83.32%	**8.90**	**1.00**
Lithium	514.83			0.004			0.046			1	2.06	23.68	514.83	0.0347	1	0	0	0.052	17.87	0.00	0.00	0.93	18.80	95.06%	0.00%	0.00%	4.94%	**18.80**	**1.00**
Manganese	28212.66			0.0792	-0.809	0.682				0.0205	2234.44	482.90	578.36	0.0347	1	0	0	0.052	20.08	0.00	0.00	50.92	71.00	28.28%	0.00%	0.00%	71.72%	**71.00**	**1.00**
Mercury (methyl)	43.36	-0.996	0.544		0.0781	0.3369				0.054	2.87	3.85	2.35	0.0347	1	0	0	0.052	0.08	0.00	0.00	0.08	0.16	51.08%	0.00%	0.00%	48.92%	**0.16**	**1.00**
Mercury (inorganic)	100.27	-0.996	0.544		0.0781	0.3369				0.054	4.53	5.11	5.44	0.0347	1	0	0	0.052	0.19	0.00	0.00	0.18	0.37	51.08%	0.00%	0.00%	48.92%	**0.37**	**1.00**
Molybdenum	71.20			1.2504			0.953			1	89.03	67.85	71.20	0.0347	1	0	0	0.052	2.47	0.00	0.00	0.13	2.60	95.06%	0.00%	0.00%	4.94%	**2.60**	**1.00**
Nickel	1438.31	-2.224	0.748				1.059	-0.2462	0.4658		24.90	1523.18	23.12	0.0347	1	0	0	0.052	0.80	0.00	0.00	2.60	3.40	23.61%	0.00%	0.00%	76.39%	**3.40**	**1.00**
Selenium	59.89	-0.678	1.104		-0.075	0.733		-0.4158	0.3764		46.53	18.63	3.08	0.0347	1	0	0	0.052	0.11	0.00	0.00	0.11	0.21	49.72%	0.00%	0.00%	50.28%	**0.22**	**1.00**
Silver	30969.35			0.014			2.045			0.0040	433.57	63332.32	123.88	0.0347	1	0	0	0.052	4.30	0.00	0.00	55.90	60.20	7.14%	0.00%	0.00%	92.86%	**60.20**	**1.00**
Strontium	1.00			0.207			0.4066			1.74	0.21	0.41	1.74	0.0347	1	0	0	0.052	0.06	0.00	0.00	0.00	0.06	97.10%	0.00%	0.00%	2.90%	**---**	**---**
Thallium	13.14			0.004			0.0541			0.1124	0.05	0.71	1.48	0.0347	1	0	0	0.052	0.05	0.00	0.00	0.02	0.08	68.37%	0.00%	0.00%	31.63%	**0.08**	**1.00**
Tin	7638.67			1			0.08			0.08	7638.67	611.09	611.09	0.0347	1	0	0	0.052	21.21	0.00	0.00	13.79	35.00	60.61%	0.00%	0.00%	39.39%	**35.00**	**1.00**
Uranium	1545.29			0.021			0.033			0.0002	32.45	50.99	0.31	0.0347	1	0	0	0.052	0.01	0.00	0.00	2.79	2.80	0.38%	0.00%	0.00%	99.62%	**2.80**	**1.00**
Vanadium	3723.18			0.00485			0.042			0.0123	18.06	156.37	45.80	0.0347	1	0	0	0.052	1.59	0.00	0.00	6.72	8.31	19.13%	0.00%	0.00%	80.87%	**8.31**	**1.00**
Zinc	38865.84	1.575	0.555		4.449	0.328		4.3632	0.0706		1703.04	2738.76	165.55	0.0347	1	0	0	0.052	5.75	0.00	0.00	70.15	75.90	7.57%	0.00%	0.00%	92.43%	**75.90**	**1.00**
Ammonia/Ammonium	1.00													0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**
Chloride	1.00													0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**
Cyanide	1.00													0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**
Fluoride	29224.21			0.006							175.35			0.0347	1	0	0	0.052	0.00	0.00	0.00	52.75	52.75	0.00%	0.00%	0.00%	100.00%	**52.75**	**1.00**

Table A-16. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Badger

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway					
		Plants			Soil Inverts			Small Mammals																					
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Mammalian LOAEL TRV (mg/kg/d)	LOAEL HQ
Iodine	7589.98			0.05							379.50			0.0347	1	0	0	0.052	0.00	0.00	0.00	13.70	13.70	0.00%	0.00%	0.00%	100.00%	**13.70**	**1.00**
Nitrate/Nitrite	626035.16													0.0347	1	0	0	0.052	0.00	0.00	0.00	1130.00	1130.00	0.00%	0.00%	0.00%	100.00%	**1130.00**	**1.00**
Phosphate	1.00													0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**
Sulfate/Sulfite	1.00													0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**
Total Organic Carbon	1.00													0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**
1,1-dichloroethane	1.00						1.010			0.0109		1.01	0.01	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	17.35%	0.00%	0.00%	82.65%	**---**	**---**
1,1-dichloroethene	1.00						1.011			0.0186		1.01	0.02	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	26.37%	0.00%	0.00%	73.63%	**---**	**---**
1,1,1-trichloroethane	1.00						1.013			0.0305		1.01	0.03	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	36.99%	0.00%	0.00%	63.01%	**---**	**---**
1,1,2-trichloroethane	1.00						1.010			0.0165		1.01	0.02	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	24.09%	0.00%	0.00%	75.91%	**---**	**---**
1,1,2,2-tetrachloroethane	32553.53						1.013			0.0270		32974.62	879.83	0.0347	1	0	0	0.052	30.54	0.00	0.00	58.76	89.30	34.20%	0.00%	0.00%	65.80%	**89.30**	**1.00**
1,2-dichlorobenzene	1.00			2.45			1.018			0.0882	2.45	1.02	0.09	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	62.91%	0.00%	0.00%	37.09%	**---**	**---**
1,2-dichloroethane (DCA)	1.00						0.988			0.0063		0.99	0.01	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	10.80%	0.00%	0.00%	89.20%	**---**	**---**
1,3-dichlorobenzene	1.00			2.23			1.018			0.0963	2.23	1.02	0.10	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.01	64.93%	0.00%	0.00%	35.07%	**---**	**---**
2-butanone (Methyl Ethyl Ketone/MEK)	2505793.22						0.094			0.0006		234537.27	1383.31	0.0347	1	0	0	0.052	48.02	0.00	0.00	4522.98	4571.00	1.05%	0.00%	0.00%	98.95%	**4571.00**	**1.00**
2-hexanone	18135.29						0.207			0.0053		3759.43	96.96	0.0347	1	0	0	0.052	3.37	0.00	0.00	32.73	36.10	9.32%	0.00%	0.00%	90.68%	**36.10**	**1.00**
Benzene	2855.63						1.011			0.0186		2887.70	53.17	0.0347	1	0	0	0.052	1.85	0.00	0.00	5.15	7.00	26.37%	0.00%	0.00%	73.63%	**7.00**	**1.00**
Butanol	268194.47						0.478			0.0017		128255.21	458.24	0.0347	1	0	0	0.052	15.91	0.00	0.00	484.09	500.00	3.18%	0.00%	0.00%	96.82%	**500.00**	**1.00**
Carbon Tetrachloride	1.00						1.015			0.0420		1.01	0.04	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	44.68%	0.00%	0.00%	55.32%	**---**	**---**
Chlorobenzene	11035.82						1.015			0.0490		11197.35	541.03	0.0347	1	0	0	0.052	18.78	0.00	0.00	19.92	38.70	48.53%	0.00%	0.00%	51.47%	**38.70**	**1.00**
Chloroform	18040.51						1.011			0.0135		18230.31	243.05	0.0347	1	0	0	0.052	8.44	0.00	0.00	32.56	41.00	20.58%	0.00%	0.00%	79.42%	**41.00**	**1.00**
Cis-1,2-dichloroethylene	1.00						1.011			0.0122		1.01	0.01	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	19.05%	0.00%	0.00%	80.95%	**---**	**---**
Dichloromethane (Methylene Chloride)	25632.44						1.007			0.0042		25805.58	107.55	0.0347	1	0	0	0.052	3.73	0.00	0.00	46.27	50.00	7.47%	0.00%	0.00%	92.53%	**50.00**	**1.00**
Ethyl Benzene	99076.93			3.21			1.016			0.0666	318474.40	100682.57	6601.95	0.0347	1	0	0	0.052	229.17	0.00	0.00	178.83	408.00	56.17%	0.00%	0.00%	43.83%	**408.00**	**1.00**
Methyl Isobutyl Ketone	2362392.98						0.197			0.0037		465337.46	8840.12	0.0347	1	0	0	0.052	306.86	0.00	0.00	4264.14	4571.00	6.71%	0.00%	0.00%	93.29%	**4571.00**	**1.00**
n-butyl Benzene	54405.85			1.67			1.022			0.1227	90940.55	55622.91	6677.77	0.0347	1	0	0	0.052	231.80	0.00	0.00	98.20	330.00	70.24%	0.00%	0.00%	29.76%	**330.00**	**1.00**
Tetrachloroethylene	2215.89						1.018			0.0390		2254.69	86.43	0.0347	1	0	0	0.052	3.00	0.00	0.00	4.00	7.00	42.86%	0.00%	0.00%	57.14%	**7.00**	**1.00**
Toluene	157633.17						1.014			0.0430		159851.75	6783.60	0.0347	1	0	0	0.052	235.47	0.00	0.00	284.53	520.00	45.28%	0.00%	0.00%	54.72%	**520.00**	**1.00**
Trans-1,2-dichloroethylene	1.00						1.011			0.0170		1.01	0.02	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	24.65%	0.00%	0.00%	75.35%	**---**	**---**
Trichloroethylene (TCE)	2168.73						1.012			0.0410		2195.73	88.89	0.0347	1	0	0	0.052	3.09	0.00	0.00	3.91	7.00	44.08%	0.00%	0.00%	55.92%	**7.00**	**1.00**
Xylene	88509.43			3.43			1.016			0.0619	303732.00	89929.99	5480.55	0.0347	1	0	0	0.052	190.24	0.00	0.00	159.76	350.00	54.35%	0.00%	0.00%	45.65%	**350.00**	**1.00**
Acenaphthene	193904.70	-5.562	-0.8556				1.470			0	0.00	285039.90	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	350.00	350.00	0.00%	0.00%	0.00%	100.00%	**350.00**	**1.00**
Acenaphthylene	193904.70	-1.144	0.791				22.9			0	4848.97	4440417.53	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	350.00	350.00	0.00%	0.00%	0.00%	100.00%	**350.00**	**1.00**
Anthracene	1.00	-0.9887	0.7784				2.42			0	0.37	2.42	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**
Benzo(a)pyrene	5540.13	-2.0615	0.975				1.33			0	568.37	7368.38	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	10.00	10.00	0.00%	0.00%	0.00%	100.00%	**10.00**	**1.00**

Table A-16. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Badger

		Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway					
		Plants			Soil Inverts			Small Mammals																					
Analyte	Soil (mg/kg)	intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil	Selected Mammalian LOAEL TRV (mg/kg/d)	LOAEL HQ
Benzo(a)anthracene	5540.13	-2.7078	0.5944				1.59			0	11.20	8808.81	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	10.00	10.00	0.00%	0.00%	0.00%	100.00%	**10.00**	**1.00**
Benzo(b)fluoranthene	5540.13			0.31			2.6			0	1717.44	14404.35	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	10.00	10.00	0.00%	0.00%	0.00%	100.00%	**10.00**	**1.00**
Benzo(ghi)perylene	5540.13	-0.9313	1.1829				2.94			0	10562.13	16287.99	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	10.00	10.00	0.00%	0.00%	0.00%	100.00%	**10.00**	**1.00**
Benzo[k]fluoranthene	5540.13	-4.6482	0.1668				2.6			0	0.04	14404.35	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	10.00	10.00	0.00%	0.00%	0.00%	100.00%	**10.00**	**1.00**
Chrysene	5540.13	-2.7078	0.5944				2.29			0	11.20	12686.91	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	10.00	10.00	0.00%	0.00%	0.00%	100.00%	**10.00**	**1.00**
Dibenz(ah)anthracene	5540.13			0.13			2.31			0	720.22	12797.71	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	10.00	10.00	0.00%	0.00%	0.00%	100.00%	**10.00**	**1.00**
Fluoranthene	138503.35			0.5			3.04			0	69251.68	421050.20	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	250.00	250.00	0.00%	0.00%	0.00%	100.00%	**250.00**	**1.00**
Fluorene	138503.35	-5.562	-0.8556				9.57			0	0.00	1325477.10	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	250.00	250.00	0.00%	0.00%	0.00%	100.00%	**250.00**	**1.00**
Indeno[1,2,3-cd]pyrene	5540.13			0.11			2.86			0	609.41	15844.78	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	10.00	10.00	0.00%	0.00%	0.00%	100.00%	**10.00**	**1.00**
2-Methylnaphthalene	63046.73	-1.3205	4.544				1.020			0	1722585297935160000000.00	64297.87	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	113.80	113.80	0.00%	0.00%	0.00%	100.00%	**113.80**	**1.00**
Naphthalene	83102.01			12.2			4.4			0	1013844.55	365648.85	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	150.00	150.00	0.00%	0.00%	0.00%	100.00%	**150.00**	**1.00**
Phenanthrene	1.00	-0.1665	0.6203				1.72			0	0.85	1.72	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**
Pyrene	69251.68			0.72			1.75			0	49861.21	121190.43	0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	125.00	125.00	0.00%	0.00%	0.00%	100.00%	**125.00**	**1.00**
Total PAHs	1.00	0.083	0.3015							0	1.09		0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	**---**	**---**
Low MW PAHs	181716.40	-1.3205	0.4544							0	65.52		0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	328.00	328.00	0.00%	0.00%	0.00%	100.00%	**328.00**	**1.00**
High MW PAHs	1700.82	-1.7026	0.9469							0	208.78		0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	3.07	3.07	0.00%	0.00%	0.00%	100.00%	**3.07**	**1.00**
Gasoline Range Organics																												**1500.00**	**0.00**
TPH - Diesel	831020.12									0			0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	1500.00	1500.00	0.00%	0.00%	0.00%	100.00%	**1500.00**	**1.00**
TPH - Kerosene	831020.12									0			0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	1500.00	1500.00	0.00%	0.00%	0.00%	100.00%	**1500.00**	**1.00**
Normal paraffin hydrocarbons	831020.12									0			0.00	0.0347	1	0	0	0.052	0.00	0.00	0.00	1500.00	1500.00	0.00%	0.00%	0.00%	100.00%	**1500.00**	**1.00**
Phenol	17756.23						0.235			0.0064		4169.26	113.79	0.0347	1	0	0	0.052	3.95	0.00	0.00	32.05	36.00	10.97%	0.00%	0.00%	89.03%	**36.00**	**1.00**
2-methylphenol (ocresol)	1.00						0.336			0.0150		0.34	0.02	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	22.43%	0.00%	0.00%	77.57%	**---**	**---**
4-methylphenol (pcresol)	1.00						0.333			0.0141		0.33	0.01	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	21.36%	0.00%	0.00%	78.64%	**---**	**---**
2,4-dinitrotoluene	597.39	1.873	-0.3768	0.376			0.184			0.0155	224.62	109.74	9.27	0.0347	1	0	0	0.052	0.32	0.00	0.00	1.08	1.40	22.98%	0.00%	0.00%	77.02%	**1.40**	**1.00**
Bis[2-ethylhexyl] phthalate	35993.87			0.07			41.144			0.0945	2374.75	1480936.51	3400.31	0.0347	1	0	0	0.052	118.03	0.00	0.00	64.97	183.00	64.50%	0.00%	0.00%	35.50%	**183.00**	**1.00**
Total PCBs	84.71			0.17	1.41	1.36				0.1792	14.36	1715.43	15.18	0.0347	1	0	0	0.052	0.53	0.00	0.00	0.15	0.68	77.51%	0.00%	0.00%	22.49%	**0.68**	**1.00**
Aroclor 1016	376.56			0.30	1.41	1.36				0.2104	111.79	13046.51	79.23	0.0347	1	0	0	0.052	2.75	0.00	0.00	0.68	3.43	80.18%	0.00%	0.00%	19.82%	**3.43**	**1.00**
Aroclor 1221	81.52			0.78	1.41	1.36				0.1883	63.94	1628.06	15.35	0.0347	1	0	0	0.052	0.53	0.00	0.00	0.15	0.68	78.36%	0.00%	0.00%	21.64%	**0.68**	**1.00**
Aroclor 1232	88.10			0.99	1.41	1.36				0.1704	87.28	1809.38	15.01	0.0347	1	0	0	0.052	0.52	0.00	0.00	0.16	0.68	76.61%	0.00%	0.00%	23.39%	**0.68**	**1.00**
Aroclor 1242	87.35			0.16	1.41	1.36				0.1756	14.13	1788.47	15.34	0.0347	1	0	0	0.052	0.53	0.00	0.00	0.16	0.69	77.15%	0.00%	0.00%	22.85%	**0.69**	**1.00**
Aroclor 1248	10.55			0.18	1.41	1.36				0.1855	1.95	100.94	1.96	0.0347	1	0	0	0.052	0.07	0.00	0.00	0.02	0.09	78.11%	0.00%	0.00%	21.89%	**0.09**	**1.00**
Aroclor 1254	91.11			0.14	1.41	1.36				0.1630	12.69	1893.82	14.85	0.0347	1	0	0	0.052	0.52	0.00	0.00	0.16	0.68	75.82%	0.00%	0.00%	24.18%	**0.68**	**1.00**
Aroclor 1260	154.21			0.05	1.41	1.36				0.0750	8.06	3874.30	11.57	0.0347	1	0	0	0.052	0.40	0.00	0.00	0.28	0.68	59.07%	0.00%	0.00%	40.93%	**0.68**	**1.00**
Aroclor-1262	376.73													0.0347	1	0	0	0.052	0.00	0.00	0.00	0.68	0.68	0.00%	0.00%	0.00%	100.00%	**0.68**	**1.00**

Table A-16. Exposure Calculation Worksheet for Determining LOAEL-Based PRGs for Badger

