UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 17 1997

OSWER 9285.7-01D-1

MEMORANDUM

SUBJECT: Implementation of *Risk Assessment Guidance for Superfund (RAGS) Volume 1 - Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments)* (Interim)

FROM: Stephen D. Luftig, Director
Office of Emergency and Remedial Response

Barry Breen, Director
Office of Site Remediation Enforcement, OECA

TO: Superfund National Managers, Regions 1 - 10

PURPOSE

The purpose of this memorandum is to:

- o convey *Part D* of *Risk Assessment Guidance for Superfund (RAGS) Volume 1 - Human Health Evaluation Manual*
- o request that you assure its implementation in all risk assessment planning and development, effective January 1, 1998.

BACKGROUND

The March 21, 1995 memorandum on Risk Characterization Policy and Guidance from Administrator Browner directed improvement in the transparency, clarity, consistency, and reasonableness of risk assessments at EPA. We, over the years, have looked for opportunities for improving Superfund risk assessments and also have received criticisms from the General Accounting Office (GAO), members of Congress, and others. Most of these criticisms questioned the transparency or consistency of our risk assessments at sites across the country. The October 1995 Superfund Reform #6A directed EPA to establish national criteria to plan, report, and review Superfund risk assessments. *RAGS Part D* responds to these challenges and fulfills the Reform #6A mandate.

An Agency workgroup of regional and headquarters risk assessors (the *RAGS Part D* Workgroup) has been active since the second quarter of FY 96 developing Standard Tools and other approaches to support standardization. Preliminary draft Standard Tools developed by the Workgroup in 1996 were tested and subjected to regional and state review in the fourth quarter of FY 96. Additional development and testing were performed by the Workgroup in FY 97, and a second regional review occurred in fourth quarter of FY 97. The Workgroup also coordinated extensively with the development team for the National Superfund Database (CERCLIS 3) during FY 97, concurrent with CERCLIS 3 development and testing efforts. The Standard Tools in *RAGS Part D* (*Technical Approach for Risk Assessment*, *Standard Tables*, and *Instructions for the Standard Tables*) reflect the results of continued development, testing, and CERCLIS 3 interaction, and are now available for use immediately.

Elements of the *RAGS Part D* Approach

The *RAGS Part D* approach consists of three basic elements: Use of Standard Tools, Continuous Involvement of EPA Risk Assessors, and Electronic Data Transfer to a National Superfund Database. Brief descriptions of the three components follow:

- **Use of Standard Tools** - The Standard Tools developed by the *RAGS Part D* Workgroup and refined through regional review include a *Technical Approach for Risk Assessment* or *TARA*, *Standard Tables*, and *Instructions for the Standard Tables*.

  -- The *Technical Approach for Risk Assessment (TARA)* is a road map for incorporating continuous involvement of the EPA risk assessor throughout the CERCLA remedial process for a particular site. Risk-related activities, beginning with scoping and problem formulation, extending through collection and analysis of risk-related data, and supporting risk management decision making and remedial design/remedial action issues are addressed. The *TARA* should be customized for each site-specific human health risk assessment as appropriate.

  -- The *Standard Tables* have been developed to clearly and consistently document important parameters, data, calculations, and conclusions from all stages of human health risk assessment development. Electronic templates for the *Standard Tables* have been developed in LOTUS® and EXCEL® for ease of use by risk assessors. For site-specific risk assessments, the *Standard Tables,* related *Worksheets* and *Supporting Information* should first be prepared as Interim Deliverables for EPA risk assessor review, and should later be included in the Draft and Final Baseline Risk Assessment Reports.

  -- *Instructions for the Standard Tables* have been prepared corresponding to each row and column on each *Standard Table.* Definitions of each field are supplied in the Glossary, and example data or selections for individual data fields are provided. The *Instructions* should be used to complete and/or review *Standard Tables* for each site-specific human health risk assessment.

- **Continuous Involvement of EPA Risk Assessors** - The EPA risk assessor is a critical participant in the CERCLA remedial process for any site, from scoping through completion and periodic review of the remedial action. EPA risk assessors support reasonable and consistent risk analysis and risk-based decision making. Early and continuous involvement by the EPA risk assessors should include scoping, workplan review, and customization of the *TARA* for each site to identify all risk-related requirements. The EPA risk assessors will review Interim Deliverables (*Standard Tables, Worksheets, and Supporting Information*) and identify corrections needed prior to preparation of the Draft and Final Baseline Risk Assessment Reports. This will help assure high quality risk assessments and greatly reduce the potential need for rework of contractor-prepared risk assessments. Participation of the EPA risk assessors in other stages of the CERCLA remedial process will ensure human health risk issues are appropriately incorporated in the remedy selection and implementation processes.

- **Electronic Data Transfer to a National Superfund Database** - Summary-level site-specific risk information will be stored in a National Superfund Database (CERCLIS 3) to provide data access and data management capabilities to all EPA staff. These risk-related summary data represent a subset of the data presented in the *Standard Tables*. The electronic versions of the *Standard Tables* (LOTUS® and EXCEL®) are structured to be compatible with CERCLIS 3. Translation software is under development to transfer data from the *Standard Tables* to CERCLIS 3, and no additional data entry should be required in the regions to fulfill the CERCLIS 3 risk data requirements.

OBJECTIVE

The three elements of the *RAGS Part D* approach described previously achieve both the objectives of Superfund Reform #6A (i.e., establish national criteria to plan, report, and review Superfund risk assessments) and the goals of the memorandum on Risk Characterization Policy and Guidance (i.e., improved transparency, clarity, consistency and reasonableness of EPA risk assessments). The elements of the *RAGS Part D* approach provide a methodology that will improve the quality and consistency of human health risk assessment development and risk-based decision making through the following:

- Standard Tools will be used to document the planning, reporting, and review of human health risk assessments in a consistent format, to clarify the assumptions made, and to increase a reader's ability to understand the approach followed (transparency).

- Continuous Involvement of EPA Risk Assessors in the planning and review of human health risk assessments, throughout all phases of the CERCLA remedial process, will improve the reasonableness and consistency of risk assessment assumptions and conclusions as well as ensure that these conclusions are appropriately understood and applied to risk management decisions.

- Electronic Data Transfer to a National Superfund Database (CERCLIS 3) from the *Standard Tables* will efficiently accomplish reporting requirements, support program-level data consistency reviews, and make data available for other readers to review easily (transparency).