Analyte	Soil (mg/kg)	Literature-derived Bioaccumulation Models									Estimated Concentrations in Biota (mg/kg DW)			Food Intake	Diet Composition (proportion)				Estimated Exposure (mg/kg/d)					Percent Estimated Exposure by Pathway				Selected Mammalian LOAEL TRV (mg/kg/d)	LOAEL HQ
		Plants			Soil Inverts			Small Mammals																					
		intercept	slope	BAF	intercept	slope	BAF	intercept	slope	BAF	Plants	Soil Inverts	Small Mam.	(kg/kg-bw/d, dw)	Small Mam.	Soil Inverts	Plants	Soil	Small Mam.	Soil Inverts	Plants	Soil	Total	Small Mam.	Soil Inverts	Plants	Soil		
Dichloroprop	1.00													0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.00	0.00%	0.00%	0.00%	100.00%	---	---
Aldrin	133.98			0.14			1.033			0.1630	18.66	138.38	21.84	0.0347	1	0	0	0.052	0.76	0.00	0.00	0.24	1.00	75.82%	0.00%	0.00%	24.18%	**1.00**	**1.00**
beta-1,2,3,4,5,6-Hexachlorocyclohexane	334.76			1.72			1.021			0.1201	575.46	341.82	40.21	0.0347	1	0	0	0.052	1.40	0.00	0.00	0.60	2.00	69.79%	0.00%	0.00%	30.21%	**2.00**	**1.00**
alpha-Chlordane	2641.24			0.16			1.031			0.1771	435.29	2724.38	467.64	0.0347	1	0	0	0.052	16.23	0.00	0.00	4.77	21.00	77.30%	0.00%	0.00%	22.70%	**21.00**	**1.00**
gamma-Chlordane	2641.24			0.16			1.036			0.1771	435.29	2735.21	467.64	0.0347	1	0	0	0.052	16.23	0.00	0.00	4.77	21.00	77.30%	0.00%	0.00%	22.70%	**21.00**	**1.00**
Dichlorodiphenyldichloroethylene	0.40	-2.5119	0.7524		2.4771	0.8804		3.6401	0.641		0.04	5.31	21.16	0.0347	1	0	0	0.052	0.73	0.00	0.00	0.00	0.74	99.90%	0.00%	0.00%	0.10%	**0.74**	**1.00**
Dichlorodiphenyltrichloroethane	12.68	-2.5119	0.7524		2.1247	0.8689		1.1788	0.7254		0.55	76.06	20.51	0.0347	1	0	0	0.052	0.71	0.00	0.00	0.02	0.73	96.89%	0.00%	0.00%	3.11%	**0.74**	**1.00**
Dieldrin	0.69			0.41			14.70			1.20	0.28	10.15	0.83	0.0347	1	0	0	0.052	0.03	0.00	0.00	0.00	0.03	95.85%	0.00%	0.00%	4.15%	**0.03**	**1.00**
Endosulfan I	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	0.0347	1	0	0	0.052	0.01	0.00	0.00	0.00	0.01	73.67%	0.00%	0.00%	26.33%	---	---
Endosulfan II	1.00			1.31			1.184			0.1455	1.31	1.18	0.15	0.0347	1	0	0	0.052	0.01	0.00	0.00	0.00	0.01	73.67%	0.00%	0.00%	26.33%	---	---
Endosulfan sulfate	1.00			1.98			1.184			0.1072	1.98	1.18	0.11	0.0347	1	0	0	0.052	0.00	0.00	0.00	0.00	0.01	67.33%	0.00%	0.00%	32.67%	---	---
Endrin aldehyde	140.40			1.44			6.686			0.1368	202.10	938.73	19.20	0.0347	1	0	0	0.052	0.67	0.00	0.00	0.25	0.92	72.45%	0.00%	0.00%	27.55%	**0.92**	**1.00**
Methoxychlor	882.02			0.52			3.739			0.2093	462.94	3297.95	184.60	0.0347	1	0	0	0.052	6.41	0.00	0.00	1.59	8.00	80.10%	0.00%	0.00%	19.90%	**8.00**	**1.00**

Notes:

It has been conservatively assumed that all chemical intake is absorbed by the receptor.

1 - When no TRV was available, the PRG is listed as 1 mg/kg based on formulas in the spreadsheet but no actual PRG is recommended.

Acronyms:

BAF = Bioaccumulation factor
DW = Dry weight
FIR = Food ingestion rate
mg/kg = Miligrams per kilogram
mg/kg BW/day, DW = Miligrams per kilogram of body weight per day, dry weight
mg/kg/d = Miligrams per kilogram per day
NOAEL = No observed adverse effect level
PRGs = Preliminary remediation goals
TRV = Toxicity reference value

Equations:

Total Estimated Exposure = Food Intake + Incidental Soil Intake
Food Intake = estimated concentration in biota X proportion of biota type X food ingestion rate (FIR)
Incidental Soil intake = concentration in soil X proportion of soil as component of diet X food ingestion rate (FIR)
Estimated Concentrations in Biota (method 1) = B1*(ln[Site Specific Soil Concentration]) + B0
where: B1 = slope and B0 = intercept
Estimated Concentrations in Biota (method 2) = soil concentration X BAF
Hazard Quotient = Total Estimated Exposure (Dose) / TRV
Therefore, when the HQ = 1, soil concentration = PRG
where: Soil concentration (mg/kg) = TRV / (Food Intake + Incidental Soil Intake) = Soil PRG

Appendix B

RESRAD-BIOTA

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TABLE B-1
Chemical-specific Parameter Values Used in the BCG calculations
Central Plateau Area at Hanford, Washington

Nuclide	Fraction of radionuclide assimilated into the body (f1) [1,2]	alpha(α) [1,2]	beta(β) [1,2]	Radiological decay constant (1/day) [3]
Am-241	0.001	0.8	0.81	4.39E-06
C-14	1	2	0.25	3.32E-07
Cm-244	0.0001	0.8	0.81	1.05E-04
Co-60	0.05	2.6	0.24	3.61E-04
Cs-134	1	3.5	0.24	9.21E-04
Cs-137	1	3.5	0.24	6.30E-05
Eu-152	0.001	1.4	0.8	1.42E-04
Eu-154	0.001	1.4	0.8	2.16E-04
Eu-155	0.001	1.4	0.8	3.83E-04
H-3	1	0.82	0.55	1.54E-04
Np-237	0.001	0.8	0.28	8.88E-10
Pu-238	0.001	0.8	0.81	2.17E-05
Pu-239	0.001	0.8	0.81	7.89E-08
Ra-226	0.2	2	0.25	1.19E-06
Ra-228	0.2	2	0.25	3.30E-04
Sb-125	0.01	0.5	0.25	6.86E-04
Sr-90	0.3	107	0.26	6.54E-05
Tc-99	0.8	0.3	0.4	8.92E-09
Th-232	0.0002	3.3	0.81	1.35E-13
U-234	0.05	0.8	0.28	7.77E-09
U-235	0.05	0.8	0.28	2.70E-12
U-238	0.05	0.8	0.28	4.25E-13

Notes:
[1] Parameter values were obtained from the database accompanied with RESRAD- Biota (version 1.5)
[2] Paramater values were for terrestrial animal.
[3] Parameter values were obtained from Risk Assessment Information System (RAIS).
References:

U.S. Department of Energy (DOE). 2009. *RESRAD-BIOTA Version 1.5.* Available at: http://web.ead.anl.gov/resrad/home2/.

Oak Ridge National Laboratory(ORNL). 2010. "RAIS: The Risk Assessment Information System." Available at http://rais.ornl.gov/.
Acronyms:
f1 = fraction of radionuclide assimilated into the body
alpha (α) = alpha parameter for calculating biological half life
beta (β) = beta parameter for calculating biological half life

TABLE B-2
Internal/External Dose Conversion Factors
Central Plateau Area at Hanford, Washington

	California Quail		Meadowlark		Killdeer		Red-tailed Hawk		Great Basin Pocket Mouse		Deer Mouse		Grasshopper Mouse		Badger	
Nuclide	DF_int	DF_ext	DF_int	DF_ext	DF_int	DF_ext	DF_int	DF_ext	DF_int	DF_ext	DF_int	DF_ext	DF_int	DF_ext	DF_int	DF_ext
Am-241	2.07E+00	4.32E-04	2.07E+00	4.32E-04	2.07E+00	4.32E-04	2.07E+00	3.60E-04	2.07	4.32E-04	2.07	4.32E-04	2.07	4.32E-04	2.07E+00	2.57E-04
C-14	9.21E-04	1.22E-06	9.21E-04	1.22E-06	9.21E-04	1.22E-06	9.22E-04	3.99E-07	9.21E-04	1.22E-06	9.21E-04	1.22E-06	9.21E-04	1.22E-06	9.22E-04	1.21E-07
Cm-244	2.20E+00	9.44E-06	2.20E+00	9.44E-06	2.20E+00	9.44E-06	2.20E+00	3.61E-06	2.2	9.44E-06	2.2	9.44E-06	2.2	9.44E-06	2.22E+00	1.44E-06
Co-60	3.20E-03	4.53E-02	3.20E-03	4.53E-02	3.20E-03	4.53E-02	6.27E-03	4.22E-02	3.20E-03	4.53E-02	3.20E-03	4.53E-02	3.20E-03	4.53E-02	1.22E-02	3.63E-02
Cs-134	3.96E-03	2.81E-02	3.96E-03	2.81E-02	3.96E-03	2.81E-02	6.10E-03	2.59E-02	3.96E-03	2.81E-02	3.96E-03	2.81E-02	3.96E-03	2.81E-02	1.03E-02	2.18E-02
Cs-137	4.80E-03	1.03E-02	4.80E-03	1.03E-02	4.80E-03	1.03E-02	5.68E-03	9.46E-03	4.80E-03	1.03E-02	4.80E-03	1.03E-02	4.80E-03	1.03E-02	7.23E-03	7.90E-03
Eu-152	2.94E-03	2.10E-02	2.94E-03	2.10E-02	2.94E-03	2.10E-02	4.52E-03	1.94E-02	2.94E-03	2.10E-02	2.94E-03	2.10E-02	2.94E-03	2.10E-02	7.53E-03	1.64E-02
Eu-154	5.66E-03	2.27E-02	5.66E-03	2.27E-02	5.66E-03	2.27E-02	7.39E-03	2.09E-02	2.94E-03	2.27E-02	2.94E-03	2.27E-02	2.94E-03	2.27E-02	1.06E-02	1.77E-02
Eu-155	1.23E-03	1.09E-03	1.23E-03	1.09E-03	1.23E-03	1.09E-03	1.34E-03	9.79E-04	1.23E-03	1.09E-03	1.23E-03	1.09E-03	1.23E-03	1.09E-03	1.57E-03	7.48E-04
H-3	1.06E-04	4.36E-09	1.06E-04	4.36E-09	1.06E-04	4.36E-09	1.06E-04	8.79E-11	1.06E-04	4.36E-09	1.06E-04	4.36E-09	1.06E-04	4.36E-09	1.06E-04	6.95E-10
Np-237	1.76E+00	4.40E-03	1.76E+00	4.40E-03	1.76E+00	4.40E-03	1.76E+00	3.95E-03	1.76E+00	4.40E-03	1.76E+00	4.40E-03	1.76E+00	4.40E-03	1.76E+00	3.18E-03
Pu-238	2.08E+00	9.78E-06	2.08E+00	9.78E-06	2.08E+00	9.78E-06	2.08E+00	3.71E-06	2.08E+00	9.78E-06	2.08E+00	9.78E-06	2.08E+00	9.78E-06	2.08E+00	1.50E-06
Pu-239	1.95E+00	4.32E-06	1.95E+00	4.32E-06	1.95E+00	4.32E-06	1.95E+00	1.73E-06	1.95E+00	4.32E-06	1.95E+00	4.32E-06	1.95E+00	4.32E-06	1.95E+00	7.47E-07
Ra-226	1.11E+01	3.27E-02	1.11E+01	3.27E-02	1.11E+01	3.27E-02	1.11E+01	2.96E-02	1.11E+01	3.27E-02	1.11E+01	3.27E-02	1.11E+01	3.27E-02	1.11E+01	2.50E-02
Ra-228	1.22E+01	1.57E-02	1.22E+01	1.57E-02	1.22E+01	1.57E-02	1.22E+01	1.43E-02	1.22E+01	1.57E-02	1.22E+01	1.57E-02	1.22E+01	1.57E-02	1.22E+01	1.21E-02
Sb-125	2.64E-03	7.96E-03	2.64E-03	7.96E-03	2.64E-03	7.96E-03	3.36E-03	7.24E-03	2.64E-03	7.96E-03	2.64E-03	7.96E-03	2.64E-03	7.96E-03	4.65E-03	5.95E-03
Sr-90	1.89E-02	2.19E-03	1.89E-02	2.19E-03	1.89E-02	2.19E-03	2.03E-02	7.17E-04	1.89E-02	2.19E-03	1.89E-02	2.19E-03	1.89E-02	2.19E-03	2.08E-02	2.64E-04
Tc-99	1.57E-03	5.50E-06	1.57E-03	5.50E-06	1.57E-03	5.50E-06	1.58E-03	1.68E-06	1.57E-03	5.50E-06	1.57E-03	5.50E-06	1.57E-03	5.50E-06	1.58E-03	5.96E-07
Th-232	1.37E+01	8.28E-06	1.37E+01	8.28E-06	1.37E+01	8.28E-06	1.37E+01	4.81E-06	1.37E+01	8.28E-06	1.37E+01	8.28E-06	1.37E+01	8.28E-06	1.37E+01	3.01E-06
U-234	1.81E+00	9.60E-06	1.81E+00	9.60E-06	1.81E+00	9.60E-06	1.81E+00	4.43E-06	1.81E+00	9.60E-06	1.81E+00	9.60E-06	1.81E+00	9.60E-06	1.81E+00	2.31E-06
U-235	1.65E+00	3.25E-03	1.65E+00	3.25E-03	1.65E+00	3.25E-03	1.65E+00	2.89E-03	1.65E+00	3.25E-03	1.65E+00	3.25E-03	1.65E+00	3.25E-03	1.65E+00	2.31E-03
U-238	1.60E+00	2.10E-03	1.60E+00	2.10E-03	1.60E+00	2.10E-03	1.61E+00	9.53E-04	1.60E+00	2.10E-03	1.60E+00	2.10E-03	1.60E+00	2.10E-03	1.61E+00	5.53E-04

Note:
Dose conversion factors were calculated based on the geometry of each species using the RESRAD-Biota (version 1.5).
Acronyms:
DF_int = internal dose conversion factor
DF_ext = external dose conversion factor

TABLE B-3
Calculation of Level 3 Biota Concentration Guide for California Quail
Central Plateau Area at Hanford, Washington

Species:	California Quail		
Parameter [6]	**Symbol**	**Value**	**Unit**
Body Weight	M_b	0.1800	(kg)
Food Intake	r_{food}	14.0400	(g-food/ individual)
Soil Ingestion	r_{soil}	0.8564	(g-soil/ individual)
Diet Composition [6]:			
Plants ($\%_{plant}$)		100%	
Terrestrial Invertebrates ($\%_{inv}$)		0%	
Mammals/Birds ($\%_{mamm}$)		0%	
Longevity	T_{life}	7.0	(years)
Dust loading in air	X_{dust}	1.00E-04	(g/m3)
Dose limit	DL	0.1	(rad/day)
Geometry Information Used to Calculate Conversion Factors:			
Assumed Geometry	3		
Geometry Dimensions	10 x 2 x 2	(cm3)	

Eqn. 1
$$k_{bio} = \frac{0.69315}{\alpha\,(M_b)^{\beta}}$$

Eqn. 2
$$k_{eff} = k_{bio} + k_{rad}$$

Eqn. 3
$$Intake_{ing} = r_{food} \times \sum (BAF \times \%_{composition}) = r_{food} \times \left[(BAF_{plant} \times \%_{plant}) + (BAF_{inv} \times \%_{inv}) + (BAF_{mammr} \times \%_{mamm}) \right]$$

Eqn. 4
$$Intake_{inh} = PT_IT \times X_{dust} \times 0.481 \times M_b^{0.76}$$

Eqn. 5 Lumped Parameter (LP)
$$\frac{f_1 \left(Intake_{ing} + Intake_{inh} \right) \times \left(1 - e^{-(k_{eff} \times 365.25 \times T_{life})} \right)}{k_{eff} \times M_b}$$

Eqn. 6 Biota Concentration Guide (BCG)
$$\frac{(365.25 \times DL)}{[(DF_int \times LP) + DF_ext]}$$