IMPLEMENTATION

Applicability of the *RAGS Part D* Approach

The approach contained in *RAGS Part D* is recommended for all risk assessments commencing after the issuance of *Part D*. Its use is also encouraged in on-going risk assessments to the extent it can efficiently be incorporated into the risk assessment process. *RAGS Part D* is not applicable to completed risk assessments.

Exhibit 1 provides guidelines regarding *RAGS Part D* applicability as a function of site lead and site type, so that site-specific applicability may be determined by each region.

EXHIBIT 1: GUIDELINES FOR *RAGS PART D* APPLICABILITY

SITE LEAD	PART D APPLICABLE
Fund Lead	✓
Federal Facility Lead	✓
PRP Lead	✓
State Lead	✓
SITE TYPE[1]	
Remedial: Scoping, RI/FS, Risk Assessment, Proposed Plan, ROD, RD/RA, Presumptive Remedy	✓
Post-Remedial: ESD, Amended ROD, Five-Year Review	✓
Removal: Non-time Critical, Time-Critical, Streamlined	--[2]
SACM	✓
RCRA Corrective Action[3]	--[2]

Notes:
1 The *RAGS Part D* Workgroup also suggests that *RAGS Part D* could be a useful tool for quantitative risk assessment for non-NPL, BRAC, and Brownfields sites and encourages its use.
2 *RAGS Part D* use is encouraged as appropriate.
3 As described in the September 1996 EPA memorandum on Coordination Between RCRA Corrective Action and Closure and CERCLA Site Activities, EPA is "...committed to the principle of parity between the RCRA corrective action and CERCLA programs...".

Implementation of the *RAGS Part D* Approach

In FY 98, each region will identify *RAGS Part D* phase-in schedules on a site-by-site basis using the guidelines presented above. The Standard Tools (*TARA*, *Standard Tables*, and *Instructions for the Standard Tables*) are for immediate use. Field testing and evaluation of *RAGS Part D* will take place during the remainder of FY 98 in all regions. Modifications to *RAGS Part D* will be made as necessary during FY 98 and in FY 99 in response to evaluation results and to address new human health risk assessment guidance, as appropriate.

We are attaching the list of *RAGS Part D* Workgroup members and a Quick Reference Fact Sheet, *Frequently Asked Questions: RAGS Part D*, to aid you and your staff in implementation of this directive. The Workgroup member in your region has multiple copies of *RAGS Part D*, including all Standard Tools and diskettes. These are also available to you on the Intranet, and to the public on the Internet at the following location:

http://www.epa.gov/superfund/oerr/techres/ragsd/ragsd.html

Training on *RAGS Part D* will be provided in each region in FY 98. Additional information will be forthcoming regarding training schedules.

If you have questions about *RAGS Part D* or its implementation, please contact Jim Konz, leader of the *RAGS Part D* Workgroup, at 703-603-8841, or David Bennett, Senior Process Manager for Risk, at 703-603-8759.

Attachments

cc: Members of *RAGS Part D* Workgroup

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If you are interested in being on a mailing list for notification of revisions and updates to the RAGS Part D guidance document, please complete the following information, and indicate whether you want to be notified by surface mail or by e-mail. Alternatively, you can go to the RAGS Part D website at http://www.epa.gov/superfund/oerr/techres/ragsd/ragsd.html.

The notifications will contain information on how to access the document revisions and updates.

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Please provide any comments you may have in the space below, or via the Internet at the RAGS Part D website at http://www.epa.gov/superfund/oerr/techres/ragsd/ragsd.html.

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Emergency Response

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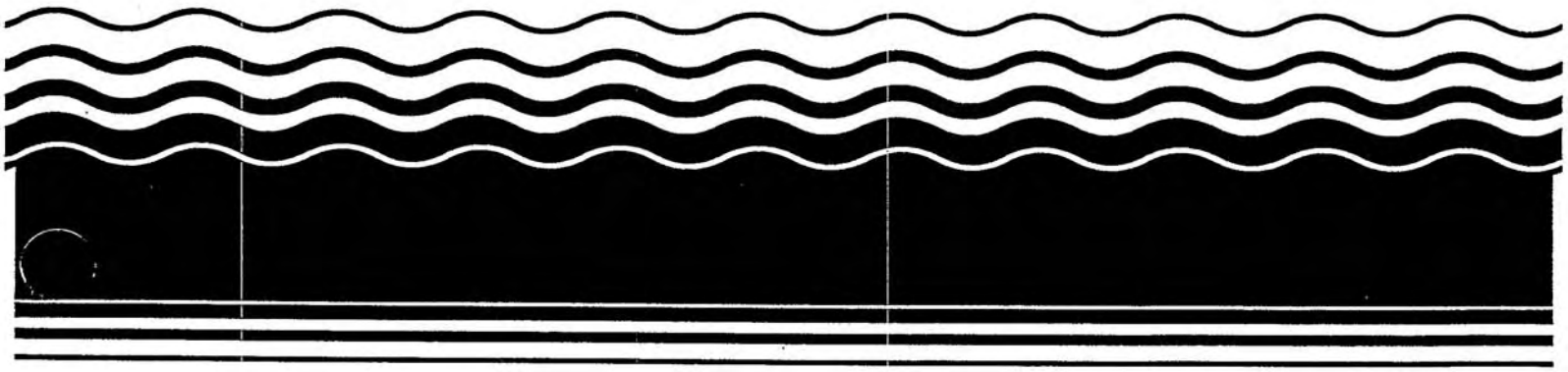
Superfund

EPA

Risk Assessment Guidance for Superfund:

Volume 1 - Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments)

Interim



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Risk Assessment Guidance for Superfund: Volume I Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments)

Interim

Office of Emergency and Remedial Response
U.S. Environmental Protection Agency
Washington, DC 20460

NOTICE

This document provides guidance to EPA staff. The guidance is designed to communicate National policy on the planning, reporting and review of Superfund risk assessments. The document does not, however, substitute for EPA's statutes or regulations, nor is it a regulation itself. Thus, it cannot impose legally-binding requirements on EPA, States, or the regulated community, and may not apply to a particular situation based upon the circumstances. EPA may change this guidance in the future, as appropriate.

This guidance is based on the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), which was published on March 8, 1990 (55 *Federal Register* 8666). The NCP should be considered the authoritative source.