Radionuclides		Chemical Specific Parameters (Unitless)				Biological Accumulation Factor (BAF) (Unitless)			Dose Conversion Factor (rad/yr per pCi/g)		Calculation of biological half life and effective half life (1/day)			Calculation of Ingestion/Inhalation Intake (g-soil/ individual)						Calculation of Lumped Parameter (LP)			Biota Concentration Guide (pCi/g)
		f1	alpha (α)	beta (β)	PT_IT	Soil to Plants (BAF_{plant})	Soil to Terrestrial Invertebrates (BAF_{inv})	Soil to Small Mammal (BAF_{mamm})	DF_int	DF_ext	Radiological decay constant (k_{rad})	Biological decay constant (k_{bio})	Effective half life (k_{eff})	Plants	Terrestrial Invertebrates	Small Mammal	Soil	Ingestion intake [Total]	Inhalation intake	Numerator (kg-soil/day)	Denominator (kg-tissue/day)	LP (pCi/g-tissue per pCi/g-soil)	
	References:	[1]	[1]	[1]	[2]	[3]	[3]	[3]	[4]	[4]	[5]	[Eqn. 1]	[Eqn. 2]					[Eqn. 3]	[Eqn. 4]			[Eqn. 5]	[Eqn. 6]
Americium-241	Am-241	0.001	0.8	0.81	1	4.96E-03	1.01E-01	4.08E-02	2.07E+00	4.32E-04	4.39E-06	1.29E-02	1.29E-02	6.96E-02	0.00E+00	0.00E+00	8.56E-01	9.26E-04	1.31E-05	9.39E-07	2.32E-03	4.04E-04	2.88E+04
Carbon-14	C-14	1	2	0.25	1	8.90E+02	4.30E+02	1.34E+03	9.21E-04	1.22E-06	3.32E-07	9.46E-02	9.46E-02	1.25E+04	0.00E+00	0.00E+00	8.56E-01	1.25E+01	1.31E-05	1.25E+01	1.70E-02	7.34E+02	5.40E+01
Curium-244	Cm-244	0.0001	0.8	0.81	1	2.75E-04	1.37E-01	4.08E-02	2.20E+00	9.44E-06	1.05E-04	1.29E-02	1.30E-02	3.86E-03	0.00E+00	0.00E+00	8.56E-01	8.60E-04	1.31E-05	8.73E-08	2.34E-03	3.73E-05	3.99E+05
Cobalt-60	Co-60	0.05	2.6	0.24	1	1.35E-02	3.52E-03	2.95E-01	3.20E-03	4.53E-02	3.61E-04	7.67E-02	7.70E-02	1.90E-01	0.00E+00	0.00E+00	8.56E-01	1.05E-03	1.31E-05	5.30E-05	1.39E-02	3.82E-03	8.06E+02
Cesium-134	Cs-134	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	3.96E-03	2.81E-02	9.21E-04	5.69E-02	5.79E-02	9.74E+00	0.00E+00	0.00E+00	8.56E-01	1.06E-02	1.31E-05	1.06E-02	1.04E-02	1.02E+00	1.14E+03
Cesium-137	Cs-137	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	4.80E-03	1.03E-02	6.30E-05	5.69E-02	5.70E-02	9.74E+00	0.00E+00	0.00E+00	8.56E-01	1.06E-02	1.31E-05	1.06E-02	1.03E-02	1.03E+00	2.39E+03
Europium-152	Eu-152	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	2.94E-03	2.10E-02	1.42E-04	7.77E-03	7.91E-03	7.30E-02	0.00E+00	0.00E+00	8.56E-01	9.29E-04	1.31E-05	9.42E-07	1.42E-03	6.62E-04	1.74E+03
Europium-154	Eu-154	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	5.66E-03	2.27E-02	2.16E-04	7.77E-03	7.99E-03	7.30E-02	0.00E+00	0.00E+00	8.56E-01	9.29E-04	1.31E-05	9.42E-07	1.44E-03	6.56E-04	1.61E+03
Europium-155	Eu-155	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	1.23E-03	1.09E-03	3.83E-04	7.77E-03	8.15E-03	7.30E-02	0.00E+00	0.00E+00	8.56E-01	9.29E-04	1.31E-05	9.42E-07	1.47E-03	6.42E-04	3.35E+04
Hydrogen-3 (tritium)	H-3	1	0.82	0.55	1	1.50E+02	1.50E+02	1.50E+02	1.06E-04	4.36E-09	1.54E-04	4.86E-02	4.88E-02	2.11E+03	0.00E+00	0.00E+00	8.56E-01	2.11E+00	1.31E-05	2.11E+00	8.78E-03	2.40E+02	1.44E+03
Neptunium-237	Np-237	0.001	0.8	0.28	1	1.73E-02	1.01E-01	4.08E-02	1.76E+00	4.40E-03	8.88E-10	2.02E-01	2.02E-01	2.42E-01	0.00E+00	0.00E+00	8.56E-01	1.10E-03	1.31E-05	1.11E-06	3.64E-02	3.05E-05	8.20E+03
Plutonium-238	Pu-238	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	2.08E+00	9.78E-06	2.17E-05	1.29E-02	1.29E-02	2.03E-01	0.00E+00	0.00E+00	8.56E-01	1.06E-03	1.31E-05	1.07E-06	2.33E-03	4.61E-04	3.77E+04
Plutonium-239	Pu-239	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	1.95E+00	4.32E-06	7.89E-08	1.29E-02	1.29E-02	2.03E-01	0.00E+00	0.00E+00	8.56E-01	1.06E-03	1.31E-05	1.07E-06	2.32E-03	4.61E-04	4.04E+04
Radium-226	Ra-226	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.11E+01	3.27E-02	1.19E-06	9.46E-02	9.46E-02	5.54E-01	0.00E+00	0.00E+00	8.56E-01	1.41E-03	1.31E-05	2.85E-04	1.70E-02	1.67E-02	1.67E+02
Radium-228	Ra-228	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.22E+01	1.57E-02	3.30E-04	9.46E-02	9.49E-02	5.54E-01	0.00E+00	0.00E+00	8.56E-01	1.41E-03	1.31E-05	2.85E-04	1.71E-02	1.67E-02	1.67E+02
Antimony-125	Sb-125	0.01	0.5	0.25	1	2.50E-02	2.53E-01	2.15E-06	2.64E-03	7.96E-03	6.86E-04	3.78E-01	3.79E-01	3.51E-01	0.00E+00	0.00E+00	8.56E-01	1.21E-03	1.31E-05	1.22E-05	6.82E-02	1.79E-04	4.59E+03
Strontium-90	Sr-90	0.3	107	0.26	1	2.07E-01	4.07E-01	1.74E+00	1.89E-02	2.19E-03	6.54E-05	1.68E-03	1.74E-03	2.90E+00	0.00E+00	0.00E+00	8.56E-01	3.76E-03	1.31E-05	1.12E-03	3.14E-04	3.56E+00	5.25E+02
Technetium-99	Tc-99	0.8	0.3	0.4	1	2.00E+01	3.70E-01	3.70E-01	1.57E-03	5.50E-06	8.92E-09	2.89E-01	2.89E-01	2.81E+02	0.00E+00	0.00E+00	8.56E-01	2.82E-01	1.31E-05	2.25E-01	5.21E-02	4.33E+00	5.37E+03
Thorium-232	Th-232	0.0002	3.3	0.81	1	4.37E-02	8.84E-03	1.22E-04	1.37E+01	8.28E-06	1.35E-13	3.13E-03	3.13E-03	6.14E-01	0.00E+00	0.00E+00	8.56E-01	1.47E-03	1.31E-05	2.97E-07	5.63E-04	5.26E-04	5.06E+03
Uranium-234	U-234	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.81E+00	9.60E-06	7.77E-09	2.02E-01	2.02E-01	2.04E-01	0.00E+00	0.00E+00	8.56E-01	1.06E-03	1.31E-05	5.37E-05	3.64E-02	1.47E-03	1.36E+04
Uranium-235	U-235	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.65E+00	3.25E-03	2.70E-12	2.02E-01	2.02E-01	2.04E-01	0.00E+00	0.00E+00	8.56E-01	1.06E-03	1.31E-05	5.37E-05	3.64E-02	1.47E-03	6.43E+03
Uranium-238	U-238	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.60E+00	2.10E-03	4.25E-13	2.02E-01	2.02E-01	2.04E-01	0.00E+00	0.00E+00	8.56E-01	1.06E-03	1.31E-05	5.37E-05	3.64E-02	1.47E-03	8.19E+03

References:

[1] ANL, 2009, RESRAD-BIOTA for Windows, Version 1.5, Argonne National Laboratory, Argonne, Illinois. Available at: http://web.ead.anl.gov/resrad/home2/biota.cfm.

[2] PT_IT value of 1 was used.

[3] Beresford, N.A., C.L. Barnett, B.J. Howard, W.A. Scott, J.E. Brown, and D. Copplestone, 2008, "Derivation of Transfer Parameters for Use Within the ERICA Tool and the Default Concentration Ratios for Terrestrial Biota," *J. Environ. Radiol*., Vol. 99, No. 9, pp. 1393–1407.

[4] Dose conversion factors were calculated based on the geometry of each species using the RESRAD-Biota (version 1.5). Oak Ridge National Laboratory (ORNL). 2010. "RIAS: The Risk Assessment Information System." Available at http://rais.ornl.gov/.

[5] Oak Ridge National Laboratory(ORNL). 2010. "RAID: The Risk Assessment Information System." Available at http://rais.ornl.gov/.

[6] References for species-specific parameter values are presented in Table 2 of the main document to which this table is an attachment

Acronyms:

f1 = fraction of radionuclide assimilated into the body
alpha (α) = alpha parameter for calculating biological half life
beta (β) = beta parameter for calculating biological half life
PT_IT = correlation factor for adjusting inhalation relative to ingestion exposure
DF_int = internal dose conversion factor
DF_ext = external dose conversion factor

TABLE B-4
Calculation of Level 3 Biota Concentration Guide for Medowlark
Central Plateau Area at Hanford, Washington

Species:	Meadowlark		
Parameter [6]	**Symbol**	**Value**	**Unit**
Body Weight	M_b	0.0995	(kg)
Food Intake	r_{food}	11.9870	(g-food/ individual)
Soil Ingestion	r_{soil}	0.2493	(g-soil/ individual)
Diet Composition [6]:			
Plants ($\%_{plant}$)		37%	
Terrestrial Invertebrates ($\%_{inv}$)		63%	
Mammals/Birds ($\%_{mamm}$)		0%	
Longevity	T_{life}	6.0	(years)
Dust loading in air	X_{dust}	1.00E-04	(g/m3)
Dose limit	DL	0.1	(rad/day)
Geometry Information Used to Calculate Conversion Factors:			
Assumed Geometry	3		
Geometry Dimensions	10 x 2 x 2	(cm3)	

Eqn. 1
$$k_{bio} = \frac{0.69315}{\alpha (M_b)^{\beta}}$$

Eqn. 2
$$k_{eff} = k_{bio} + k_{rad}$$

Eqn. 3
$$Intake_{ing} = r_{food} \times \sum (BAF \times \%_{composition}) = r_{food} \times \left[(BAF_{plant} \times \%_{plant}) + (BAF_{inv} \times \%_{inv}) + (BAF_{mammal} \times \%_{mamm}) \right]$$

Eqn. 4
$$Intake_{inh} = PT_IT \times X_{dust} \times 0.481 \times M_b^{0.76}$$

Eqn. 5 Lumped Parameter (LP)
$$\frac{f_1 \left(Intake_{ing} + Intake_{inh} \right) \times \left(1 - e^{-(k_{eff} \times 365.25 \times T_{life})} \right)}{k_{eff} \times M_b}$$

Eqn. 6 Biota Concentration Guide (BCG)
$$\frac{(365.25 \times DL)}{[(DF_int \times LP) + DF_ext]}$$

Radionuclies		Chemical Specific Parameters (Unitless)				Biological Accumulation Factor (BAF) (Unitless)			Dose Conversion Factor (rad/yr per pCi/g)		Calculation of biological half life and effective half life (1/day)			Calculation of Ingestion/Inhalation Intake (g-soil/ individual)						Calculation of Lumped Parameter (LP)			Biota Concentration Guide (pCi/g)
		f1	alpha (α)	beta (β)	PT_IT	Soil to Plants (BAF_{plant})	Soil to Terrestrial Invertebrates (BAF_{inv})	Soil to Small Mammal (BAF_{mamm})	DF_int	DF_ext	Radiological decay constant (k_{rad})	Biological decay constant (k_{bio})	Effective half life (k_{eff})	Plants	Terrestrial Invertebrates	Small Mammal	Soil	Ingestion intake [Total]	Inhalation intake	Numerator (kg-soil/day)	Denominator (kg-tissue/day)	LP (pCi/g-tissue per pCi/g-soil)	
	References:	[1]	[1]	[1]	[2]	[3]	[3]	[3]	[4]	[4]	[5]	[Eqn. 1]	[Eqn. 2]					[Eqn. 3]	[Eqn. 4]			[Eqn. 5]	[Eqn. 6]
Americium-241	Am-241	0.001	0.8	0.81	1	4.96E-03	1.01E-01	4.08E-02	2.07E+00	4.32E-04	4.39E-06	2.09E-02	2.09E-02	2.20E-02	7.59E-01	0.00E+00	2.49E-01	1.03E-03	8.33E-06	1.04E-06	2.08E-03	5.00E-04	2.49E+04
Carbon-14	C-14	1	2	0.25	1	8.90E+02	4.30E+02	1.34E+03	9.21E-04	1.22E-06	3.32E-07	1.10E-01	1.10E-01	3.95E+03	3.25E+03	0.00E+00	2.49E-01	7.19E+00	8.33E-06	7.19E+00	1.09E-02	6.59E+02	6.02E+01
Curium-244	Cm-244	0.0001	0.8	0.81	1	2.75E-04	1.37E-01	4.08E-02	2.20E+00	9.44E-06	1.05E-04	2.09E-02	2.10E-02	1.22E-03	1.04E+00	0.00E+00	2.49E-01	1.29E-03	8.33E-06	1.30E-07	2.09E-03	6.21E-05	2.50E+05
Cobalt-60	Co-60	0.05	2.6	0.24	1	1.35E-02	3.52E-03	2.95E-01	3.20E-03	4.53E-02	3.61E-04	8.84E-02	8.87E-02	5.99E-02	2.66E-02	0.00E+00	2.49E-01	3.36E-04	8.33E-06	1.72E-05	8.83E-03	1.95E-03	8.06E+02
Cesium-134	Cs-134	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	3.96E-03	2.81E-02	9.21E-04	6.57E-02	6.66E-02	3.08E+00	1.01E+00	0.00E+00	2.49E-01	4.34E-03	8.33E-06	4.35E-03	6.62E-03	6.56E-01	1.19E+03
Cesium-137	Cs-137	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	4.80E-03	1.03E-02	6.30E-05	6.57E-02	6.57E-02	3.08E+00	1.01E+00	0.00E+00	2.49E-01	4.34E-03	8.33E-06	4.35E-03	6.54E-03	6.65E-01	2.71E+03
Europium-152	Eu-152	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	2.94E-03	2.10E-02	1.42E-04	1.25E-02	1.26E-02	2.31E-02	5.99E-03	0.00E+00	2.49E-01	2.78E-04	8.33E-06	2.87E-07	1.26E-03	2.28E-04	1.74E+03
Europium-154	Eu-154	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	5.66E-03	2.27E-02	2.16E-04	1.25E-02	1.27E-02	2.31E-02	5.99E-03	0.00E+00	2.49E-01	2.78E-04	8.33E-06	2.87E-07	1.26E-03	2.27E-04	1.61E+03
Europium-155	Eu-155	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	1.23E-03	1.09E-03	3.83E-04	1.25E-02	1.29E-02	2.31E-02	5.99E-03	0.00E+00	2.49E-01	2.78E-04	8.33E-06	2.87E-07	1.28E-03	2.24E-04	3.35E+04
Hydrogen-3 (tritium)	H-3	1	0.82	0.55	1	1.50E+02	1.50E+02	1.50E+02	1.06E-04	4.36E-09	1.54E-04	6.73E-02	6.75E-02	6.65E+02	1.13E+03	0.00E+00	2.49E-01	1.80E+00	8.33E-06	1.80E+00	6.71E-03	2.68E+02	1.29E+03
Neptunium-237	Np-237	0.001	0.8	0.28	1	1.73E-02	1.01E-01	4.08E-02	1.76E+00	4.40E-03	8.88E-10	2.39E-01	2.39E-01	7.65E-02	7.59E-01	0.00E+00	2.49E-01	1.09E-03	8.33E-06	1.09E-06	2.38E-02	4.60E-05	8.15E+03
Plutonium-238	Pu-238	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	2.08E+00	9.78E-06	2.17E-05	2.09E-02	2.09E-02	6.40E-02	2.93E-01	0.00E+00	2.49E-01	6.06E-04	8.33E-06	6.14E-07	2.08E-03	2.96E-04	5.85E+04
Plutonium-239	Pu-239	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	1.95E+00	4.32E-06	7.89E-08	2.09E-02	2.09E-02	6.40E-02	2.93E-01	0.00E+00	2.49E-01	6.06E-04	8.33E-06	6.14E-07	2.08E-03	2.96E-04	6.28E+04
Radium-226	Ra-226	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.11E+01	3.27E-02	1.19E-06	1.10E-01	1.10E-01	1.75E-01	6.80E-01	0.00E+00	2.49E-01	1.10E-03	8.33E-06	2.22E-04	1.09E-02	2.04E-02	1.41E+02
Radium-228	Ra-228	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.22E+01	1.57E-02	3.30E-04	1.10E-01	1.10E-01	1.75E-01	6.80E-01	0.00E+00	2.49E-01	1.10E-03	8.33E-06	2.22E-04	1.10E-02	2.03E-02	1.39E+02
Antimony-125	Sb-125	0.01	0.5	0.25	1	2.50E-02	2.53E-01	2.15E-06	2.64E-03	7.96E-03	6.86E-04	4.39E-01	4.40E-01	1.11E-01	1.91E+00	0.00E+00	2.49E-01	2.27E-03	8.33E-06	2.28E-05	4.37E-02	5.20E-04	4.59E+03
Strontium-90	Sr-90	0.3	107	0.26	1	2.07E-01	4.07E-01	1.74E+00	1.89E-02	2.19E-03	6.54E-05	1.96E-03	2.02E-03	9.17E-01	3.07E+00	0.00E+00	2.49E-01	4.24E-03	8.33E-06	1.26E-03	2.01E-04	6.25E+00	3.04E+02
Technetium-99	Tc-99	0.8	0.3	0.4	1	2.00E+01	3.70E-01	3.70E-01	1.57E-03	5.50E-06	8.92E-09	3.67E-01	3.67E-01	8.87E+01	2.79E+00	0.00E+00	2.49E-01	9.18E-02	8.33E-06	7.34E-02	3.65E-02	2.01E+00	1.15E+04
Thorium-232	Th-232	0.0002	3.3	0.81	1	4.37E-02	8.84E-03	1.22E-04	1.37E+01	8.28E-06	1.35E-13	5.06E-03	5.06E-03	1.94E-01	6.68E-02	0.00E+00	2.49E-01	5.10E-04	8.33E-06	1.04E-07	5.03E-04	2.06E-04	1.29E+04
Uranium-234	U-234	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.81E+00	9.60E-06	7.77E-09	2.39E-01	2.39E-01	6.45E-02	6.68E-02	0.00E+00	2.49E-01	3.81E-04	8.33E-06	1.94E-05	2.38E-02	8.18E-04	2.45E+04
Uranium-235	U-235	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.65E+00	3.25E-03	2.70E-12	2.39E-01	2.39E-01	6.45E-02	6.68E-02	0.00E+00	2.49E-01	3.81E-04	8.33E-06	1.94E-05	2.38E-02	8.18E-04	7.94E+03
Uranium-238	U-238	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.60E+00	2.10E-03	4.25E-13	2.39E-01	2.39E-01	6.45E-02	6.68E-02	0.00E+00	2.49E-01	3.81E-04	8.33E-06	1.94E-05	2.38E-02	8.18E-04	1.07E+04

References:
[1] ANL, 2009, RESRAD-BIOTA for Windows, Version 1.5, Argonne National Laboratory, Argonne, Illinois. Available at: http://web.ead.anl.gov/resrad/home2/biota.cfm.
[2] PT_IT value of 1 was used.
[3] Beresford, N.A., C.L. Barnett, B.J. Howard, W.A. Scott, J.E. Brown, and D. Copplestone, 2008, "Derivation of Transfer Parameters for Use Within the ERICA Tool and the Default
[4] Dose conversion factors were calculated based on the geometry of each species using the RESRAD-Biota (version 1.5). Oak Ridge National Laboratory (ORNL). 2010. "RAIS: The Risk
[5] Oak Ridge National Laboratory (ORNL). 2010. "RAIS: The Risk Assessment Information System." Available at http://rais.ornl.gov/.
[6] References for species-specific parameter values are presented in Table 2 of the main document to which this table is an attachment

Acronyms:
f1 = fraction of radionuclide assimilated into the body
alpha (α) = alpha parameter for calculating biological half life
beta (β) = beta parameter for calculating biological half life
PT_IT = correlation factor for adjusting inhalation relative to ingestion exposure
DF_int = internal dose conversion factor
DF_ext = external dose conversion factor

TABLE B-5
Calculation of Level 3 Biota Concentration Guide for Killdeer
Central Plateau Area at Hanford, Washington