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EXHIBITS

Exhibit **Page**

DEFINITIONS

Term	Definition
Applicable or Relevant and Appropriate Requirements (ARARs)	"Applicable" requirements are those clean-up standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site. "Relevant and appropriate" requirements are those clean-up standards which, while not "applicable" at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site. ARARs can be action-specific, location-specific, or chemical-specific.
CERCLIS 3	The newest version of the Comprehensive Environmental Response, Compensation, and Liability Information System, EPA's primary Superfund database. CERCLIS 3 enables Superfund staff nationwide to share comprehensive and reliable data across EPA and eventually with other federal partners and the public.
Conceptual Site Model	A "model" of a site developed at scoping using readily available information. Used to identify all potential or suspected sources of contamination, types and concentrations of contaminants detected at the site, potentially contaminated media, and potential exposure pathways, including receptors. This model is also known as "conceptual evaluation model."
Deterministic Analysis	Calculation and expression of health risks as single numerical values or "single point" estimates of risk. In risk assessments, the uncertainty and variability are discussed in a qualitative manner.
EPA Risk Assessor	The risk assessor responsible for reviewing the risk assessment on behalf of EPA. The individual may be an EPA employee or contractor, a State employee, or some other party, as appropriate for an individual site.

DEFINITIONS (Continued)

Term	Definition
Exposure Medium	The contaminated environmental medium to which an individual is exposed. Includes the transfer of contaminants from one medium to another.
Exposure Pathway	The course a chemical takes from the source to the exposed individual. An exposure pathway analysis links the sources, locations, and types of environmental releases with population locations and activity patterns to determine the significant pathways of human exposure.
Exposure Point	An exact location of potential contact between a person and a chemical within an exposure medium.
Exposure Point Concentration	The value that represents a conservative estimate of the chemical concentration available from a particular medium or route of exposure. See definitions for Medium EPC and Route EPC, which follow.
Exposure Route	The way a chemical comes in contact with a person (e.g., by ingestion, inhalation, dermal contact).
Interim Deliverables	A series of Standard Tables, Worksheets, and Supporting Information, identified in the Workplan for each site, that should be developed by the risk assessment author, and evaluated by the EPA risk assessor, prior to development of the Draft Baseline Risk Assessment Report. After review and revision, as necessary, these documents should be included in the Baseline Risk Assessment Report. The Standard Tables should be prepared for each site to achieve standardization in risk assessment reporting. The Worksheets and Supporting Information should also be prepared to further improve transparency, clarity, consistency, and reasonableness of risk assessments.
Medium	The environmental substance (e.g, air, water, soil) originally contaminated.
Medium EPC	The EPC, based on either a statistical derivation of measured data or modeled data. The Medium EPC differs from the Route EPC in that the Medium EPC does not consider the transfer of contaminants from one medium to another.

DEFINITIONS (Continued)

Term	Definition
Preliminary Remediation Goals (PRGs)	Initial clean-up goals that (1) are protective of human health and the environment and (2) comply with ARARs. They are developed early in the remedy selection process based on readily available information and are modified to reflect results of the baseline risk assessment. They also are used during analysis of remedial alternatives in the remedial investigation/feasibility study (RI/FS).
Probabilistic Analysis	Calculation and expression of health risks using multiple risk descriptors to provide the likelihood of various risk levels. Probabilistic risk results approximate a full range of possible outcomes and the likelihood of each, which often is presented as a frequency distribution graph, thus allowing uncertainty or variability to be expressed quantitatively.
Risk Assessment Author	The risk assessor responsible for preparing the risk assessment. This individual may be an EPA employee or contractor, a State employee, a PRP employee or contractor, or some other party, as appropriate for an individual site.
Receptor Age	The description of the exposed individual as defined by the EPA region or dictated by the site.
Receptor Population	The exposed individual relative to the exposure pathway considered.
Route EPC	The EPC, based on either a statistical derivation of measured data or based on modeled data, that was selected to represent the route-specific concentration for the exposure calculations. The Route EPC differs from the Medium EPC in that the Route EPC may consider the transfer of contaminants from one medium to another, where applicable for a particular exposure route.
Scenario Timeframe	The time period (current and/or future) being considered for the exposure pathway.

DEFINITIONS (Continued)

Term	Definition
Standard Tables	One of the Standard Tools under the RAGS Part D approach. The Standard Tables have been developed to clearly and consistently document important parameters, data, calculations, and conclusions from all stages of human health risk assessment development. Electronic templates for the Standard Tables have been developed in LOTUS® and EXCEL® for ease of use by risk assessors. For each site-specific risk assessment, the Standard Tables, related Worksheets, and Supporting Information should first be prepared as Interim Deliverables for EPA risk assessor review, and should later be included in the Draft and Final Baseline Risk Assessment Reports. The Standard Tables may be found in Appendix A and on the electronic media provided with this guidance document. Use of the Standard Tables will standardize the reporting of human health risk assessments. The Standard Table formats can not be altered (i.e., columns can not be added, deleted, or changed); however, rows and footnotes can be added as appropriate. Standardization of the Tables is needed to achieve Superfund program-wide reporting consistency and to accomplish electronic data transfer to the Superfund database.
Standard Tools	A basic element of the RAGS Part D approach. The Standard Tools have been developed to standardize the planning, reporting, and review of Superfund risk assessments. The three Standard Tools contained in the Part D approach include the Technical Approach for Risk Assessment (TARA), the Standard Tables, and Instructions for the Standard Tables.
Supporting Information	Information submissions that substantiate or summarize detailed data analysis, calculations, or modeling and associated parameters and assumptions. Examples of recommended Supporting Information include: derivations of background values, exposure point concentrations, modeled intakes, and chemical-specific parameters. Supporting Information should be provided as Interim Deliverables for EPA risk assessor review prior to the development of the Draft Baseline Risk Assessment Report.

DEFINITIONS (Continued)

Term	Definition
Technical Approach for Risk Assessment (TARA)	One of the Standard Tools under the RAGS Part D approach. The TARA is a road map for incorporating continuous involvement of the EPA risk assessor throughout the CERCLA remedial process. Risk-related activities, beginning with scoping and problem formulation, extending through collection and analysis of risk-related data, and supporting risk management decision making and remedial design/remedial action issues are addressed. The TARA should be customized for each site and the requirements identified should be included in project workplans so that risk assessment requirements and approaches are clearly defined. Chapters 2 through 5 of Part D present the TARA.
Worksheets	Formats for documenting assumptions, input parameters, and conclusions regarding complex risk assessment issues. The Data Useability Worksheet (found in Exhibit 3-3) should be an Interim Deliverable for all sites. Worksheets addressing Lead and Radionuclides are under development and will be provided in a revision to RAGS Part D.

ACRONYMS/ABBREVIATIONS

Acronym/ Abbreviation	Definition
ARARs	Applicable or Relevant and Appropriate Requirements
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CERCLIS 3	Version 3 of Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS)
COPCs	Chemicals of Potential Concern
CSF	Cancer Slope Factor
CT	Central Tendency
CWA	Clean Water Act
DQOs	Data Quality Objectives
EPA	U.S. Environmental Protection Agency
EPC	Exposure Point Concentration
ESD	Explanation of Significant Differences
FS	Feasibility Study
FY	Fiscal Year
GAO	General Accounting Office
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HQ	Hazard Quotient
IEUBK	Integrated Exposure Uptake Biokinetic Model
IRIS	Integrated Risk Information System
MCLs	Maximum Contaminant Levels
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan
NPL	National Priority List
non-TCL	non-Target Compound List
OSWER	Office of Solid Waste and Emergency Response
PAHs	Polynuclear Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PQLs	Procedure Quantitation Limits
PRGs	Preliminary Remediation Goals
PRP	Potentially Responsible Party
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAGS	*Risk Assessment Guidance for Superfund*
RAGS/HHEM	*Risk Assessment Guidance for Superfund: Volume I -- Human Health Evaluation Manual*
RAOs	Remedial Action Objectives
RfC	Reference Concentration
RfD	Reference Dose
RI/FS	Remedial Investigation/Feasibility Study

ACRONYMS/ABBREVIATIONS (Continued)

Acronym/ Abbreviation	Definition
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
ROD	Record of Decision
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
SDWA	Safe Drinking Water Act
TARA	Technical Approach for Risk Assessment
UCL	Upper Confidence Level
UTL	Upper Tolerance Limit

ACKNOWLEDGMENTS

This manual was developed by EPA's Office of Emergency and Remedial Response. A large number of EPA regional technical staff (see below) participated in the Workgroup that developed the RAGS Part D approach presented in this manual.

CDM Federal Programs Corporation provided technical assistance to EPA in the development of this manual, under contract No. 68-W9-0056.

RAGS PART D WORKGROUP

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Region 10:	Dana Davoli

PREFACE

Risk Assessment Guidance for Superfund: Volume I -- Human Health Evaluation Manual (RAGS/HHEM) Part D is the fourth part in the series of guidance manuals on Superfund human health risk assessment. Part A addresses the baseline risk assessment; Part B addresses the development of risk-based preliminary remediation goals; and Part C addresses the human health risk evaluations of remedial alternatives. Part D provides guidance on standardized risk assessment planning, reporting, and review throughout the CERCLA remedial process, from scoping through remedy selection and completion and periodic review of the remedial action. Thus, Part D strives for effective and efficient implementation of Superfund risk assessment practice described in Parts A, B, and C, and in supplemental Office of Solid Waste and Emergency Response (OSWER) directives. The potential users of Part D are persons involved in the risk evaluation, remedy selection, and implementation process, including risk assessors, risk assessment reviewers, remedial project managers, and other decision-makers.

This guidance does not discuss the standardization of ecological risk assessments, nor does it discuss the risk management decisions that are necessary at a CERCLA site (e.g., selection of final remediation goals).

This manual is being distributed as an interim document to allow for a period of field testing and evaluation. In addition, EPA is developing standardized approaches to plan, report and review:

- lead risks;
- radionuclide risks; and
- probabilistic analyses.

These will be issued as future revisions of RAGS Part D. In addition, EPA will provide standard tables for ecological evaluation.

RAGS/HHEM will be revised in the future, and new documents in appropriate print and electronic format will be issued.

Comments addressing usefulness, changes, and additional areas where guidance is needed should be addressed to the RAGS Part D website at http://www.epa.gov/superfund/oerr/techres/ragsd/ragsd.html, or to:

Senior Process Manager for Risk
RAGS Part D
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CHAPTER 1

INTRODUCTION

This guidance has been developed by the U.S. Environmental Protection Agency (EPA) to assist remedial project managers (RPMs), risk assessors, site engineers, and others in standardizing risk assessment planning, reporting, and review at Comprehensive Environmental Response Compensation and Liability Act (CERCLA) sites. This guidance could also be a useful tool for quantitative risk assessment for non-NPL, BRAC, and Brownfields sites.

This guidance is the fourth part (Part D) in the series *Risk Assessment Guidance for Superfund: Volume I -- Human Health Evaluation Manual* (RAGS/HHEM). Part A of this guidance describes how to conduct a site-specific baseline risk assessment: the information in Part A is necessary background for Part D. Part B provides guidance for calculating risk-based concentrations that may be used, along with applicable or relevant and appropriate requirements (ARARs) and other information, to develop preliminary remediation goals (PRGs) during project scoping. PRGs (and final remediation levels set in the Record of Decision [ROD]) can be used throughout the analyses in Part C to assist in evaluating the human health risks of remedial alternatives. Part D complements the guidance provided in Parts A, B, and C and presents approaches to standardize risk assessment planning, reporting, and review. Part D guidance spans the CERCLA remedial process from project scoping to periodic review of the implemented remedial action. Exhibit 1-1 illustrates the major correspondence of RAGS/HHEM activities with the steps in the CERCLA remedial process.

The remainder of this chapter:

- presents an overview of Part D, including the background and elements of the Part D approach;
- describes the applicability of Part D;
- discusses process improvements expected as a result of Part D;
- presents the organization of the remainder of this document; and
- describes where to find additional information regarding Part D.

1.1 OVERVIEW OF PART D

1.1.1 BACKGROUND

The March 21, 1995, memorandum on Risk Characterization Policy and Guidance from EPA Administrator Browner directed improvement in the transparency, clarity, consistency, and reasonableness of risk assessments at EPA. EPA, over the years, has identified opportunities for improvement in presentation of Superfund risk assessments. Furthermore, the General Accounting Office (GAO), members of Congress, and others have called for betterment of Superfund risk assessments. The October 1995 Superfund Administrative Reform #6A directed EPA to: Establish National Criteria to Plan, Report, and Review Superfund Risk Assessments. EPA has developed an approach to respond to these challenges, which is presented in RAGS Part D.

1.1.2 ELEMENTS OF PART D APPROACH

The *Risk Assessment Guidance for Superfund* (RAGS) Part D approach consists of three basic elements: Use of Standard Tools, Continuous Involvement of EPA Risk Assessors, and Electronic Data Transfer to a National Superfund Database. Brief descriptions of the three components follow:

- **Use of Standard Tools** - The Standard Tools developed by the EPA RAGS Part D Workgroup and refined through regional review include a Technical Approach for Risk Assessment or TARA, Standard Tables, and Instructions for the Standard Tables.