Species:	Killdeer		
Parameter [6]	**Symbol**	**Value**	**Unit**
Body Weight	M_b	0.0756	(kg)
Food Intake	r_{food}	14.5296	(g-food/ individual)
Soil Ingestion	r_{soil}	1.0607	(g-soil/ individual)
Diet Composition [6]:			
Plants ($\%_{plant}$)		0%	
Terrestrial Invertebrates ($\%_{inv}$)		100%	
Mammals/Birds ($\%_{mamm}$)		0%	
Longevity	T_{life}	10.0	(years)
Dust loading in air	X_{dust}	1.00E-04	(g/m3)
Dose limit	DL	0.1	(rad/day)
Geometry Information Used to Calculate Conversion Factors:			
Assumed Geometry	3		
Geometry Dimensions	10 x 2 x 2	(cm3)	

Eqn. 1

$$k_{bio} = \frac{0.69315}{\alpha (M_b)^{\beta}}$$

Eqn. 2

$$k_{eff} = k_{bio} + k_{rad}$$

Eqn. 3

$$Intake_{ing} = r_{food} \times \sum (BAF \times \%_{composition}) = r_{food} \times \left[(BAF_{plant} \times \%_{plant}) + (BAF_{inv} \times \%_{inv}) + (BAF_{mammal} \times \%_{mamm}) \right]$$

Eqn. 4

$$Intake_{inh} = PT_IT \times X_{dust} \times 0.481 \times M_b^{0.76}$$

Eqn. 5 Lumped Parameter (LP)

$$\frac{f_1 \left(Intake_{ing} + Intake_{inh} \right) \times \left(1 - e^{-(k_{eff} \times 365.25 \times T_{life})} \right)}{k_{eff} \times M_b}$$

Eqn. 6 Biota Concentration Guide (BCG)

$$\frac{(365.25 \times DL)}{[(DF_int \times LP) + DF_ext]}$$

Radionuclides		Chemical Specific Parameters (Unitless)				Biological Accumulation Factor (BAF) (Unitless)			Dose Conversion Factor (rad/yr per pCi/g)		Calculation of biological half life and effective half life (1/day)			Calculation of Ingestion/Inhalation Intake (g-soil/ individual)						Calculation of Lumped Parameter (LP)			Biota Concentration Guide (pCi/g)
		f1	alpha (α)	beta (β)	PT_IT	Soil to Plants (BAF_{plant})	Soil to Terrestrial Invertebrates (BAF_{inv})	Soil to Small Mammal (BAF_{mamm})	DF_int	DF_ext	Radiological decay constant (k_{rad})	Biological decay constant (k_{bio})	Effective half life (k_{eff})	Plants	Terrestrial Invertebrates	Small Mammal	Soil	Ingestion intake [Total]	Inhalation intake	Numerator (kg-soil/day)	Denominator (kg-tissue/day)	LP (pCi/g-tissue per pCi/g-soil)	
	References:	[1]	[1]	[1]	[2]	[3]	[3]	[3]	[4]	[4]	[5]	[Eqn. 1]	[Eqn. 2]					[Eqn. 3]	[Eqn. 4]			[Eqn. 5]	[Eqn. 6]
Americium-241	Am-241	0.001	0.8	0.81	1	4.96E-03	1.01E-01	4.08E-02	2.07E+00	4.32E-04	4.39E-06	2.61E-02	2.61E-02	0.00E+00	1.46E+00	0.00E+00	1.06E+00	2.52E-03	6.76E-06	2.53E-06	1.97E-03	1.28E-03	1.18E+04
Carbon-14	C-14	1	2	0.25	1	8.90E+02	4.30E+02	1.34E+03	9.21E-04	1.22E-06	3.32E-07	1.18E-01	1.18E-01	0.00E+00	6.25E+03	0.00E+00	1.06E+00	6.25E+00	6.76E-06	6.25E+00	8.89E-03	7.03E+02	5.64E+01
Curium-244	Cm-244	0.0001	0.8	0.81	1	2.75E-04	1.37E-01	4.08E-02	2.20E+00	9.44E-06	1.05E-04	2.61E-02	2.62E-02	0.00E+00	2.00E+00	0.00E+00	1.06E+00	3.06E-03	6.76E-06	3.06E-07	1.98E-03	1.55E-04	1.04E+05
Cobalt-60	Co-60	0.05	2.6	0.24	1	1.35E-02	3.52E-03	2.95E-01	3.20E-03	4.53E-02	3.61E-04	9.44E-02	9.48E-02	0.00E+00	5.12E-02	0.00E+00	1.06E+00	1.11E-03	6.76E-06	5.59E-05	7.16E-03	7.81E-03	8.06E+02
Cesium-134	Cs-134	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	3.96E-03	2.81E-02	9.21E-04	7.01E-02	7.11E-02	0.00E+00	1.95E+00	0.00E+00	1.06E+00	3.01E-03	6.76E-06	3.02E-03	5.37E-03	5.61E-01	1.20E+03
Cesium-137	Cs-137	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	4.80E-03	1.03E-02	6.30E-05	7.01E-02	7.02E-02	0.00E+00	1.95E+00	0.00E+00	1.06E+00	3.01E-03	6.76E-06	3.02E-03	5.31E-03	5.68E-01	2.80E+03
Europium-152	Eu-152	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	2.94E-03	2.10E-02	1.42E-04	1.56E-02	1.57E-02	0.00E+00	1.15E-02	0.00E+00	1.06E+00	1.07E-03	6.76E-06	1.08E-06	1.19E-03	9.09E-04	1.74E+03
Europium-154	Eu-154	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	5.66E-03	2.27E-02	2.16E-04	1.56E-02	1.58E-02	0.00E+00	1.15E-02	0.00E+00	1.06E+00	1.07E-03	6.76E-06	1.08E-06	1.19E-03	9.05E-04	1.61E+03
Europium-155	Eu-155	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	1.23E-03	1.09E-03	3.83E-04	1.56E-02	1.59E-02	0.00E+00	1.15E-02	0.00E+00	1.06E+00	1.07E-03	6.76E-06	1.08E-06	1.20E-03	8.95E-04	3.35E+04
Hydrogen-3 (tritium)	H-3	1	0.82	0.55	1	1.50E+02	1.50E+02	1.50E+02	1.06E-04	4.36E-09	1.54E-04	7.83E-02	7.85E-02	0.00E+00	2.18E+03	0.00E+00	1.06E+00	2.18E+00	6.76E-06	2.18E+00	5.93E-03	3.68E+02	9.37E+02
Neptunium-237	Np-237	0.001	0.8	0.28	1	1.73E-02	1.01E-01	4.08E-02	1.76E+00	4.40E-03	8.88E-10	2.58E-01	2.58E-01	0.00E+00	1.46E+00	0.00E+00	1.06E+00	2.52E-03	6.76E-06	2.53E-06	1.95E-02	1.30E-04	7.89E+03
Plutonium-238	Pu-238	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	2.08E+00	9.78E-06	2.17E-05	2.61E-02	2.61E-02	0.00E+00	5.63E-01	0.00E+00	1.06E+00	1.62E-03	6.76E-06	1.63E-06	1.97E-03	8.27E-04	2.11E+04
Plutonium-239	Pu-239	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	1.95E+00	4.32E-06	7.89E-08	2.61E-02	2.61E-02	0.00E+00	5.63E-01	0.00E+00	1.06E+00	1.62E-03	6.76E-06	1.63E-06	1.97E-03	8.27E-04	2.26E+04
Radium-226	Ra-226	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.11E+01	3.27E-02	1.19E-06	1.18E-01	1.18E-01	0.00E+00	1.31E+00	0.00E+00	1.06E+00	2.37E-03	6.76E-06	4.75E-04	8.89E-03	5.35E-02	5.83E+01
Radium-228	Ra-228	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.22E+01	1.57E-02	3.30E-04	1.18E-01	1.18E-01	0.00E+00	1.31E+00	0.00E+00	1.06E+00	2.37E-03	6.76E-06	4.75E-04	8.91E-03	5.33E-02	5.48E+01
Antimony-125	Sb-125	0.01	0.5	0.25	1	2.50E-02	2.53E-01	2.15E-06	2.64E-03	7.96E-03	6.86E-04	4.70E-01	4.71E-01	0.00E+00	3.67E+00	0.00E+00	1.06E+00	4.73E-03	6.76E-06	4.74E-05	3.56E-02	1.33E-03	4.59E+03
Strontium-90	Sr-90	0.3	107	0.26	1	2.07E-01	4.07E-01	1.74E+00	1.89E-02	2.19E-03	6.54E-05	2.10E-03	2.17E-03	0.00E+00	5.91E+00	0.00E+00	1.06E+00	6.97E-03	6.76E-06	2.09E-03	1.64E-04	1.28E+01	1.50E+02
Technetium-99	Tc-99	0.8	0.3	0.4	1	2.00E+01	3.70E-01	3.70E-01	1.57E-03	5.50E-06	8.92E-09	4.10E-01	4.10E-01	0.00E+00	5.38E+00	0.00E+00	1.06E+00	6.44E-03	6.76E-06	5.15E-03	3.10E-02	1.66E-01	1.37E+05
Thorium-232	Th-232	0.0002	3.3	0.81	1	4.37E-02	8.84E-03	1.22E-04	1.37E+01	8.28E-06	1.35E-13	6.32E-03	6.32E-03	0.00E+00	1.28E-01	0.00E+00	1.06E+00	1.19E-03	6.76E-06	2.39E-07	4.78E-04	5.01E-04	5.32E+03
Uranium-234	U-234	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.81E+00	9.60E-06	7.77E-09	2.58E-01	2.58E-01	0.00E+00	1.28E-01	0.00E+00	1.06E+00	1.19E-03	6.76E-06	5.98E-05	1.95E-02	3.06E-03	6.57E+03
Uranium-235	U-235	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.65E+00	3.25E-03	2.70E-12	2.58E-01	2.58E-01	0.00E+00	1.28E-01	0.00E+00	1.06E+00	1.19E-03	6.76E-06	5.98E-05	1.95E-02	3.06E-03	4.40E+03
Uranium-238	U-238	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.60E+00	2.10E-03	4.25E-13	2.58E-01	2.58E-01	0.00E+00	1.28E-01	0.00E+00	1.06E+00	1.19E-03	6.76E-06	5.98E-05	1.95E-02	3.06E-03	5.22E+03

References:

[1] ANL, 2009, RESRAD-BIOTA for Windows, Version 1.5, Argonne National Laboratory, Argonne, Illinois. Available at: http://web.ead.anl.gov/resrad/home2/biota.cfm.

[2] PT_IT value of 1 was used.

[3] Beresford, N.A., C.L. Barnett, B.J. Howard, W.A. Scott, J.E. Brown, and D. Copplestone, 2008, "Derivation of Transfer Parameters for Use Within the ERICA Tool and the Default

[4] Dose conversion factors were calculated based on the geometry of each species using the RESRAD-Biota (version 1.5). Oak Ridge National Laboratory (ORNL). 2010. "RAIS: The Risk

[5] Oak Ridge National Laboratory (ORNL). 2010. "RAIS: The Risk Assessment Information System." Available at http://rais.ornl.gov/.

[6] References for species-specific parameter values are presented in Table 2 of the main document to which this table is an attachment

Acronyms:

f1 = fraction of radionuclide assimilated into the body

alpha (α) = alpha parameter for calculating biological half life

beta (β) = beta parameter for calculating biological half life

PT_IT = correlation factor for adjusting inhalation relative to ingestion exposure

DF_int = internal dose conversion factor

DF_ext = external dose conversion factor

TABLE B-6
Calculation of Level 3 Biota Concentration Guide for Red-tailed Hawk
Central Plateau Area at Hanford, Washington

Species:	Red-tailed Hawk		
Parameter [6]	**Symbol**	**Value**	**Unit**
Body Weight	M_b	1.1790	(kg)
Food Intake	r_{food}	41.6187	(g-food/ individual)
Soil Ingestion	r_{soil}	0.9988	(g-soil/ individual)
Diet Composition [6]:			
Plants ($\%_{plant}$)		0%	
Terrestrial Invertebrates ($\%_{inv}$)		0%	
Mammals/Birds ($\%_{mamm}$)		100%	
Longevity	T_{life}	7.0	(years)
Dust loading in air	X_{dust}	1.00E-04	(g/m3)
Dose limit	DL	0.1	(rad/day)
Geometry Information Used to Calculate Conversion Factors:			
Assumed Geometry	4		
Geometry Dimensions	45 x 8.7 x 4.9	(cm3)	

Eqn. 1

$$k_{bio} = \frac{0.69315}{\alpha (M_b)^{\beta}}$$

Eqn. 2

$$k_{eff} = k_{bio} + k_{rad}$$

Eqn. 3

$$Intake_{ing} = r_{food} \times \sum (BAF \times \%_{composition})$$
$$= r_{food} \times \left[(BAF_{plant} \times \%_{plant}) + (BAF_{inv} \times \%_{inv}) + (BAF_{mammx} \times \%_{mamm}) \right]$$

Eqn. 4

$$Intake_{inh} = PT_IT \times X_{dust} \times 0.481 \times M_b^{0.76}$$

Eqn. 5 Lumped Parameter (LP)

$$\frac{f_1 \left(Intake_{ing} + Intake_{inh} \right) \times \left(1 - e^{-(k_{eff} \times 365.25 \times T_{life})} \right)}{k_{eff} \times M_b}$$

Eqn. 6 Biota Concentration Guide (BCG)

$$\frac{(365.25 \times DL)}{[(DF_int \times LP) + DF_ext]}$$

Radionuclies		Chemical Specific Parameters (Unitless)				Biological Accumulation Factor (BAF) (Unitless)			Dose Conversion Factor (rad/yr per pCi/g)		Calculation of biological half life and effective half life (1/day)			Calculation of Ingestion/Inhalation Intake (g-soil/ individual)						Calculation of Lumped Parameter (LP)			Biota Concentration Guide (pCi/g)
		f1	alpha (α)	beta (β)	PT_IT	Soil to Plants (BAF_{plant})	Soil to Terrestrial Invertebrates (BAF_{inv})	Soil to Small Mammal (BAF_{mamm})	DF_int	DF_ext	Radiological decay constant (k_{rad})	Biological decay constant (k_{bio})	Effective half life (k_{eff})	Plants	Terrestrial Invertebrates	Small Mammal	Soil	Ingestion intake [Total]	Inhalation intake	Numerator (kg-soil/day)	Denominator (kg-tissue/day)	LP (pCi/g-tissue per pCi/g-soil)	
	References:	[1]	[1]	[1]	[2]	[3]	[3]	[3]	[4]	[4]	[5]	[Eqn. 1]	[Eqn. 2]					[Eqn. 3]	[Eqn. 4]			[Eqn. 5]	[Eqn. 6]
Americium-241	Am-241	0.001	0.8	0.81	1	4.96E-03	1.01E-01	4.08E-02	2.07E+00	3.60E-04	4.39E-06	2.82E-03	2.82E-03	0.00E+00	0.00E+00	1.70E+00	9.99E-01	2.70E-03	5.45E-05	2.75E-06	3.33E-03	8.26E-04	1.76E+04
Carbon-14	C-14	1	2	0.25	1	8.90E+02	4.30E+02	1.34E+03	9.22E-04	3.99E-07	3.32E-07	5.91E-02	5.91E-02	0.00E+00	0.00E+00	5.58E+04	9.99E-01	5.58E+01	5.45E-05	5.58E+01	6.97E-02	8.00E+02	4.95E+01
Curium-244	Cm-244	0.0001	0.8	0.81	1	2.75E-04	1.37E-01	4.08E-02	2.20E+00	3.61E-06	1.05E-04	2.82E-03	2.92E-03	0.00E+00	0.00E+00	1.70E+00	9.99E-01	2.70E-03	5.45E-05	2.75E-07	3.45E-03	7.98E-05	2.04E+05
Cobalt-60	Co-60	0.05	2.6	0.24	1	1.35E-02	3.52E-03	2.95E-01	6.27E-03	4.22E-02	3.61E-04	4.88E-02	4.92E-02	0.00E+00	0.00E+00	1.23E+01	9.99E-01	1.33E-02	5.45E-05	6.68E-04	5.80E-02	1.15E-02	8.64E+02
Cesium-134	Cs-134	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	6.10E-03	2.59E-02	9.21E-04	3.63E-02	3.72E-02	0.00E+00	0.00E+00	1.20E+02	9.99E-01	1.21E-01	5.45E-05	1.21E-01	4.39E-02	2.75E+00	8.56E+02
Cesium-137	Cs-137	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	5.68E-03	9.46E-03	6.30E-05	3.63E-02	3.63E-02	0.00E+00	0.00E+00	1.20E+02	9.99E-01	1.21E-01	5.45E-05	1.21E-01	4.28E-02	2.82E+00	1.43E+03
Europium-152	Eu-152	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	4.52E-03	1.94E-02	1.42E-04	1.73E-03	1.87E-03	0.00E+00	0.00E+00	8.51E-02	9.99E-01	1.08E-03	5.45E-05	1.13E-06	2.20E-03	5.12E-04	1.88E+03
Europium-154	Eu-154	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	7.39E-03	2.09E-02	2.16E-04	1.73E-03	1.94E-03	0.00E+00	0.00E+00	8.51E-02	9.99E-01	1.08E-03	5.45E-05	1.13E-06	2.29E-03	4.93E-04	1.75E+03
Europium-155	Eu-155	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	1.34E-03	9.79E-04	3.83E-04	1.73E-03	2.11E-03	0.00E+00	0.00E+00	8.51E-02	9.99E-01	1.08E-03	5.45E-05	1.13E-06	2.49E-03	4.55E-04	3.73E+04
Hydrogen-3 (tritium)	H-3	1	0.82	0.55	1	1.50E+02	1.50E+02	1.50E+02	1.06E-04	8.79E-11	1.54E-04	1.73E-02	1.74E-02	0.00E+00	0.00E+00	6.24E+03	9.99E-01	6.24E+00	5.45E-05	6.24E+00	2.06E-02	3.04E+02	1.13E+03
Neptunium-237	Np-237	0.001	0.8	0.28	1	1.73E-02	1.01E-01	4.08E-02	1.76E+00	3.95E-03	8.88E-10	1.20E-01	1.20E-01	0.00E+00	0.00E+00	1.70E+00	9.99E-01	2.70E-03	5.45E-05	2.75E-06	1.41E-01	1.95E-05	9.17E+03
Plutonium-238	Pu-238	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	2.08E+00	3.71E-06	2.17E-05	2.82E-03	2.84E-03	0.00E+00	0.00E+00	9.73E-01	9.99E-01	1.97E-03	5.45E-05	2.03E-06	3.35E-03	6.05E-04	2.89E+04
Plutonium-239	Pu-239	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	1.95E+00	1.73E-06	7.89E-08	2.82E-03	2.82E-03	0.00E+00	0.00E+00	9.73E-01	9.99E-01	1.97E-03	5.45E-05	2.03E-06	3.32E-03	6.10E-04	3.07E+04
Radium-226	Ra-226	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.11E+01	2.96E-02	1.19E-06	5.91E-02	5.91E-02	0.00E+00	0.00E+00	1.10E+00	9.99E-01	2.10E-03	5.45E-05	4.31E-04	6.97E-02	6.19E-03	3.72E+02
Radium-228	Ra-228	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.22E+01	1.43E-02	3.30E-04	5.91E-02	5.95E-02	0.00E+00	0.00E+00	1.10E+00	9.99E-01	2.10E-03	5.45E-05	4.31E-04	7.01E-02	6.15E-03	4.09E+02
Antimony-125	Sb-125	0.01	0.5	0.25	1	2.50E-02	2.53E-01	2.15E-06	3.36E-03	7.24E-03	6.86E-04	2.37E-01	2.37E-01	0.00E+00	0.00E+00	8.93E-05	9.99E-01	9.99E-04	5.45E-05	1.05E-05	2.80E-01	3.77E-05	5.04E+03
Strontium-90	Sr-90	0.3	107	0.26	1	2.07E-01	4.07E-01	1.74E+00	2.03E-02	7.17E-04	6.54E-05	1.03E-03	1.10E-03	0.00E+00	0.00E+00	7.24E+01	9.99E-01	7.34E-02	5.45E-05	2.07E-02	1.29E-03	1.60E+01	1.12E+02
Technetium-99	Tc-99	0.8	0.3	0.4	1	2.00E+01	3.70E-01	3.70E-01	1.58E-03	1.68E-06	8.92E-09	1.36E-01	1.36E-01	0.00E+00	0.00E+00	1.54E+01	9.99E-01	1.64E-02	5.45E-05	1.32E-02	1.61E-01	8.18E-02	2.79E+05
Thorium-232	Th-232	0.0002	3.3	0.81	1	4.37E-02	8.84E-03	1.22E-04	1.37E+01	4.81E-06	1.35E-13	6.83E-04	6.83E-04	0.00E+00	0.00E+00	5.07E-03	9.99E-01	1.00E-03	5.45E-05	1.75E-07	8.05E-04	2.17E-04	1.23E+04
Uranium-234	U-234	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.81E+00	4.43E-06	7.77E-09	1.20E-01	1.20E-01	0.00E+00	0.00E+00	4.42E-03	9.99E-01	1.00E-03	5.45E-05	5.29E-05	1.41E-01	3.75E-04	5.34E+04
Uranium-235	U-235	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.65E+00	2.89E-03	2.70E-12	1.20E-01	1.20E-01	0.00E+00	0.00E+00	4.42E-03	9.99E-01	1.00E-03	5.45E-05	5.29E-05	1.41E-01	3.75E-04	1.04E+04
Uranium-238	U-238	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.61E+00	9.53E-04	4.25E-13	1.20E-01	1.20E-01	0.00E+00	0.00E+00	4.42E-03	9.99E-01	1.00E-03	5.45E-05	5.29E-05	1.41E-01	3.75E-04	2.35E+04