EXHIBIT 1-1
RELATIONSHIP OF THE HUMAN HEALTH EVALUATION TO THE CERCLA PROCESS

-- The Technical Approach for Risk Assessment (TARA) is a road map for incorporating continuous involvement of the EPA risk assessor throughout the CERCLA remedial process for a particular site. Risk-related activities, beginning with scoping and problem formulation, extending through collection and analysis of risk-related data, and supporting risk management decision making and remedial design/remedial action issues are addressed.

  Chapters 2 through 5 of this guidance document present the TARA in the four CERCLA remedial process phases: During Scoping, During the Remedial Investigation, During the Feasibility Study, and After the Feasibility Study. It is recommended that the requirements identified in the TARA in Chapters 2 through 5 be customized for each site-specific human health risk assessment, as appropriate. These requirements should be included in project workplans so that risk assessment requirements are clearly defined and standardized planning will occur.

-- The Standard Tables have been developed to clearly and consistently document important parameters, data, calculations, and conclusions from all stages of human health risk assessment development. Electronic templates for the Standard Tables have been developed in LOTUS® and EXCEL® for ease of use by risk assessors. For each site-specific risk assessment, the Standard Tables, related Worksheets, and Supporting Information should first be prepared as Interim Deliverables for EPA risk assessor review, and should later be included in the Draft and Final Baseline Risk Assessment Reports. The Standard Tables may be found in Appendix A and on electronic media provided with this guidance document. Use of the Standard Tables will standardize the reporting of human health risk assessments.

-- Instructions for the Standard Tables have been prepared corresponding to each row and column on each Standard Table. Definitions of each field are supplied in the Glossary and example data or selections for individual data fields are provided. The Instructions should be used to complete and/or review Standard Tables for each site-specific human health risk assessment. The Instructions may be found in Appendix B and on electronic media provided with this document.

- **Continuous Involvement of EPA Risk Assessors** - The EPA risk assessor is a critical participant in the CERCLA remedial process for any site, from scoping through completion and periodic review of the remedial action. EPA risk assessors support reasonable and consistent risk analysis and risk-based decision making. Early and continuous involvement by the EPA risk assessors should include scoping, workplan review, and customization of the TARA for each site to identify all risk-related requirements. The EPA risk assessors will review Interim Deliverables and identify corrections needed prior to preparation of the Draft and Final Baseline Risk Assessment Reports. Participation of the EPA risk assessors in all other phases of the CERCLA remedial process will ensure human health risk issues are appropriately incorporated in the remedy selection and implementation processes.

- **Electronic Data Transfer to a National Superfund Database** - Summary-level site-specific risk information will be stored in a National Superfund database (i.e., CERCLIS 3) to provide data access and data management capabilities to all EPA staff. The CERCLIS 3 risk-related summary data represent a subset of the data presented in the Standard Tables. The electronic versions of the Standard Tables (LOTUS® and EXCEL®) are structured to be compatible with CERCLIS 3. Translation software is under development to transfer data from the Standard Tables to CERCLIS 3, and no additional data entry should be required in the regions to fulfill the CERCLIS 3 risk data requirements.

1.2 APPLICABILITY OF PART D APPROACH

The approach contained in RAGS Part D is recommended for all risk assessments commencing after the issuance of Part D. The use of Part D is also encouraged in on-going risk assessments to the extent it can efficiently be incorporated into the risk assessment process. Part D is not applicable to completed risk assessments.

Exhibit 1-2 provides guidelines regarding RAGS Part D applicability as a function of site lead and site type, so that site-specific applicability may be defined by each region.

1.3 PROCESS IMPROVEMENTS RESULTING FROM PART D APPROACH

The RAGS Part D approach provides numerous advantages over current practices in the Superfund program at both the site level and the overall Superfund program level. Several of these advantages are discussed in Exhibit 1-3.

A brief discussion of the process improvements associated with each RAGS Part D element follows:

- **Use of Standard Tools** - Standard Tools will facilitate planning with TARA, reporting with Standard Table formats, and reviewing with Interim Deliverables. The Standard Tools will provide consistent content and clarity of data, parameters, and assumptions. Transparency for the public and others to understand the risk assessment will be improved by the Standard Tables, and review will be facilitated because the basis for conclusions will be clear. Because Interim Deliverables are integral parts of the baseline risk assessment, their early review and resolution by EPA risk assessors will minimize rework and may reduce project schedules and budgets, while improving consistency.

- **Continuous Involvement of EPA Risk Assessor** - Involvement of the EPA risk assessor throughout the CERCLA remedial process will result in holistic consideration of risk issues during scoping and will ensure that appropriate and adequate data are collected. Planning for special evaluations can also be conducted efficiently at project inception rather than at a later point with associated schedule delays and additional costs. Ongoing review of Interim Deliverables by the EPA risk assessor will provide direction regarding reasonable assumptions and eliminate rework requirements, particularly for those deliverables that build on previous analyses (e.g., the Baseline Risk Assessment Report).

  At later stages of the project (e.g., after the feasibility study), continuous involvement of the EPA risk assessor will promote reasonableness and consistency in risk management decision-making by clearly providing risk managers with the information they need.

- **Electronic Data Transfer to National Superfund Database** - Through submission of electronic Standard Tables, CERCLIS 3 risk data reporting requirements will be met electronically. Additional data entry should not be required by EPA or contractor risk assessors. Submission of the risk data to CERCLIS 3 will also fulfill the review objectives of Superfund Administrative Reform #6A by providing risk data access to EPA and the public. Use of the data by EPA risk assessors will improve consistency in future risk assessments.

1.4 ORGANIZATION OF DOCUMENT

The remainder of this guidance is organized into four additional chapters and three appendices as follows:

- Chapter 2: Risk Considerations During Project Scoping;

EXHIBIT 1- 2
GUIDELINES FOR PART D APPLICABILITY

SITE LEAD	PART D APPLICABLE
Fund Lead	✓
Federal Facility Lead	✓
PRP Lead	✓
State Lead	✓
SITE TYPE[1]	
Remedial: Scoping, RI/FS, Risk Assessment, Proposed Plan, ROD, RD/RA, Presumptive Remedy	✓
Post-Remedial: ESD, Amended ROD, Five-Year Review	✓
Removal: Non-time Critical, Time-Critical, Streamlined	--[2]
SACM[3]	✓
RCRA Corrective Action[4]	--[2]

Notes:

1 The RAGS Part D Workgroup also suggests that RAGS Part D could be a useful tool for quantitative risk assessment for non-NPL, BRAC, and Brownfields sites and encourages its use.

2 RAGS Part D use is encouraged as appropriate.

3 Superfund Accelerated Cleanup Model.

4 As described in the September 1996 EPA memorandum on Coordination Between Resource Conservation and Recovery Act (RCRA) Corrective Action and Closure and CERCLA Site Activities, EPA is "...committed to the principle of parity between the RCRA corrective action and CERCLA programs...".

EXHIBIT 1-3
PROCESS IMPROVEMENTS EXPECTED WITH PART D APPROACH

PROCESS IMPROVEMENTS	RAGS PART D APPROACH	CURRENT PRACTICES
SITE LEVEL		
1--Interim Deliverables increase the likelihood that risk assessments are reasonable, transparent, and acceptable.	Planning, submission, and EPA review of Interim Deliverables will clarify requirements and assumptions, promote reasonableness, and minimize rework.	For some sites, only the end product is now reviewed. This often results in longer schedules and higher costs due to rework requirements.
2--Continuous Involvement of EPA risk assessors improves consistency between project phases, and provides real-time review of risk assessment deliverables.	Continuous involvement of EPA risk assessors beyond the RI/risk assessment will improve and document consistency between the risk assessment and subsequent phases (FS, Proposed Plan, ROD, RD, RA, ESD, and Five-Year Reviews).	Current EPA risk assessor involvement is often limited after the RI/risk assessment and may result in inconsistent approaches in different project phases, a highly criticized aspect of the Superfund program.
3--Clarity of Standard Tables presentation promotes easy use in risk management decisions.	Easy to follow (transparent and clear) standardized risk assessments will maximize understanding and minimize misinterpretation by risk managers and other non-risk assessors.	The current use of non-standardized risk assessments by risk managers and other non-risk assessors may lead to misunderstanding and misinterpretation of information.
4--Electronic data transfer simplifies CERCLIS 3 data entry.	Data transfer from Standard Tables to CERCLIS 3 will be electronic and QC will require less time.	Entry of risk data into CERCLIS 3 (through screens) will be time consuming and will require skilled risk assessors to enter and QC data.
PROGRAM LEVEL		
5--Easy risk information access promotes Superfund program consistency.	Data presentation in Standard Table format will provide efficient access to assumptions and information from other risk assessments, promoting consistency.	Tedious research into individualized text-based risk assessments is currently required to access site-specific assumptions and other information.
6--More efficient EPA risk assessor review improves Superfund program quality.	EPA staff will be able to conduct better reviews of risk assessment deliverables with less time and effort, due to clear standard presentation of Interim Deliverables.	EPA staff currently selectively review risk assessment deliverables due to extensive volume, complexity, and variability of non-standard risk assessments.
7--Transparency of risk information facilitates Superfund program-level risk management evaluations.	Data availability for program management use will be simplified because all assumptions and results will be clearly documented.	Program management requests currently require extensive research by regional staff, often conflicting with other priorities.

- Chapter 3: Risk Assessment Data Needs and Tasks During the Remedial Investigation;
- Chapter 4 Risk Evaluations During the Feasibility Study;
- Chapter 5: Risk Evaluations After the Feasibility Study;
- Appendix A: Standard Tables
- Appendix B: Instructions for Completion of Standard Tables
- Appendix C: Data Useability Worksheet.

In addition, other useful information has been presented in highlight boxes placed throughout the document.

Exhibit 1-4 depicts the continuous involvement of the EPA risk assessor during scoping, during the remedial investigation, and during and after the feasibility study. The various activities the risk assessor conducts are listed, as well as the Part D chapter that addresses that phase.

1.5 ADDITIONAL INFORMATION

This guidance will be updated periodically in response to user comments and suggestions and to address new human health risk assessment guidance as appropriate. The loose-leaf format of the document has been specifically designed to conveniently accommodate revisions.

A RAGS Part D mailing list will be compiled for all interested users. Please complete and mail the card at the back of the Part D package to register for the Part D mailing list for automatic notification of availability of future updates.

In addition to the guidance document, the Part D guidance and corresponding information may be accessed electronically on the RAGS Part D website, at http://www.epa.gov/superfund/oerr/techres/ragsd/ragsd.html. Updates to Part D will also appear on the website along with an index of the current version of each Chapter or Appendix.

Questions or comments regarding Part D usage should be directed to your EPA regional risk assessor or to the EPA RAGS Part D Workgroup through the RAGS Part D website. Questions or comments received through the website will be considered by the Workgroup and a response will be developed and forwarded via telephone or email as appropriate. Frequently asked questions will be assembled and displayed on the website with corresponding responses to provide Part D user support.