References:

[1] ANL, 2009, RESRAD-BIOTA for Windows, Version 1.5, Argonne National Laboratory, Argonne, Illinois. Available at: http://web.ead.anl.gov/resrad/home2/biota.cfm.

[2] PT_IT value of 1 was used.

[3] Beresford, N.A., C.L. Barnett, B.J. Howard, W.A. Scott, J.E. Brown, and D. Copplestone, 2008, "Derivation of Transfer Parameters for Use Within the ERICA Tool and the Default

[4] Dose conversion factors were calculated based on the geometry of each species using the RESRAD-Biota (version 1.5). Oak Ridge National Laboratory (ORNL). 2010. "RAIS: The Risk

[5] Oak Ridge National Laboratory (ORNL). 2010. "RAIS: The Risk Assessment Information System." Available at http://rais.ornl.gov/.

[6] References for species-specific parameter values are presented in Table 2 of the main document to which this table is an attachment

Acronyms:

f1 = fraction of radionuclide assimilated into the body

alpha (α) = alpha parameter for calculating biological half life

beta (β) = beta parameter for calculating biological half life

PT_IT = correlation factor for adjusting inhalation relative to ingestion exposure

DF_int = internal dose conversion factor

DF_ext = external dose conversion factor

TABLE B-7
Calculation of Level 3 Biota Concentration Guide for Great Basin Pocket Mouse
Central Plateau Area at Hanford, Washington

Species:	Great Basin Pocket Mouse		
Parameter [6]	**Symbol**	**Value**	**Unit**
Body Weight	M_b	0.0175	(kg)
Food Intake	r_{food}	2.1491	(g-food/ individual)
Soil Ingestion	r_{soil}	0.0430	(g-soil/ individual)
Diet Composition [6]:			
Plants ($\%_{plant}$)		100%	
Terrestrial Invertebrates ($\%_{inv}$)		0%	
Mammals/Birds ($\%_{mamm}$)		0%	
Longevity	T_{life}	4.0	(years)
Dust loading in air	X_{dust}	1.00E-04	(g/m3)
Dose limit	DL	0.1	(rad/day)
Geometry Information Used to Calculate Conversion Factors:			
Assumed Geometry	3		
Geometry Dimensions	10 x 2 x 2	(cm3)	

Eqn. 1
$$k_{bio} = \frac{0.69315}{\alpha (M_b)^{\beta}}$$

Eqn. 2
$$k_{eff} = k_{bio} + k_{rad}$$

Eqn. 3
$$Intake_{ing} = r_{food} \times \sum (BAF \times \%_{composition}) = r_{food} \times \left[(BAF_{plant} \times \%_{plant}) + (BAF_{inv} \times \%_{inv}) + (BAF_{mammx} \times \%_{mamm}) \right]$$

Eqn. 4
$$Intake_{inh} = PT_IT \times X_{dust} \times 0.481 \times M_b^{0.76}$$

Eqn. 5 Lumped Parameter (LP)
$$\frac{f_1 \left(Intake_{ing} + Intake_{inh} \right) \times \left(1 - e^{-(k_{eff} \times 365.25 \times T_{life})} \right)}{k_{eff} \times M_b}$$

Eqn. 6 Biota Concentration Guide (BCG)
$$\frac{(365.25 \times DL)}{[(DF_int \times LP) + DF_ext]}$$

Radionuclies		Chemical Specific Parameters (Unitless)				Biological Accumulation Factor (BAF) (Unitless)			Dose Conversion Factor (rad/yr per pCi/g)		Calculation of biological half life and effective half life (1/day)			Calculation of Ingestion/Inhalation Intake (g-soil/ individual)						Calculation of Lumped Parameter (LP)			Biota Concentration Guide (pCi/g)
		f1	alpha (α)	beta (β)	PT_IT	Soil to Plants (BAF_{plant})	Soil to Terrestrial Invertebrates (BAF_{inv})	Soil to Small Mammal (BAF_{mamm})	DF_int	DF_ext	Radiological decay constant (k_{rad})	Biological decay constant (k_{bio})	Effective half life (k_{eff})	Plants	Terrestrial Invertebrates	Small Mammal	Soil	Ingestion intake [Total]	Inhalation intake	Numerator (kg-soil/day)	Denominator (kg-tissue/day)	LP (pCi/g-tissue per pCi/g-soil)	
	References:	[1]	[1]	[1]	[2]	[3]	[3]	[3]	[4]	[4]	[5]	[Eqn. 1]	[Eqn. 2]					[Eqn. 3]	[Eqn. 4]			[Eqn. 5]	[Eqn. 6]
Americium-241	Am-241	0.001	0.8	0.81	1	4.96E-03	1.01E-01	4.08E-02	2.07E+00	4.32E-04	4.39E-06	8.53E-02	8.53E-02	1.07E-02	0.00E+00	0.00E+00	4.30E-02	5.36E-05	2.22E-06	5.59E-08	1.49E-03	3.74E-05	7.17E+04
Carbon-14	C-14	1	2	0.25	1	8.90E+02	4.30E+02	1.34E+03	9.21E-04	1.22E-06	3.32E-07	1.69E-01	1.69E-01	1.91E+03	0.00E+00	0.00E+00	4.30E-02	1.91E+00	2.22E-06	1.91E+00	2.97E-03	6.45E+02	6.15E+01
Curium-244	Cm-244	0.0001	0.8	0.81	1	2.75E-04	1.37E-01	4.08E-02	2.20E+00	9.44E-06	1.05E-04	8.53E-02	8.54E-02	5.91E-04	0.00E+00	0.00E+00	4.30E-02	4.36E-05	2.22E-06	4.58E-09	1.49E-03	3.06E-06	2.26E+06
Cobalt-60	Co-60	0.05	2.6	0.24	1	1.35E-02	3.52E-03	2.95E-01	3.20E-03	4.53E-02	3.61E-04	1.34E-01	1.34E-01	2.90E-02	0.00E+00	0.00E+00	4.30E-02	7.20E-05	2.22E-06	3.71E-06	2.35E-03	1.58E-03	8.06E+02
Cesium-134	Cs-134	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	3.96E-03	2.81E-02	9.21E-04	9.96E-02	1.01E-01	1.49E+00	0.00E+00	0.00E+00	4.30E-02	1.53E-03	2.22E-06	1.54E-03	1.76E-03	8.73E-01	1.16E+03
Cesium-137	Cs-137	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	4.80E-03	1.03E-02	6.30E-05	9.96E-02	9.97E-02	1.49E+00	0.00E+00	0.00E+00	4.30E-02	1.53E-03	2.22E-06	1.54E-03	1.74E-03	8.80E-01	2.51E+03
Europium-152	Eu-152	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	2.94E-03	2.10E-02	1.42E-04	5.01E-02	5.03E-02	1.12E-02	0.00E+00	0.00E+00	4.30E-02	5.42E-05	2.22E-06	5.64E-08	8.80E-04	6.41E-05	1.74E+03
Europium-154	Eu-154	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	2.94E-03	2.27E-02	2.16E-04	5.01E-02	5.04E-02	1.12E-02	0.00E+00	0.00E+00	4.30E-02	5.42E-05	2.22E-06	5.64E-08	8.81E-04	6.40E-05	1.61E+03
Europium-155	Eu-155	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	1.23E-03	1.09E-03	3.83E-04	5.01E-02	5.05E-02	1.12E-02	0.00E+00	0.00E+00	4.30E-02	5.42E-05	2.22E-06	5.64E-08	8.84E-04	6.38E-05	3.35E+04
Hydrogen-3 (tritium)	H-3	1	0.82	0.55	1	1.50E+02	1.50E+02	1.50E+02	1.06E-04	4.36E-09	1.54E-04	1.75E-01	1.75E-01	3.22E+02	0.00E+00	0.00E+00	4.30E-02	3.22E-01	2.22E-06	3.22E-01	3.07E-03	1.05E+02	3.28E+03
Neptunium-237	Np-237	0.001	0.8	0.28	1	1.73E-02	1.01E-01	4.08E-02	1.76E+00	4.40E-03	8.88E-10	3.89E-01	3.89E-01	3.71E-02	0.00E+00	0.00E+00	4.30E-02	8.01E-05	2.22E-06	8.23E-08	6.80E-03	1.21E-05	8.26E+03
Plutonium-238	Pu-238	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	2.08E+00	9.78E-06	2.17E-05	8.53E-02	8.53E-02	3.10E-02	0.00E+00	0.00E+00	4.30E-02	7.40E-05	2.22E-06	7.62E-08	1.49E-03	5.10E-05	3.15E+05
Plutonium-239	Pu-239	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	1.95E+00	4.32E-06	7.89E-08	8.53E-02	8.53E-02	3.10E-02	0.00E+00	0.00E+00	4.30E-02	7.40E-05	2.22E-06	7.62E-08	1.49E-03	5.11E-05	3.52E+05
Radium-226	Ra-226	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.11E+01	3.27E-02	1.19E-06	1.69E-01	1.69E-01	8.48E-02	0.00E+00	0.00E+00	4.30E-02	1.28E-04	2.22E-06	2.60E-05	2.97E-03	8.77E-03	2.81E+02
Radium-228	Ra-228	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.22E+01	1.57E-02	3.30E-04	1.69E-01	1.70E-01	8.48E-02	0.00E+00	0.00E+00	4.30E-02	1.28E-04	2.22E-06	2.60E-05	2.97E-03	8.75E-03	2.98E+02
Antimony-125	Sb-125	0.01	0.5	0.25	1	2.50E-02	2.53E-01	2.15E-06	2.64E-03	7.96E-03	6.86E-04	6.78E-01	6.78E-01	5.37E-02	0.00E+00	0.00E+00	4.30E-02	9.67E-05	2.22E-06	9.89E-07	1.19E-02	8.33E-05	4.59E+03
Strontium-90	Sr-90	0.3	107	0.26	1	2.07E-01	4.07E-01	1.74E+00	1.89E-02	2.19E-03	6.54E-05	3.08E-03	3.14E-03	4.44E-01	0.00E+00	0.00E+00	4.30E-02	4.87E-04	2.22E-06	1.45E-04	5.50E-05	2.64E+00	7.00E+02
Technetium-99	Tc-99	0.8	0.3	0.4	1	2.00E+01	3.70E-01	3.70E-01	1.57E-03	5.50E-06	8.92E-09	7.35E-01	7.35E-01	4.30E+01	0.00E+00	0.00E+00	4.30E-02	4.30E-02	2.22E-06	3.44E-02	1.29E-02	2.68E+00	8.68E+03
Thorium-232	Th-232	0.0002	3.3	0.81	1	4.37E-02	8.84E-03	1.22E-04	1.37E+01	8.28E-06	1.35E-13	2.07E-02	2.07E-02	9.40E-02	0.00E+00	0.00E+00	4.30E-02	1.37E-04	2.22E-06	2.78E-08	3.62E-04	7.70E-05	3.44E+04
Uranium-234	U-234	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.81E+00	9.60E-06	7.77E-09	3.89E-01	3.89E-01	3.13E-02	0.00E+00	0.00E+00	4.30E-02	7.43E-05	2.22E-06	3.82E-06	6.80E-03	5.62E-04	3.56E+04
Uranium-235	U-235	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.65E+00	3.25E-03	2.70E-12	3.89E-01	3.89E-01	3.13E-02	0.00E+00	0.00E+00	4.30E-02	7.43E-05	2.22E-06	3.82E-06	6.80E-03	5.62E-04	8.74E+03
Uranium-238	U-238	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.60E+00	2.10E-03	4.25E-13	3.89E-01	3.89E-01	3.13E-02	0.00E+00	0.00E+00	4.30E-02	7.43E-05	2.22E-06	3.82E-06	6.80E-03	5.62E-04	1.22E+04

References:
[1] ANL, 2009, RESRAD-BIOTA for Windows, Version 1.5, Argonne National Laboratory, Argonne, Illinois. Available at: http://web.ead.anl.gov/resrad/home2/biota.cfm.
[2] PT_IT value of 1 was used.
[3] Beresford, N.A., C.L. Barnett, B.J. Howard, W.A. Scott, J.E. Brown, and D. Copplestone, 2008, "Derivation of Transfer Parameters for Use Within the ERICA Tool and the Default
[4] Dose conversion factors were calculated based on the geometry of each species using the RESRAD-Biota (version 1.5). Oak Ridge National Laboratory (ORNL). 2010. "RAIS: The Risk
[5] Oak Ridge National Laboratory (ORNL). 2010. "RAIS: The Risk Assessment Information System." Available at http://rais.ornl.gov/.
[6] References for species-specific parameter values are presented in Table 2 of the main document to which this table is an attachment

Acronyms:
f1 = fraction of radionuclide assimilated into the body
alpha (α) = alpha parameter for calculating biological half life
beta (β) = beta parameter for calculating biological half life
PT_IT = correlation factor for adjusting inhalation relative to ingestion exposure
DF_int = internal dose conversion factor
DF_ext = external dose conversion factor

TABLE B-8
Calculation of Level 3 Biota Concentration Guide for Deer Mouse
Central Plateau Area at Hanford, Washington

Species:	Deer Mouse		
Parameter [6]	**Symbol**	**Value**	**Unit**
Body Weight	M_b	0.0194	(kg)
Food Intake	r_{food}	3.2204	(g-food/ individual)
Soil Ingestion	r_{soil}	0.0644	(g-soil/ individual)
Diet Composition [6]:			
Plants ($\%_{plant}$)		50%	
Terrestrial Invertebrates ($\%_{inv}$)		50%	
Mammals/Birds ($\%_{mamm}$)		0%	
Longevity	T_{life}	1.0	(years)
Dust loading in air	X_{dust}	1.00E-04	(g/m3)
Dose limit	DL	0.1	(rad/day)
Geometry Information Used to Calculate Conversion Factors:			
Assumed Geometry	3		
Geometry Dimensions	10 x 2 x 2	(cm3)	

Eqn. 1
$$k_{bio} = \frac{0.69315}{\alpha (M_b)^{\beta}}$$

Eqn. 2
$$k_{eff} = k_{bio} + k_{rad}$$

Eqn. 3
$$Intake_{ing} = r_{food} \times \sum (BAF \times \%_{composition}) = r_{food} \times \left[(BAF_{plant} \times \%_{plant}) + (BAF_{inv} \times \%_{inv}) + (BAF_{mammx} \times \%_{mamm}) \right]$$

Eqn. 4
$$Intake_{inh} = PT_IT \times X_{dust} \times 0.481 \times M_b^{0.76}$$

Eqn. 5 Lumped Parameter (LP)
$$\frac{f_1 \left(Intake_{ing} + Intake_{inh} \right) \times \left(1 - e^{-(k_{eff} \times 365.25 \times T_{life})} \right)}{k_{eff} \times M_b}$$

Eqn. 6 Biota Concentration Guide (BCG)
$$\frac{(365.25 \times DL)}{[(DF_int \times LP) + DF_ext]}$$