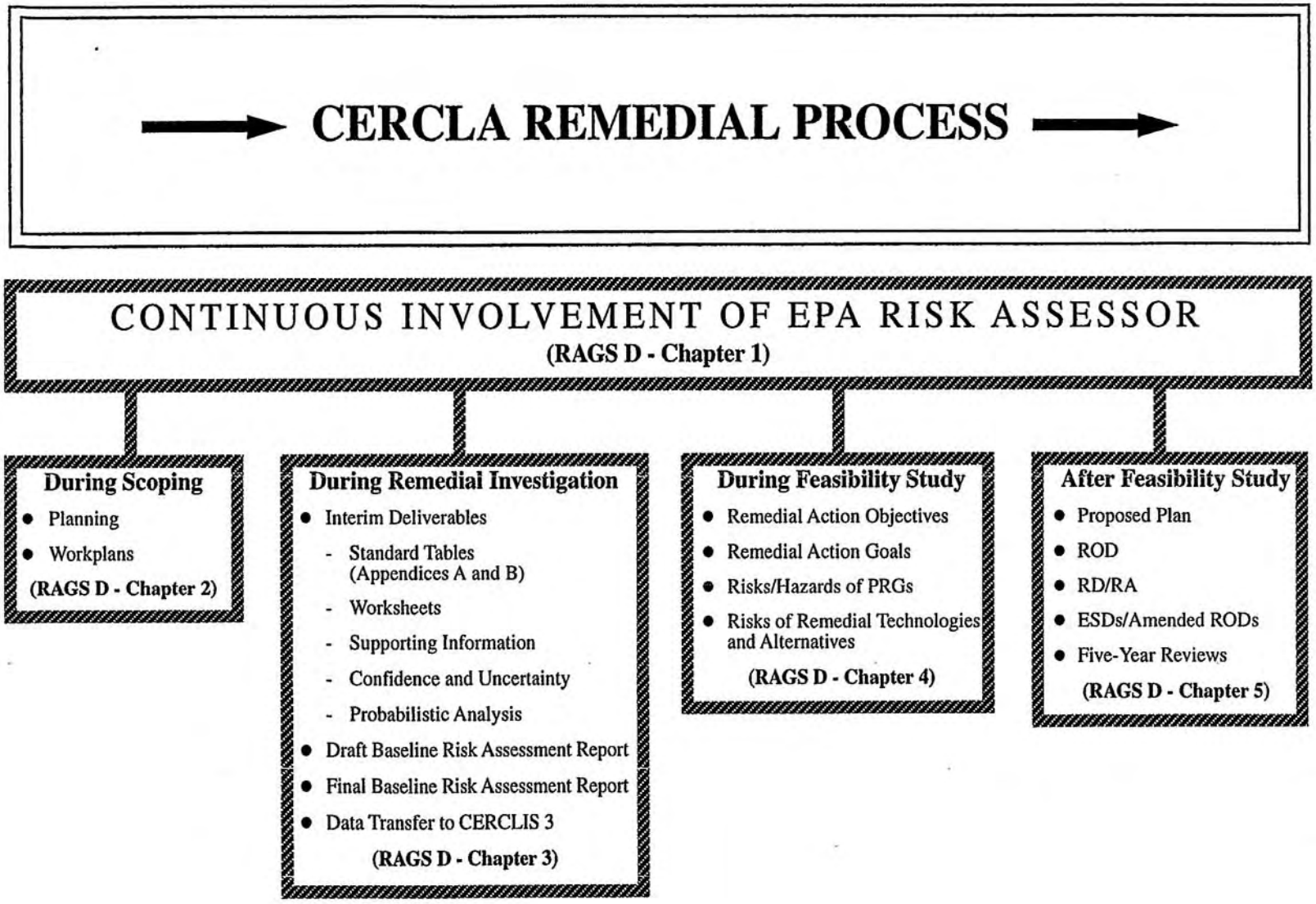

EXHIBIT 1-4
ROLE OF RISK ASSESSOR IN THE CERCLA REMEDIAL PROCESS

CHAPTER 2

RISK CONSIDERATIONS DURING PROJECT SCOPING

The project scoping stage of the remedial investigation (RI) and baseline risk assessment is critical to the success of a Superfund project. The EPA risk assessor should be involved in the project scoping discussions and meetings to ensure that the planning and workplan development tasks incorporate risk assessment data needs and achieve standardization in risk assessment planning.

2.1 PLANNING

The following planning activities should be performed at the beginning of the project. These activities should involve the EPA remedial project manager and EPA risk assessor, as decision-makers, and the risk assessment author and other resources tasked with preparing the Remedial Investigation Report, to support planning. Pertinent information should be incorporated, as appropriate, into the Remedial Investigation Report or Site Characterization Report and the Baseline Risk Assessment Report:

- Provide site background information, site maps, sample location map; discuss historical site activity and chronology of land use.
- Discuss historical data and data useability, previous studies and actions, and an overview of the nature and extent of contamination.
- Discuss the purpose of the investigation.
- Prepare the preliminary site conceptual model which clearly identifies all potential sources of contamination (soil, groundwater, surface water, leachate, air, etc.), release mechanisms, and receptor routes and identifies all potential pathways (including secondary pathways) and the media and receptors associated with each.
- Discuss PRGs and ARARs for the site.

WHEN PREPARING THE SITE CONCEPTUAL MODEL, CONSIDER THE FOLLOWING:

- sensitive populations, including but not limited to the elderly, pregnant or nursing women, infants and children, and people suffering from chronic illnesses
- people exposed to particularly high levels of contaminants
- circumstances where a disadvantaged population is exposed to hazardous materials (i.e., Environmental Justice situations)
- significant contamination sources
- potential contaminant release mechanisms (e.g., volatilization, fugitive dust emission, surface runoff/overland flow, leaching to groundwater, tracking by humans/animals, soil gas generation, biodegradation and radioactive decay)
- contaminant transport pathways such as direct air transport downwind, diffusion in surface water, surface water flow, groundwater flow, soil gas migration, and biomagnification in the food chain
- cross media transfer effects, such as volatilization to air, wet deposition, dry deposition, groundwater discharge to surface water, groundwater recharge from surface water, and bioaccumulation by aquatic species.

- Involve the risk assessor in discussions with the stakeholders concerning land use, groundwater use, and exposure pathways and variables. If possible, the risk assessor should also visit the site.
- Identify deliverables (Interim, Draft, and Final) for the risk assessment. Interim Deliverables

should include: Standard Tables 1 through 10; Worksheets on Data Useability, Lead, and Radionuclides (as applicable); Supporting Information as described in Chapter 3.1.1, the Assessment of Confidence and Uncertainty, and Probabilistic Analysis information. Draft and Final Deliverables include the Draft and Final Baseline Risk Assessment Reports, which also incorporate the Interim Deliverables.

- Prepare a preliminary version of Standard Table 1.

- During project scoping the EPA remedial project manager and EPA risk assessor should also meet to discuss the potential need for including a Probabilistic Analysis in the RI. Consider the following: extent of site remediation, potential costs of remediation, degree of uncertainty associated with the exposure information available for each portion of the site conceptual model, value added in the decision-making process, etc. This preliminary discussion is necessary to determine whether funds should be allocated to carry out a Probabilistic Analysis. This decision should be revisited throughout Workplan development and the risk assessment process.

2.2 WORKPLAN DEVELOPMENT

Tasks to be conducted during the remedial investigation/feasibility study (RI/FS) are identified and documented in several workplans. These usually include the RI/FS Workplan, a Sampling and Analysis Plan (SAP), and a Quality Assurance Project Plan (QAPP). Tasks related to development of the baseline risk assessment are sometimes presented in a separate Risk Assessment Workplan or incorporated into the RI/FS Workplan.

Risk assessment needs should be considered not only in tasks related to development of the baseline risk assessment but also in tasks related to sampling and analysis (i.e., those in the SAP and

the QAPP) in the RI and tasks needing risk assessment input in the feasibility study (FS) (e.g., development of remedial goals and estimates of potential risk from remediation options).

2.2.1 RI/FS WORKPLAN/BASELINE RISK ASSESSMENT WORKPLAN

The RI/FS Workplan summarizes site background, the current and potential problems posed by site contaminants, and the objectives and scope of the RI/FS. It also includes a description of the tasks to be performed and the information and work products that will be produced from each task. Deliverables for specific tasks are included. Tasks and deliverables for the baseline risk assessment may be included as a part of the RI/FS Workplan or in a separate Risk Assessment Workplan.