Radionuclies		Chemical Specific Parameters (Unitless)				Biological Accumulation Factor (BAF) (Unitless)			Dose Conversion Factor (rad/yr per pCi/g)		Calculation of biological half life and effective half life (1/day)			Calculation of Ingestion/Inhalation Intake (g-soil/ individual)						Calculation of Lumped Parameter (LP)			Biota Concentration Guide (pCi/g)
		f1	alpha (α)	beta (β)	PT_IT	Soil to Plants (BAF_{plant})	Soil to Terrestrial Invertebrates (BAF_{inv})	Soil to Small Mammal (BAF_{mamm})	DF_int	DF_ext	Radiological decay constant (k_{rad})	Biological decay constant (k_{bio})	Effective half life (k_{eff})	Plants	Terrestrial Invertebrates	Small Mammal	Soil	Ingestion intake [Total]	Inhalation intake	Numerator (kg-soil/day)	Denominator (kg-tissue/day)	LP (pCi/g-tissue per pCi/g-soil)	
	References:	[1]	[1]	[1]	[2]	[3]	[3]	[3]	[4]	[4]	[5]	[Eqn. 1]	[Eqn. 2]					[Eqn. 3]	[Eqn. 4]			[Eqn. 5]	[Eqn. 6]
Americium-241	Am-241	0.001	0.8	0.81	1	4.96E-03	1.01E-01	4.08E-02	2.07E+00	4.32E-04	4.39E-06	7.85E-02	7.85E-02	7.98E-03	1.62E-01	0.00E+00	6.44E-02	2.34E-04	2.40E-06	2.37E-07	1.52E-03	1.56E-04	4.84E+04
Carbon-14	C-14	1	2	0.25	1	8.90E+02	4.30E+02	1.34E+03	9.21E-04	1.22E-06	3.32E-07	1.65E-01	1.65E-01	1.43E+03	6.92E+02	0.00E+00	6.44E-02	2.13E+00	2.40E-06	2.13E+00	3.20E-03	6.63E+02	5.98E+01
Curium-244	Cm-244	0.0001	0.8	0.81	1	2.75E-04	1.37E-01	4.08E-02	2.20E+00	9.44E-06	1.05E-04	7.85E-02	7.86E-02	4.43E-04	2.21E-01	0.00E+00	6.44E-02	2.86E-04	2.40E-06	2.89E-08	1.52E-03	1.89E-05	7.15E+05
Cobalt-60	Co-60	0.05	2.6	0.24	1	1.35E-02	3.52E-03	2.95E-01	3.20E-03	4.53E-02	3.61E-04	1.31E-01	1.31E-01	2.17E-02	5.67E-03	0.00E+00	6.44E-02	9.18E-05	2.40E-06	4.71E-06	2.55E-03	1.85E-03	8.06E+02
Cesium-134	Cs-134	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	3.96E-03	2.81E-02	9.21E-04	9.72E-02	9.81E-02	1.12E+00	2.16E-01	0.00E+00	6.44E-02	1.40E-03	2.40E-06	1.40E-03	1.90E-03	7.35E-01	1.18E+03
Cesium-137	Cs-137	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	4.80E-03	1.03E-02	6.30E-05	9.72E-02	9.73E-02	1.12E+00	2.16E-01	0.00E+00	6.44E-02	1.40E-03	2.40E-06	1.40E-03	1.89E-03	7.42E-01	2.64E+03
Europium-152	Eu-152	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	2.94E-03	2.10E-02	1.42E-04	4.62E-02	4.63E-02	8.37E-03	1.28E-03	0.00E+00	6.44E-02	7.41E-05	2.40E-06	7.65E-08	8.99E-04	8.51E-05	1.74E+03
Europium-154	Eu-154	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	2.94E-03	2.27E-02	2.16E-04	4.62E-02	4.64E-02	8.37E-03	1.28E-03	0.00E+00	6.44E-02	7.41E-05	2.40E-06	7.65E-08	9.00E-04	8.49E-05	1.61E+03
Europium-155	Eu-155	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	1.23E-03	1.09E-03	3.83E-04	4.62E-02	4.66E-02	8.37E-03	1.28E-03	0.00E+00	6.44E-02	7.41E-05	2.40E-06	7.65E-08	9.03E-04	8.46E-05	3.35E+04
Hydrogen-3 (tritium)	H-3	1	0.82	0.55	1	1.50E+02	1.50E+02	1.50E+02	1.06E-04	4.36E-09	1.54E-04	1.65E-01	1.66E-01	2.42E+02	2.42E+02	0.00E+00	6.44E-02	4.83E-01	2.40E-06	4.83E-01	3.21E-03	1.50E+02	2.29E+03
Neptunium-237	Np-237	0.001	0.8	0.28	1	1.73E-02	1.01E-01	4.08E-02	1.76E+00	4.40E-03	8.88E-10	3.78E-01	3.78E-01	2.78E-02	1.62E-01	0.00E+00	6.44E-02	2.54E-04	2.40E-06	2.56E-07	7.33E-03	3.50E-05	8.19E+03
Plutonium-238	Pu-238	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	2.08E+00	9.78E-06	2.17E-05	7.85E-02	7.85E-02	2.32E-02	6.24E-02	0.00E+00	6.44E-02	1.50E-04	2.40E-06	1.52E-07	1.52E-03	1.00E-04	1.67E+05
Plutonium-239	Pu-239	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	1.95E+00	4.32E-06	7.89E-08	7.85E-02	7.85E-02	2.32E-02	6.24E-02	0.00E+00	6.44E-02	1.50E-04	2.40E-06	1.52E-07	1.52E-03	1.00E-04	1.83E+05
Radium-226	Ra-226	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.11E+01	3.27E-02	1.19E-06	1.65E-01	1.65E-01	6.35E-02	1.45E-01	0.00E+00	6.44E-02	2.73E-04	2.40E-06	5.50E-05	3.20E-03	1.72E-02	1.63E+02
Radium-228	Ra-228	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.22E+01	1.57E-02	3.30E-04	1.65E-01	1.65E-01	6.35E-02	1.45E-01	0.00E+00	6.44E-02	2.73E-04	2.40E-06	5.50E-05	3.21E-03	1.71E-02	1.62E+02
Antimony-125	Sb-125	0.01	0.5	0.25	1	2.50E-02	2.53E-01	2.15E-06	2.64E-03	7.96E-03	6.86E-04	6.61E-01	6.61E-01	4.03E-02	4.07E-01	0.00E+00	6.44E-02	5.11E-04	2.40E-06	5.14E-06	1.28E-02	4.00E-04	4.59E+03
Strontium-90	Sr-90	0.3	107	0.26	1	2.07E-01	4.07E-01	1.74E+00	1.89E-02	2.19E-03	6.54E-05	3.00E-03	3.06E-03	3.33E-01	6.55E-01	0.00E+00	6.44E-02	1.05E-03	2.40E-06	2.13E-04	5.94E-05	3.59E+00	5.22E+02
Technetium-99	Tc-99	0.8	0.3	0.4	1	2.00E+01	3.70E-01	3.70E-01	1.57E-03	5.50E-06	8.92E-09	7.06E-01	7.06E-01	3.22E+01	5.96E-01	0.00E+00	6.44E-02	3.29E-02	2.40E-06	2.63E-02	1.37E-02	1.92E+00	1.21E+04
Thorium-232	Th-232	0.0002	3.3	0.81	1	4.37E-02	8.84E-03	1.22E-04	1.37E+01	8.28E-06	1.35E-13	1.90E-02	1.90E-02	7.04E-02	1.42E-02	0.00E+00	6.44E-02	1.49E-04	2.40E-06	3.03E-08	3.69E-04	8.20E-05	3.23E+04
Uranium-234	U-234	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.81E+00	9.60E-06	7.77E-09	3.78E-01	3.78E-01	2.34E-02	1.42E-02	0.00E+00	6.44E-02	1.02E-04	2.40E-06	5.22E-06	7.33E-03	7.13E-04	2.81E+04
Uranium-235	U-235	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.65E+00	3.25E-03	2.70E-12	3.78E-01	3.78E-01	2.34E-02	1.42E-02	0.00E+00	6.44E-02	1.02E-04	2.40E-06	5.22E-06	7.33E-03	7.13E-04	8.25E+03
Uranium-238	U-238	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.60E+00	2.10E-03	4.25E-13	3.78E-01	3.78E-01	2.34E-02	1.42E-02	0.00E+00	6.44E-02	1.02E-04	2.40E-06	5.22E-06	7.33E-03	7.13E-04	1.13E+04

References:
[1] ANL, 2009, RESRAD-BIOTA for Windows, Version 1.5, Argonne National Laboratory, Argonne, Illinois. Available at: http://web.ead.anl.gov/resrad/home2/biota.cfm.
[2] PT_IT value of 1 was used.
[3] Beresford, N.A., C.L. Barnett, B.J. Howard, W.A. Scott, J.E. Brown, and D. Copplestone, 2008, "Derivation of Transfer Parameters for Use Within the ERICA Tool and the Default
[4] Dose conversion factors were calculated based on the geometry of each species using the RESRAD-Biota (version 1.5). Oak Ridge National Laboratory (ORNL). 2010. "RAIS: The Risk
[5] Oak Ridge National Laboratory (ORNL). 2010. "RAIS: The Risk Assessment Information System." Available at http://rais.ornl.gov/.
[6] References for species-specific parameter values are presented in Table 2 of the main document to which this table is an attachment

Acronyms:
f1 = fraction of radionuclide assimilated into the body
alpha (α) = alpha parameter for calculating biological half life
beta (β) = beta parameter for calculating biological half life
PT_IT = correlation factor for adjusting inhalation relative to ingestion exposure
DF_int = internal dose conversion factor
DF_ext = external dose conversion factor

TABLE B-9
Calculation of Level 3 Biota Concentration Guide for Grasshopper Mouse
Central Plateau Area at Hanford, Washington

Species:	Grasshopper Mouse		
Parameter [6]	**Symbol**	**Value**	**Unit**
Body Weight	M_b	0.0346	(kg)
Food Intake	r_{food}	3.3808	(g-food/ individual)
Soil Ingestion	r_{soil}	0.0304	(g-soil/ individual)
Diet Composition [6]:			
Plants ($\%_{plant}$)		0%	
Terrestrial Invertebrates ($\%_{inv}$)		100%	
Mammals/Birds ($\%_{mamm}$)		0%	
Longevity	T_{life}	5.0	(years)
Dust loading in air	X_{dust}	1.00E-04	(g/m3)
Dose limit	DL	0.1	(rad/day)
Geometry Information Used to Calculate Conversion Factors:			
Assumed Geometry	3		
Geometry Dimensions	10 x 2 x 2	(cm3)	

Eqn. 1

$$k_{bio} = \frac{0.69315}{\alpha (M_b)^{\beta}}$$

Eqn. 2

$$k_{eff} = k_{bio} + k_{rad}$$

Eqn. 3

$$Intake_{ing} = r_{food} \times \sum (BAF \times \%_{composition})$$
$$= r_{food} \times \left[(BAF_{plant} \times \%_{plant}) + (BAF_{inv} \times \%_{inv}) + (BAF_{mammx} \times \%_{mamm}) \right]$$

Eqn. 4

$$Intake_{inh} = PT_IT \times X_{dust} \times 0.481 \times M_b^{0.76}$$

Eqn. 5 Lumped Parameter (LP)

$$\frac{f_1 \left(Intake_{ing} + Intake_{inh} \right) \times \left(1 - e^{-(k_{eff} \times 365.25 \times T_{life})} \right)}{k_{eff} \times M_b}$$

Eqn. 6 Biota Concentration Guide (BCG)

$$\frac{(365.25 \times DL)}{[(DF_int \times LP) + DF_ext]}$$

Radionuclides		Chemical Specific Parameters (Unitless)				Biological Accumulation Factor (BAF) (Unitless)			Dose Conversion Factor (rad/yr per pCi/g)		Calculation of biological half life and effective half life (1/day)			Calculation of Ingestion/Inhalation Intake (g-soil/ individual)						Calculation of Lumped Parameter (LP)			Biota Concentration Guide (pCi/g)
		f1	alpha (α)	beta (β)	PT_IT	Soil to Plants (BAF_{plant})	Soil to Terrestrial Invertebrates (BAF_{inv})	Soil to Small Mammal (BAF_{mamm})	DF_int	DF_ext	Radiological decay constant (k_{rad})	Biological decay constant (k_{bio})	Effective half life (k_{eff})	Plants	Terrestrial Invertebrates	Small Mammal	Soil	Ingestion intake [Total]	Inhalation intake	Numerator (kg-soil/day)	Denominator (kg-tissue/day)	LP (pCi/g-tissue per pCi/g-soil)	
	References:	[1]	[1]	[1]	[2]	[3]	[3]	[3]	[4]	[4]	[5]	[Eqn. 1]	[Eqn. 2]					[Eqn. 3]	[Eqn. 4]			[Eqn. 5]	[Eqn. 6]
Americium-241	Am-241	0.001	0.8	0.81	1	4.96E-03	1.01E-01	4.08E-02	2.07E+00	4.32E-04	4.39E-06	4.91E-02	4.91E-02	0.00E+00	3.40E-01	0.00E+00	3.04E-02	3.70E-04	3.73E-06	3.74E-07	1.70E-03	2.20E-04	4.11E+04
Carbon-14	C-14	1	2	0.25	1	8.90E+02	4.30E+02	1.34E+03	9.21E-04	1.22E-06	3.32E-07	1.43E-01	1.43E-01	0.00E+00	1.45E+03	0.00E+00	3.04E-02	1.45E+00	3.73E-06	1.45E+00	4.94E-03	2.94E+02	1.35E+02
Curium-244	Cm-244	0.0001	0.8	0.81	1	2.75E-04	1.37E-01	4.08E-02	2.20E+00	9.44E-06	1.05E-04	4.91E-02	4.92E-02	0.00E+00	4.65E-01	0.00E+00	3.04E-02	4.95E-04	3.73E-06	4.99E-08	1.70E-03	2.93E-05	4.94E+05
Cobalt-60	Co-60	0.05	2.6	0.24	1	1.35E-02	3.52E-03	2.95E-01	3.20E-03	4.53E-02	3.61E-04	1.14E-01	1.14E-01	0.00E+00	1.19E-02	0.00E+00	3.04E-02	4.23E-05	3.73E-06	2.30E-06	3.95E-03	5.83E-04	8.06E+02
Cesium-134	Cs-134	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	3.96E-03	2.81E-02	9.21E-04	8.46E-02	8.55E-02	0.00E+00	4.53E-01	0.00E+00	3.04E-02	4.84E-04	3.73E-06	4.87E-04	2.96E-03	1.65E-01	1.27E+03
Cesium-137	Cs-137	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	4.80E-03	1.03E-02	6.30E-05	8.46E-02	8.47E-02	0.00E+00	4.53E-01	0.00E+00	3.04E-02	4.84E-04	3.73E-06	4.87E-04	2.93E-03	1.66E-01	3.29E+03
Europium-152	Eu-152	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	2.94E-03	2.10E-02	1.42E-04	2.91E-02	2.92E-02	0.00E+00	2.68E-03	0.00E+00	3.04E-02	3.31E-05	3.73E-06	3.68E-08	1.01E-03	3.64E-05	1.74E+03
Europium-154	Eu-154	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	2.94E-03	2.27E-02	2.16E-04	2.91E-02	2.93E-02	0.00E+00	2.68E-03	0.00E+00	3.04E-02	3.31E-05	3.73E-06	3.68E-08	1.01E-03	3.64E-05	1.61E+03
Europium-155	Eu-155	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	1.23E-03	1.09E-03	3.83E-04	2.91E-02	2.95E-02	0.00E+00	2.68E-03	0.00E+00	3.04E-02	3.31E-05	3.73E-06	3.68E-08	1.02E-03	3.62E-05	3.35E+04
Hydrogen-3 (tritium)	H-3	1	0.82	0.55	1	1.50E+02	1.50E+02	1.50E+02	1.06E-04	4.36E-09	1.54E-04	1.20E-01	1.21E-01	0.00E+00	5.07E+02	0.00E+00	3.04E-02	5.07E-01	3.73E-06	5.07E-01	4.17E-03	1.22E+02	2.83E+03
Neptunium-237	Np-237	0.001	0.8	0.28	1	1.73E-02	1.01E-01	4.08E-02	1.76E+00	4.40E-03	8.88E-10	3.21E-01	3.21E-01	0.00E+00	3.40E-01	0.00E+00	3.04E-02	3.70E-04	3.73E-06	3.74E-07	1.11E-02	3.37E-05	8.19E+03
Plutonium-238	Pu-238	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	2.08E+00	9.78E-06	2.17E-05	4.91E-02	4.91E-02	0.00E+00	1.31E-01	0.00E+00	3.04E-02	1.61E-04	3.73E-06	1.65E-07	1.70E-03	9.72E-05	1.72E+05
Plutonium-239	Pu-239	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	1.95E+00	4.32E-06	7.89E-08	4.91E-02	4.91E-02	0.00E+00	1.31E-01	0.00E+00	3.04E-02	1.61E-04	3.73E-06	1.65E-07	1.70E-03	9.72E-05	1.88E+05
Radium-226	Ra-226	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.11E+01	3.27E-02	1.19E-06	1.43E-01	1.43E-01	0.00E+00	3.04E-01	0.00E+00	3.04E-02	3.35E-04	3.73E-06	6.77E-05	4.94E-03	1.37E-02	1.98E+02
Radium-228	Ra-228	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.22E+01	1.57E-02	3.30E-04	1.43E-01	1.43E-01	0.00E+00	3.04E-01	0.00E+00	3.04E-02	3.35E-04	3.73E-06	6.77E-05	4.96E-03	1.37E-02	2.00E+02
Antimony-125	Sb-125	0.01	0.5	0.25	1	2.50E-02	2.53E-01	2.15E-06	2.64E-03	7.96E-03	6.86E-04	5.72E-01	5.72E-01	0.00E+00	8.54E-01	0.00E+00	3.04E-02	8.84E-04	3.73E-06	8.88E-06	1.98E-02	4.48E-04	4.59E+03
Strontium-90	Sr-90	0.3	107	0.26	1	2.07E-01	4.07E-01	1.74E+00	1.89E-02	2.19E-03	6.54E-05	2.58E-03	2.64E-03	0.00E+00	1.37E+00	0.00E+00	3.04E-02	1.41E-03	3.73E-06	4.19E-04	9.15E-05	4.58E+00	4.11E+02
Technetium-99	Tc-99	0.8	0.3	0.4	1	2.00E+01	3.70E-01	3.70E-01	1.57E-03	5.50E-06	8.92E-09	5.60E-01	5.60E-01	0.00E+00	1.25E+00	0.00E+00	3.04E-02	1.28E-03	3.73E-06	1.03E-03	1.94E-02	5.31E-02	4.11E+05
Thorium-232	Th-232	0.0002	3.3	0.81	1	4.37E-02	8.84E-03	1.22E-04	1.37E+01	8.28E-06	1.35E-13	1.19E-02	1.19E-02	0.00E+00	2.99E-02	0.00E+00	3.04E-02	6.03E-05	3.73E-06	1.28E-08	4.12E-04	3.11E-05	8.41E+04
Uranium-234	U-234	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.81E+00	9.60E-06	7.77E-09	3.21E-01	3.21E-01	0.00E+00	2.99E-02	0.00E+00	3.04E-02	6.03E-05	3.73E-06	3.20E-06	1.11E-02	2.88E-04	6.88E+04
Uranium-235	U-235	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.65E+00	3.25E-03	2.70E-12	3.21E-01	3.21E-01	0.00E+00	2.99E-02	0.00E+00	3.04E-02	6.03E-05	3.73E-06	3.20E-06	1.11E-02	2.88E-04	9.80E+03
Uranium-238	U-238	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.60E+00	2.10E-03	4.25E-13	3.21E-01	3.21E-01	0.00E+00	2.99E-02	0.00E+00	3.04E-02	6.03E-05	3.73E-06	3.20E-06	1.11E-02	2.88E-04	1.43E+04

References:

[1] ANL, 2009, RESRAD-BIOTA for Windows, Version 1.5, Argonne National Laboratory, Argonne, Illinois. Available at: http://web.ead.anl.gov/resrad/home2/biota.cfm.
[2] PT_IT value of 1 was used.
[3] Beresford, N.A., C.L. Barnett, B.J. Howard, W.A. Scott, J.E. Brown, and D. Copplestone, 2008, "Derivation of Transfer Parameters for Use Within the ERICA Tool and the Default
[4] Dose conversion factors were calculated based on the geometry of each species using the RESRAD-Biota (version 1.5). Oak Ridge National Laboratory (ORNL). 2010. "RAIS: The Risk
[5] Oak Ridge National Laboratory (ORNL). 2010. "RAIS: The Risk Assessment Information System." Available at http://rais.ornl.gov/.
[6] References for species-specific parameter values are presented in Table 2 of the main document to which this table is an attachment

Acronyms:

f1 = fraction of radionuclide assimilated into the body
alpha (α) = alpha parameter for calculating biological half life
beta (β) = beta parameter for calculating biological half life
PT_IT = correlation factor for adjusting inhalation relative to ingestion exposure
DF_int = internal dose conversion factor
DF_ext = external dose conversion factor

TABLE B-10
Calculation of Level 3 Biota Concentration Guide for Badger
Central Plateau Area at Hanford, Washington

Species:	Badger		
Parameter [6]	**Symbol**	**Value**	**Unit**
Body Weight	M_b	7.6000	(kg)
Food Intake	r_{food}	263.8092	(g-food/ individual)
Soil Ingestion	r_{soil}	13.7181	(g-soil/ individual)
Diet Composition [6]:			
Plants ($\%_{plant}$)		0%	
Terrestrial Invertebrates ($\%_{inv}$)		0%	
Mammals/Birds ($\%_{mamm}$)		100%	
Longevity	T_{life}	5.0	(years)
Dust loading in air	X_{dust}	1.00E-04	(g/m3)
Dose limit	DL	0.1	(rad/day)
Geometry Information Used to Calculate Conversion Factors:			
Assumed Geometry	5		
Geometry Dimensions	50 x 26 x 13	(cm3)	

Eqn. 1

$$k_{bio} = \frac{0.69315}{\alpha (M_b)^{\beta}}$$

Eqn. 2

$$k_{eff} = k_{bio} + k_{rad}$$

Eqn. 3

$$Intake_{ing} = r_{food} \times \sum (BAF \times \%_{composition})$$
$$= r_{food} \times \left[(BAF_{plant} \times \%_{plant}) + (BAF_{inv} \times \%_{inv}) + (BAF_{mammx} \times \%_{mamm}) \right]$$

Eqn. 4

$$Intake_{inh} = PT_IT \times X_{dust} \times 0.481 \times M_b^{0.76}$$

Eqn. 5 Lumped Parameter (LP)

$$\frac{f_1 \left(Intake_{ing} + Intake_{inh} \right) \times \left(1 - e^{-(k_{eff} \times 365.25 \times T_{life})} \right)}{k_{eff} \times M_b}$$

Eqn. 6 Biota Concentration Guide (BCG)

$$\frac{(365.25 \times DL)}{[(DF_int \times LP) + DF_ext]}$$

Radionuclides		Chemical Specific Parameters (Unitless)				Biological Accumulation Factor (BAF) (Unitless)			Dose Conversion Factor (rad/yr per pCi/g)		Calculation of biological half life and effective half life (1/day)			Calculation of Ingestion/Inhalation Intake (g-soil/ individual)						Calculation of Lumped Parameter (LP)			Biota Concentration Guide (pCi/g)
		f1	alpha (α)	beta (β)	PT_IT	Soil to Plants (BAF_{plant})	Soil to Terrestrial Invertebrates (BAF_{inv})	Soil to Small Mammal (BAF_{mamm})	DF_int	DF_out	Radiological decay constant (k_{rad})	Biological decay constant (k_{bio})	Effective half life (k_{eff})	Plants	Terrestrial Invertebrates	Small Mammal	Soil	Ingestion intake [Total]	Inhalation intake	Numerator (kg-soil/day)	Denominator (kg-tissue/day)	LP (pCi/g-tissue per pCi/g-soil)	
	References:	[1]	[1]	[1]	[2]	[3]	[3]	[3]	[4]	[4]	[5]	[Eqn. 1]	[Eqn. 2]					[Eqn. 3]	[Eqn. 4]			[Eqn. 5]	[Eqn. 6]
Americium-241	Am-241	0.001	0.8	0.81	1	4.96E-03	1.01E-01	4.08E-02	2.07E+00	2.57E-04	4.39E-06	6.23E-04	6.27E-04	0.00E+00	0.00E+00	1.08E+01	1.37E+01	2.45E-02	2.25E-04	1.68E-05	4.77E-03	3.53E-03	4.82E+03
Carbon-14	C-14	1	2	0.25	1	8.90E+02	4.30E+02	1.34E+03	9.22E-04	1.21E-07	3.32E-07	3.71E-02	3.71E-02	0.00E+00	0.00E+00	3.54E+05	1.37E+01	3.54E+02	2.25E-04	3.54E+02	2.82E-01	1.25E+03	3.16E+01
Curium-244	Cm-244	0.0001	0.8	0.81	1	2.75E-04	1.37E-01	4.08E-02	2.22E+00	1.44E-06	1.05E-04	6.23E-04	7.28E-04	0.00E+00	0.00E+00	1.08E+01	1.37E+01	2.45E-02	2.25E-04	1.82E-06	5.53E-03	3.28E-04	5.00E+04
Cobalt-60	Co-60	0.05	2.6	0.24	1	1.35E-02	3.52E-03	2.95E-01	1.22E-02	3.63E-02	3.61E-04	3.12E-02	3.16E-02	0.00E+00	0.00E+00	7.79E+01	1.37E+01	9.17E-02	2.25E-04	4.59E-03	2.40E-01	1.91E-02	1.00E+03
Cesium-134	Cs-134	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	1.03E-02	2.18E-02	9.21E-04	2.32E-02	2.41E-02	0.00E+00	0.00E+00	7.58E+02	1.37E+01	7.72E-01	2.25E-04	7.72E-01	1.83E-01	4.21E+00	5.60E+02
Cesium-137	Cs-137	1	3.5	0.24	1	6.93E-01	1.34E-01	2.87E+00	7.23E-03	7.90E-03	6.30E-05	2.32E-02	2.33E-02	0.00E+00	0.00E+00	7.58E+02	1.37E+01	7.72E-01	2.25E-04	7.72E-01	1.77E-01	4.37E+00	9.25E+02
Europium-152	Eu-152	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	7.53E-03	1.64E-02	1.42E-04	3.89E-04	5.31E-04	0.00E+00	0.00E+00	5.39E-01	1.37E+01	1.43E-02	2.25E-04	8.99E-06	4.04E-03	2.23E-03	2.22E+03
Europium-154	Eu-154	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	1.06E-02	1.77E-02	2.16E-04	3.89E-04	6.05E-04	0.00E+00	0.00E+00	5.39E-01	1.37E+01	1.43E-02	2.25E-04	9.69E-06	4.60E-03	2.11E-03	2.06E+03
Europium-155	Eu-155	0.001	1.4	0.8	1	5.20E-03	7.93E-04	2.04E-03	1.57E-03	7.48E-04	3.83E-04	3.89E-04	7.72E-04	0.00E+00	0.00E+00	5.39E-01	1.37E+01	1.43E-02	2.25E-04	1.09E-05	5.87E-03	1.87E-03	4.86E+04
Hydrogen-3 (tritium)	H-3	1	0.82	0.55	1	1.50E+02	1.50E+02	1.50E+02	1.06E-04	6.95E-10	1.54E-04	6.20E-03	6.36E-03	0.00E+00	0.00E+00	3.96E+04	1.37E+01	3.96E+01	2.25E-04	3.96E+01	4.83E-02	8.19E+02	4.20E+02
Neptunium-237	Np-237	0.001	0.8	0.28	1	1.73E-02	1.01E-01	4.08E-02	1.76E+00	3.18E-03	8.88E-10	7.10E-02	7.10E-02	0.00E+00	0.00E+00	1.08E+01	1.37E+01	2.45E-02	2.25E-04	2.47E-05	5.39E-01	4.58E-05	1.12E+04
Plutonium-238	Pu-238	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	2.08E+00	1.50E-06	2.17E-05	6.23E-04	6.44E-04	0.00E+00	0.00E+00	6.17E+00	1.37E+01	1.99E-02	2.25E-04	1.39E-05	4.90E-03	2.84E-03	6.18E+03
Plutonium-239	Pu-239	0.001	0.8	0.81	1	1.44E-02	3.88E-02	2.34E-02	1.95E+00	7.47E-07	7.89E-08	6.23E-04	6.23E-04	0.00E+00	0.00E+00	6.17E+00	1.37E+01	1.99E-02	2.25E-04	1.37E-05	4.73E-03	2.89E-03	6.49E+03
Radium-226	Ra-226	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.11E+01	2.50E-02	1.19E-06	3.71E-02	3.71E-02	0.00E+00	0.00E+00	6.99E+00	1.37E+01	2.07E-02	2.25E-04	4.19E-03	2.82E-01	1.48E-02	1.92E+02
Radium-228	Ra-228	0.2	2	0.25	1	3.94E-02	9.00E-02	2.65E-02	1.22E+01	1.21E-02	3.30E-04	3.71E-02	3.74E-02	0.00E+00	0.00E+00	6.99E+00	1.37E+01	2.07E-02	2.25E-04	4.19E-03	2.85E-01	1.47E-02	1.91E+02
Antimony-125	Sb-125	0.01	0.5	0.25	1	2.50E-02	2.53E-01	2.15E-06	4.65E-03	5.95E-03	6.86E-04	1.48E-01	1.49E-01	0.00E+00	0.00E+00	5.66E-04	1.37E+01	1.37E-02	2.25E-04	1.39E-04	1.13E+00	1.23E-04	6.14E+03
Strontium-90	Sr-90	0.3	107	0.26	1	2.07E-01	4.07E-01	1.74E+00	2.08E-02	2.64E-04	6.54E-05	6.34E-04	7.00E-04	0.00E+00	0.00E+00	4.59E+02	1.37E+01	4.73E-01	2.25E-04	1.02E-01	5.32E-03	1.92E+01	9.12E+01
Technetium-99	Tc-99	0.8	0.3	0.4	1	2.00E+01	3.70E-01	3.70E-01	1.58E-03	5.96E-07	8.92E-09	6.48E-02	6.48E-02	0.00E+00	0.00E+00	9.76E+01	1.37E+01	1.11E-01	2.25E-04	8.92E-02	4.92E-01	1.81E-01	1.27E+05
Thorium-232	Th-232	0.0002	3.3	0.81	1	4.37E-02	8.84E-03	1.22E-04	1.37E+01	3.01E-06	1.35E-13	1.51E-04	1.51E-04	0.00E+00	0.00E+00	3.21E-02	1.37E+01	1.38E-02	2.25E-04	6.73E-07	1.15E-03	5.87E-04	4.54E+03
Uranium-234	U-234	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.81E+00	2.31E-06	7.77E-09	7.10E-02	7.10E-02	0.00E+00	0.00E+00	2.80E-02	1.37E+01	1.37E-02	2.25E-04	6.99E-04	5.39E-01	1.30E-03	1.56E+04
Uranium-235	U-235	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.65E+00	2.31E-03	2.70E-12	7.10E-02	7.10E-02	0.00E+00	0.00E+00	2.80E-02	1.37E+01	1.37E-02	2.25E-04	6.99E-04	5.39E-01	1.30E-03	8.21E+03
Uranium-238	U-238	0.05	0.8	0.28	1	1.46E-02	8.84E-03	1.06E-04	1.61E+00	5.53E-04	4.25E-13	7.10E-02	7.10E-02	0.00E+00	0.00E+00	2.80E-02	1.37E+01	1.37E-02	2.25E-04	6.99E-04	5.39E-01	1.30E-03	1.38E+04

References:

[1] ANL, 2009, RESRAD-BIOTA for Windows, Version 1.5, Argonne National Laboratory, Argonne, Illinois. Available at: http://web.ead.anl.gov/resrad/home2/biota.cfm.

[2] PT_IT value of 1 was used.

[3] Beresford, N.A., C.L. Barnett, B.J. Howard, W.A. Scott, J.E. Brown, and D. Copplestone, 2008a, "Derivation of Transfer Parameters for Use Within the ERICA Tool and the Default

[4] Dose conversion factors were calculated based on the geometry of each species using the RESRAD-Biota (version 1.5). Oak Ridge National Laboratory (ORNL). 2010. "RAIS: The Risk

[5] Oak Ridge National Laboratory (ORNL). 2010. "RAIS: The Risk Assessment Information System." Available at http://rais.ornl.gov/.

[6] References for species-specific parameter values are presented in Table 2 of the main document to which this table is an attachment

Acronyms:

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beta (β) = beta parameter for calculating biological half life

PT_IT = correlation factor for adjusting inhalation relative to ingestion exposure

DF_int = internal dose conversion factor

DF_ext = external dose conversion factor

Appendix C

Evaluation and Selection of the Uranium TRV for Mammals at the Hanford Site

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Ecology Memorandum

Ecology Position
January 2014

Subject: Toxicity reference value (TRV) for uranium (U) for mammals (underlying a wildlife preliminary remediation goal [PRG] for Hanford soils)

Problem

USDOE (2013) has proposed a LOAEL based soil PRG (40 mg/kg) for U for mammals, calculated for a badger receptor with a soil to small mammal bioaccumulation regression equation, using the wildlife exposure model used to derive EPA EcoSSLs (USEPA, 2007). In addition, this PRG incorporates a mammalian LOAEL TRV (6.13 mg U/kg-d) from Sample et al (1996). However, this proposed TRV from Sample et al (1996) is based on a single study (Paternain et al, 1989) and does not utilize data from the most sensitive study endpoint (i.e., decreased body weight in pups) to identify a LOAEL.

Analysis

Data have been tabulated for key studies, relating to TRV development for U (Table 1). Sample et al (1996) derived a final LOAEL of 6.13 mg U/kg-d. This is based on the 10 mg/kg-d dose of uranyl acetate (and a U fraction of 0.6132 of the test compound) in a study by Paternain et al (1989), employing oral exposure to mice. However, Sample et al (1996) did not include the significant decrease in pup body weight at the 5 mg/kg-d dose. Pup body weight decreased ($P<0.05$) by 8% after 21 days. Also, the chemical form of U is reported as uranyl acetate by Sample et al (1996) vs. uranyl acetate dihydrate by Paternain et al (1989). Thus, the fraction of U should be 0.561 (rather than 0.6132). Using the decrease in pup body weight at 5 mg/kg-d of uranyl acetate dihydrate, as well as the lower U fraction (Paternain et al, 1989), a LOAEL of 2.8 mg U/kg-d is derived.

LOAEL results of Domingo et al (1989) and Ortega et al (1989), using rats and mice orally exposed to uranyl acetate dihydrate, are consistent with those of Paternain et al (1989) (Table 1). A 33% decrease in maternal body weight ($P<0.05$) and a 26% decrease in fetal body weight ($P<0.001$) were reported in mice after a 9 day gestational exposure period at 5 mg/kg-d (2.8 mg U/kg-d) (Domingo et al, 1989). Similarly, a 38% decrease in body weight ($P<0.05$) was observed in male rats after 3 weeks at 4 mg/kg-d (2.2 mg U/kg-d) (Ortega et al, 1989).

LOAEL results for histopathological changes in the kidney (e.g., renal tubular lesions) and liver (e.g., nuclear and cytoplasmic changes) of rats and kidney of rabbits (e.g., renal tubular lesions) after oral exposure to uranyl nitrate hexahydrate for 91 days have been reported by Gilman et al (1998a,b,c) (Table1). In particular, a LOAEL of 0.06 mg U/kg-d was derived in male rats for renal damage (Gilman et al, 1998b). Although these histopathological endpoints are not directly useful for deriving soil PRGs (which preferentially employ ecologically relevant endpoints, e.g., growth, reproduction, survival), intake rates relating to histopathological endpoints (Gilman et al, 1998a,b) were compared allometrically with intake rates relating to growth effect endpoints (Ortega et al, 1989; Paternain et al, 1989; Domingo et al, 1989) to estimate their relative difference in sensitivity (Sheppard et al, 2005). In this manner, growth effects were shown to be approximately 21.6 (ratio of allometric coefficients=1.3/0.06) times less sensitive than renal damage, resulting in a LOAEL of 1.3 mg U/kg-d (21.6*0.06 mg U/kg-d) for growth and development in small mammals (Sheppard et al, 2005) (Table 1).

Recommendation

Using a weight of evidence approach (which considers a wider range of studies) and an allometric ratio between renal damage and growth effects, a more defensible LOAEL TRV (1.3 mg U/kg-d) for small mammals has been derived by Sheppard et al (2007). It is recommended that this LOAEL be used as the TRV for deriving a soil PRG for U for mammals at the Hanford Site. This would reduce the current Tier 2 soil PRG for U from 40 to approximately 13 mg/kg.

References

Domingo, JL et al. 1989. The developmental toxicity of uranium in mice. Toxicol 55:143-152.

Gilman, AP et al. 1998a. Uranyl nitrate: 91 day toxicity studies in the New Zealand White rabbit. Toxicol Sci 41:129-137.

Gilman, AP et al. 1998b. Uranyl nitrate: 28 day and 91 day toxicity studies in the Sprague-Dawley rat. Toxicol Sci 41:117-128.

Gilman, AP et al. 1998c. Uranyl nitrate: 91 day exposure and recovery studies in the male New Zealand White rabbit. Toxicol Sci 41:138-151.

Ortega, A et al. 1989. Evaluation of the oral toxicity of uranium in a 4 week drinking water study in rats.

Paternain, JL et al. 1989. The effects of uranium on reproduction, gestation, and postnatal survival in mice. Ecotoxicol Environ Safety 17:291-296.

Sample, BE et al. 1996. Toxicological benchmarks for wildlife: 1996 revision. ES/ER/TM-86/R3, ORNL, Oak Ridge, TN.

Sheppard, SC et al. 2005. Derivation of ecotoxicity thresholds for uranium. J Environ Radioact 79:55-83.

USDOE. 2013. Tier 2 risk based soil concentrations protective of ecological receptors at the Hanford Site. CHPRC-01311, Rev 1, Richland, WA.

USEPA. 2007. Guidance for developing EcoSSLs. Exposure models and bioaccumulation factors for derivation of wildlife EcoSSLs. OSWER Directive 9285.7-55, Attachment 4-1

Table 1. Key studies, relating to TRV development for U.

Test Chemical	MW (g/mol)	U fraction (238.0/MW)	Test Species	Exposure Duration	Exposure Route	Dose (test chemical)	Endpoint selected	NOAEL (mg U/kg-d)	LOAEL (mg U/kg-d)	Reference
uranyl acetate[1]	390.1	0.6132	mice	60 d prior to mating, plus through gestation, delivery, lactation	oral (intubation)	5, 10, 25 mg/kg-d	reproduction	3.07	6.13	Sample et al (1996) citing Paternain et al (1989
uranyl acetate dihydrate	424.1	0.561	mice (male, female)	60 d prior to mating, plus through gestation, delivery, lactation	oral (intragastric)	0, 5, 10, 25 mg/kg-d	growth/body weight (pups)	NS	2.8	Paternain et al (1989)
uranyl acetate dihydrate	424.1	0.561	mice (female)	gestational days 6-15	oral (gavage)	0, 5, 10, 25, 50 mg/kg-d	growth/body weight (maternal, fetal)	NS	2.8	Domingo et al (1989)
uranyl acetate dihydrate	424.1	0.561	rats (male)	4 wks	oral (drinking water)	0, 2, 4, 8, 16 mg/kg-d	growth/body weight	1.1	2.2	Ortega et al (1989)
uranyl nitrate hexahydrate	502.1	0.474	rabbits (male)	91 d	oral (drinking water)	0.96, 4.8, 24, 120, 600 mg/L	renal damage	NS	0.05	Gilman et al (1998a)
uranyl nitrate	502.1	0.474	rabbits	91 d	oral (drinking	4.8, 24,	renal damage	NS	0.49	Gilman et al

hexahydrate			(female)		water)	600 mg/L				(1998a)
uranyl nitrate hexahydrate	502.1	0.474	rats (male)	91 d	oral (drinking water)	0.96, 4.8, 24, 120, 600 mg/L	renal and hepatic damage	NS	0.06	Gilman et al (1998b)
uranyl nitrate hexahydrate	502.1	0.474	rats (female)	91 d	oral (drinking water)	0.96, 4.8, 24, 120, 600 mg/L	renal and hepatic damage	NS	0.09	Gilman et al (1998b)
uranyl nitrate hexahydrate	502.1	0.474	rabbits (male)	91 d	oral (drinking water)	24, 600 mg/L	renal damage	NS	≤1.36	Gilman et al (1998c)
various	NA	NA	mammal (1 kg)	various	oral	various	growth and development	0.1	1.3	Sheppard et al (2005)

Abbreviations: TRV=toxicity reference value, U=uranium, MW=molecular weight, NOAEL=no observed adverse effect level, LOAEL=lowest observed adverse effect level, NS=not specified, NA=not applicable.
[1]uranyl acetate dihydrate (according to Paternain et al, 1989).

RL Response

Ecological Risk, Inc.

To: James Hansen, Alaa Aly

From: Bradley E. Sample, PhD

Date: 1/16/2013

Re: Mammalian TRV for Uranium

On January 8, 2014, the Washington Department of Ecology (Ecology) provided to the US Department of Energy (DOE) a document representing the January 2014 Ecology Position on the Toxicity Reference Value (TRV) for uranium (U) for mammals. Ecological Risk, Inc., reviewed this document on behalf of CHPRC and DOE. This technical memorandum summarizes our comments on the Ecology Uranium TRV document. In addition we present the results of our evaluation of uranium mammalian toxicity data.

Comments on Ecology Uranium TRV document

In our review of the Ecology uranium TRV document, we identified a number of issues. These are listed below.

1) **2nd paragraph, 4th sentence:** Sample et al. (1996) did not consider this response biologically significant as the growth reduction was less than 20%. Use of a 20% threshold to identify biologically significant effects is consistent with existing regulatory policy and practice (Suter et al. 2000; see Attachment 1) and has previously been applied at the Hanford Site (DOE 2011). It should be noted that in their review of Paternain et al. (1989), WHO (2004) only identified effects at the 5.6 and 14 mg U/kg/d doses. In their review of Paternain et al. (1989), ATSDR (1999) identified the 5.6 mg U/kg/d dose (rounded to 6) as the NOAEL.

2) **2nd paragraph, 5th sentence:** We agree that the dose calculation in Sample et al. (1996) is incorrect - the corrected dose calculation will be used in future calculations, as necessary.

3) **3rd paragraph, last sentence:** We do not agree that the data presented in Ortega et al. (1989) is suitable to define a LOAEL. Ecology is correct in stating that male rats displayed a statistically significant 38% weight loss after 3 weeks exposure to 4 mg/kg/d uranyl acetate. However the weight loss at 3 weeks was not uniform across doses: it was 38% at 4 mg/kg/d; 24% at 8 mg/kg/d; and 29% at 16 mg/kg/d. Higher concentrations of uranium produced less weight loss than lower concentrations. Further, at 4 weeks there was no statistically significant weight differences between control and any treatment doses. In fact, mean weight of control rats was 11% to 35% less than rats in any of the U dose groups.

4) **4th paragraph, 3rd sentence:** We agree that text corresponds with the analyses presented in Sheppard et al. (2005). However, there are a number of serious issues with the analysis presented in Sheppard et al. (2005) that we believe undermine its validity to define a mammalian TRV for uranium. Specifically:

A) Sheppard et al. (2005) assume that 'intake' scales uniformly to the 0.75 power. Published allometric models for both food and water ingestion do not support this statement. The allometric model for water consumption in mammals developed by Calder and Braun (1983) is:

$$0.099(\text{BW in kg})^{0.90}$$

Nagy (2001) developed allometric scaling based on field observations of food ingestion rates for mammals, birds and reptiles. Allometric scaling factors for dry matter food ingestion for mammals ranged from 0.41 to 0.86. Further, Nagy (2005) states '*The scaling slopes for FMR (*field metabolic rate*) often differ from BMR (*basal metabolic rate*) slopes for the same Class of animals, and most differ from the theoretical slope of 0.75*."

B) Sheppard et al. (2005) employ an allometric scaling approach to extrapolate uranium doses among test species. Allometric scaling for extrapolating wildlife toxicity data is no longer recommended by USEPA (USEPA 2005). This position is supported by Allard et al. (2011).

C) Sheppard et al. (2005) identifies 1.3 mg U /kg/d to be a LOAEL for 'growth', however the basis for this value is not evident. It appears that Sheppard et al. (2005) conflate the renal effects from Gilman et al. (1989c) with growth and reproductive effects in other studies. In section 10.1 of their paper, Sheppard et al. (2005) compare the renal LOAEL from Gilman et al. (1989c; 1.36 mg/kg/d) to the growth and development LOAELs from Ortega et al. (1989; 2.2 mg/kg/d), Paternain et al. (1989; 5.6 mg/kg/d), and Domingo et al. (1989a; 2.8 mg/kg/d) and state that "*Despite the rather different animals, dosage methods and endpoints, the effect concentrations were quite similar.*" We do not agree that the effect concentrations are similar; a LOAEL of 1.36 mg/kg/d is not equal to LOAELs of 2.2 mg/kg/d, 2.8 mg/kg/d, or 5.6 mg/kg/d. Further, the 1.36 mg/kg/d dose reported in Gilman et al. (1998c) is not actually a LOAEL, but rather a NOAEL (see below). Because of these multiple issues with the Sheppard et al. (2005) study, we believe that their analysis is flawed and do not agree that the 1.3 mg U/kg/d value is defensible or appropriate.

CHPRC Evaluation of Mammalian Toxicity Data

CHPRC conducted a review of available uranium toxicity data for mammals, using the Sheppard et al. (2005) paper as a starting point, as it is the basis for the TRV recommended by Ecology.

We obtained and reviewed the key papers which form the basis for Sheppard et al. (2005). These are summarized in Table 1. We also evaluated two additional reviews of uranium toxicity to mammals: WHO (2004) and ATSDR (1999). These were considered to provide independent interpretations of the studies.

The study that appears to be the basis for the 1.3 mg/kg/d TRV in Sheppard et al. (2005) is Gilman et al. (1998c). In this study, rabbits were exposed to uranyl nitrate in drinking water for 91 days followed by a 91 day recovery period. Two doses were provided: 1.36 and 40.98 mg U /kg/d. Gilman et al. (1998c) observed no statistically significant increase in the incidence of kidney lesions at 1.36 mg/kg/d but did observe multiple highly significant differences at 40.98 mg/kg/d. None the less, Gilman et al. (1998c) estimate that the LOAEL is at or below 1.36 mg/kg/d. This is based on U concentrations in kidneys and not on the actual dose. Further, although Gilman et al. (1998c) state in the text of the paper that kidney U concentrations were significantly elevated relative to controls for both the 1.36 and 40.98 mg U /kg/d doses, this is not supported by the results they present in tables. In their discussion, Gilman et al. (1998c) also state: '*The rabbits exposed to 24 mg UN/L* [1.36 mg U/kg/d]*in this study showed few dose-related changes (tubular atrophy or dilation and cytoplasmic vacuolation or pigmentation), contrasting markedly with the findings of the previous study in male rabbits (Gilman et al, 1998b).*

In their review of toxicity of U in drinking water, WHO (2004) interpreted the results from Gilman et al. (1998c) to indicate a LOAEL between 1.36 and 40.98 mg/kg/d. This is consistent with the results actually reported in Gilman et al. (1998c) and our interpretation. In their review of Gilman et al. (1998c), ATSDR (1999) identifies 1.36 as a less serious LOAEL for renal effects and 40.98 as a serious LOAEL.

In relation to the kidney toxicity studies of Gilman et al. (1998a, 1998b, and 1998c), Sheppard et al. (2005) state: "*However, it is not clear these effects would have ecological significance, because both the testes and the kidney probably have inherent excess capacity, so that some degree of damage is sustainable. In addition, it is possible that kidney function can recover on cessation of U intake.*" We concur with this statement from Sheppard et al. (2005). This is also consistent with the Eco-SSLs and how we generally select toxicity data for TRVs, by focusing on growth, reproduction and survival[1].

Additional studies were referenced by Sheppard et al. (2005). These were performed on mice, focused on developmental and reproduction effects, and summarized in Table 1. Sheppard et al.

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[1] USEPA (2007)defines a TRV as: '*Doses above which ecologically relevant effects (growth, reproduction or survival) might occur to wildlife species following chronic dietary exposure and below which it is reasonably expected that such effects will not occur.*'

(2005) states that "*Despite the rather different animals, dosage methods and endpoints, the effect concentrations were quite similar. These effects are more clearly related to ecological function, because they deal with growth and development rate.*" We agree that the results from these studies are more ecologically relevant. We do not agree however that the effect concentrations are similar (see comment 4D, above).

Based on the results from the reproductive studies on mice (Domingo et al. 1989a, Domingo et al. 1989b, and Paternain et al. 1989), LOAELs range from 2.8 to 28 mg U /kg/d. Sample et al. (1996) recommends use of the LOAEL from Paternain et al. (1989). We concur, as this represents effects associated with the longest term (>60 days) reproductive exposure. The lowest LOAEL (Domingo et al. 1989a) is based on only 9 days exposure. In addition, Domingo et al. (1989a) only observed statistically significant fetal weight reduction at the 2.8 mg/kg/d dose; no other reproductive effects were evident. At the next highest (5.6 mg/kg/d) and all subsequent doses, fetal weight, length, and number of stunted fetuses/litter are all statistically significantly increased. This 5.6 mg/kg/d dose corresponds with the dose at which Paternain et al. (1989) observed statistically significant embryolethality and reduced fetal growth.

Conclusion

We agree with statements made in Sheppard et al. (2005) concerning the ecological relevancy of developmental toxicity data relative to kidney data. However, due to the significant uncertainties/inconsistencies associated with the derivation of the 1.3 mg/kg/d TRV, we do not agree with Ecology that this value represents the most defensible TRV. Rather, based on our evaluation of the available data, we believe that the 5.6 mg/kg/d TRV is most suitable. However, because WAC 173-340-7493(4)(a) states "*Toxicity reference values or soil concentrations established from the literature shall represent the lowest relevant LOAEL found in the literature*", the LOAEL of 2.8 mg/kg/d from Domingo et al. (1989b) may be the most defendable.

In conclusion, we find that the TRV of 1.3 mg U/kg/d proposed in Sheppard et al. (2005), and recommended by Ecology for use at Hanford, is not suitable based on our evaluation of the original published literature (see Comment 4C, above), coupled with reviews performed by ATSDR (1999) and WHO (2004). Similarly, we find the 2.2 mg U/kg/d TRV from Ortega et al. (1989) not to be an acceptable LOAEL based on our review Ortega et al. (1989) outlined in Comment 3 (above). Based on our review of results presented in Domingo et al. (1989a and 1989b) and Paternain et al. (1989), it appears that serious reproductive effects are first evident at a dose of 5.6 mg U/kg/d. However, Domingo et al. (1989a) also observed a statistically significant 25.5% fetal growth reduction at a dose of 2.8 mg U/kg/d. Therefore, to be consistent with WAC 173-340-7493(4)(a), we believe this dose of 2.8 mg U/kg/d to be the most appropriate LOAEL for application at the Hanford Site.

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Attachment 1

From Suter at el. (2000):

For the Oak Ridge Reservation, a level of effect that is considered potentially significant has been inferred on the basis of analysis of EPA and Tennessee regulatory practice (Suter et al. 1994a). The clearest ecological criteria for regulation in the U.S. are those developed for the regulation of aqueous effluent under the National Pollution Discharge Elimination System (NPDES). NPDES permitting may be based on any of three types of evidence: water quality criteria, effluent toxicity tests, and biological surveys, and the use of each of these implies that a 20% reduction in ecological parameters is acceptable.

1. The Chronic National Ambient Water Quality Criteria (NAWQC) for Protection of Aquatic Life are based on thresholds for statistically significant effects on individual responses of fish and aquatic invertebrates. Those thresholds correspond to approximately 25% reductions in the parameters of fish chronic tests (Suter et al. 1987). Because of the compounding of individual responses across life stages, the chronic NAWQC concentrations are estimated to correspond to much more than 20% effects on a continuously-exposed fish population (Barnthouse et al. 1990). Hence, while the EPA did not intend to design the NAWQC to correspond to a 20% effect or any other particular level of effect, the consequence of the procedure used to derive the NAWQC is to specify a concentration that, in chronic exposures, results in effects of that are greater than 20%, on average.

2. The subchronic tests used to regulate effluents based on their toxicity cannot reliably detect reductions of less than 20% in the test endpoints (Anderson and Norberg-King 1991). Once again, this is a consequence of the manner in which the EPA regulates effluents rather than a conscious policy decision.

3. Twenty percent is the approximate detection limit of field measurement techniques used in regulating aqueous contaminants based on bioassessment. For example, the community metrics for an exposed benthic macroinvertebrate community must be reduced by more than 20% relative to the best communities within the ecoregion to be considered even slightly impaired in the EPA's rapid bioassessment procedure (Plafkin et al. 1989). Measures for other taxa that are more difficult to sample may be even less sensitive. For example, the number of fish species and individuals must be reduced by 33% to receive less than the top score in the EPA's rapid bioassessment procedure for fish (Plafkin et al. 1989). Once again, this effects level is a

consequence of the manner in which the EPA regulates effluents rather than a conscious policy decision.

The 20% level is also consistent with practice in assessments of terrestrial effects. The Lowest-Observed-Effects-Concentration (LOEC) for dietary tests of avian reproduction (the most important chronic test endpoint for ecological assessment of terrestrial effects of pesticides and arguably the most applicable test for waste sites) corresponds to approximately a 20% effect on individual response parameters (Office of Pesticide Programs 1982).

Therefore, a decrement in an ecological assessment endpoint that is less than 20% is generally acceptable based on current EPA regulatory practice and could not be reliably confirmed by field studies. Therefore, it is de minimis in practice.

Table 1. Summary of dietary toxicity data for uranium in mammals

Study	Test Species	Form	Exposure	Duration	effects	NOAEL (mg U/kg/d)	LOAEL (mg U/kg/d)	Notes
Gilman et al. 1998a	rats	uranyl nitrate	drinking water	91 days	renal lesions	NA	0.06 (male) 0.09 (female)	
Gilman et al. 1998b	rabbits - male	uranyl nitrate	drinking water	91 days	renal lesions	NA	0.05	Note that this LOAEL is associated with *Pasteurella* infection; Authors note that influence of infection on LOAEL cannot be excluded
Gilman et al. 1998b	rabbits - female	uranyl nitrate	drinking water	91 days	renal lesions	NA	0.49	rabbits were *Pasteurella*-free
Gilman et al. 1998c	rabbits - male	uranyl nitrate	drinking water	91 days exposure/ 91 days recovery	renal lesions	1.36	40.98	rabbits were *Pasteurella*-free; The authors of this study observed no statistically significant increase in the incidence of kidney lesions at 1.36 mg/kg/d but did observe multiple highly significant differences at 40.98 mg/kg/d. None the less, in the authors *estimate* that the LOAEL is at or below 1.36 mg/kg/d. This is based on U concentrations in kidneys and not on the actual dose. Note that in their review of toxicity of U in drinking water, WHO (2004) interpreted the results from Gilman et al. (1998c) to indicate a LOAEL between 1.36 and 40.98 mg/kg/d. This is consistent with the results actually reported in Gilman et al. (1998c). ATSDR (1999) identifies 1.36 as a less serious LOAEL for renal effects and 40.98 as a serious LOAEL.

Domingo et al. 1989a	mice	uranyl acetate	drinking water	gestational days 6-15	reproduction development		2.8	Only one measure, fetal weight, was significantly reduced at 2.8 mg/kg/d. Fetal growth and number of stunted fetuses/litter increased in a dose-dependent manner, starting at 5.6 mg/kg/d.
Domingo et al. 1989b	mice	uranyl acetate	oral gavage	d 13 of pregnancy to d 21 of lactation	reproduction development	2.8	28	Whereas litter size and other reproductive and developmental indices were not reduced at 2.8 mg/kg/d, they were significantly reduced among mice recieving the 28 mg/kg/d dose. In their review of toxicity of U in drinking water, WHO (2004) identified the NOAEL to be 2.8 mg/kg based on developmental effects to pups. Also, ATSDR (1999) identifies the serious LOAEL from this study to be 28 mg/kg/d based on decreased litter size.
Paternain et al. 1989	mice	uranyl acetate	oral gavage	60 d prior to gestation plus through lactation	reproduction development	2.8	5.6	Fetal growth and embryolethality occur in a dose-dependent manner starting at 5.6 mg/kg/d. Both Sample et al. (1996) and WHO (2004) identify this dose as a LOAEL. ATSDR (1999) identifies the NOAEL from this study to be 6 (rounded from 5.6) mg/kg/d and the LOAEL to be 14 mg/kg/d. **(note that Sample et al. [1996] includes a calculation error for proportion of U in uranyl acetate - NOAEL and LOAEL are correctly reported as 2.8 and 5.6 mg/kg/d, not 3.07 and 6.13 mg/kg/d)**