Within these Workplans, it should be clear that risk assessment needs are being considered in the RI/FS objectives. The site-specific objectives and scope of the risk assessment should be included in the Workplan. This includes information needed to complete the baseline risk assessment in the RI as well as information needed for the FS, such as that needed to develop risk-based remedial goals (e.g., PRGs), and to assess risks from remediation (e.g., incineration).

These Workplans should also reference the methods (e.g., National guidance such as RAGS/HHEM**)**, that will be used to prepare the Interim, Draft, and Final risk assessment deliverables and define the schedule for submission. These deliverables are described in more detail in Chapter 3. Deliverables related to development of risk-based remedial goals and assessment of risk from remediation should also be included in the Workplan (see Chapter 4).

The EPA risk assessor and EPA remedial project manager should revisit the question of the potential value added by using Probabilistic Analyses in the risk assessment. If these analyses are to be used, the issues concerning the time, expense, and possible benefit associated with the collection of additional exposure information or sampling data should be considered to identify

those exposure parameters with the greatest uncertainty where collection of additional data and/or information may be warranted.

2.2.2 SAP AND QAPP

Sampling and analysis activities undertaken during the RI should provide adequate data to evaluate all appropriate exposure pathways. Therefore, risk assessors should be involved in the development of the data quality objectives (DQOs) for sampling and analysis and in selecting the types of sampling and analyses that will be done. The DQOs should address the qualitative and quantitative nature of the sampling data in terms of relative quality and intent for use, to ensure that the data collected will be appropriate for the intended objectives.

Sampling. The SAP should discuss how the types, numbers, and locations of samples to be collected will be adequate to evaluate each exposure pathway (both current and future) and medium. The SAP should be accompanied by detailed sampling maps showing the location and type of samples (e.g., grab, composite, or duplicate). It is important to consider how sample results will be used to estimate exposure point concentrations. Background samples should be collected from appropriate areas (e.g., areas proximate to the site, free of potential contamination by site chemicals and similar to the site in topography, geology, meteorology, and other characteristics).

If models will be used to evaluate exposure pathways and estimate exposure point concentrations, these models should be identified in the Workplan. Site-specific data collection needed for these models should also be discussed.

Analysis. Development of the DQOs for analysis should not be limited to concern for the precision, accuracy, representativeness, completeness, and comparability of the data. DQOs that are important for risk assessment should consider: types of laboratory analyses used, sensitivity of detection limits of the analytical techniques (especially for non-Target Compound List [non-TCL] chemicals and non-standard matrices), resulting data quality, and the employment of adequate quality assurance/quality control (QA/QC) measures.

In some cases, risk assessment data needs may be best supported by additional chemicals, different analytical methods, and/or lower detection limits than are being used for the RI. Based upon the values of the risk-based PRGs calculated during scoping, detection limits may need to be lower than those obtained by the standard Superfund methods. The adequacy of detection limits for conducting the baseline risk assessment and for comparing to PRGs should be evaluated in the Workplan (QAPP). For example, a table listing expected contaminants and comparing the method detection limit or quantitation limit for each compound with the appropriate risk-based goal for that chemical could be presented. This information along with issues of cost and other data uses should affect the methods and detection limits finally selected.

Analytical data should be evaluated and reviewed in accordance with the criteria to evaluate data (i.e., the National Functional Guidelines). Also refer to your regional office for guidance on data validation and/or chemical-specific guidance, as applicable.

WHEN DEVELOPING THE SAP, CONSIDER THE FOLLOWING:

- How will data from multiple groundwater wells collected over time be used to calculate exposure?
- At what depths will soil samples be taken and how will they be combined to describe exposures for different scenarios (e.g., industrial versus residential) or to characterize hotspots?
- What type of sampling design (e.g., random versus purposive) will be used?
- Are SAPs adequate to distinguish site contamination from background contamination for each medium and for organic and inorganic parameters?

The Workplan should also discuss how split samples, duplicates, blanks (trip, field, and laboratory), and qualified and rejected data will be used in assessing site risks. The Workplan should describe the analysis for each medium and how the types of analyses were selected based on site history.

CHAPTER 3

RISK ASSESSMENT DATA NEEDS AND TASKS DURING THE REMEDIAL INVESTIGATION

Project Management Guidelines. Remedial project managers will establish the schedule of submission for the deliverables for the RI Reports and Baseline Risk Assessment Reports. The schedule may vary from site to site, as appropriate. Interested parties (States, Commonwealths, tribes and other stakeholders) may be involved in the scheduling and review process, as appropriate. Refer to your regional office for guidance regarding the order of the deliverables. These deliverables should also be defined in the Workplan.

General RI Guidelines. RI guidance should be followed in performing the remedial investigation. The following items are of particular importance to risk assessments. If the risk assessment is being prepared as a stand-alone document, the following items should be included. If, instead, the risk assessment is a section of the RI Report, the items which follow should be addressed in the RI Report and clearly referenced in the Baseline Risk Assessment Report.

- Present a general map of the site depicting boundaries and surface topography, which illustrates site features, such as fences, ponds, structures, as well as geographical relationships between potential receptors and the site.
- Discuss historical site activity.
- Discuss chronology of land use (specify agriculture, industry, recreation, waste deposition, and residential development at the site).
- Present an overview of the nature and extent of contamination, including when samples were collected and the kinds of contaminants and media potentially contaminated.
- Describe the analytical and data validation methods used.
- If modeling was used to estimate exposure point concentrations, document the parameters related to soil/sediment, hydrogeology, hydrology, and meteorology either in the risk assessment or the RI Report.

Risk Assessment Guidelines. The risk assessment should be conducted in accordance with all appropriate guidance and policies. Consult with your EPA regional risk assessor regarding the most appropriate guidance.

Interim Deliverables should be prepared as described in Chapter 3.1.1 and should ultimately be incorporated into the Baseline Risk Assessment Report. The Interim Deliverables prepared by the risk assessment author should be reviewed by the EPA risk assessor prior to submission of the Baseline Risk Assessment Report. Hazard identification and exposure parameters, among others, may require discussion, refinement, and revision. Review and modification of Interim Deliverables will greatly reduce the Baseline Risk Assessment Report preparation and review time. Discussions of the three categories of risk assessment deliverables (Interim Deliverables, Draft Baseline Risk Assessment Report, and Final Baseline Risk Assessment Report) follow. Transfer of risk assessment data to the CERCLIS 3 database is also addressed.

3.1 INTERIM DELIVERABLES

This section presents an outline of the Standard Tables, Worksheets, and Supporting Information that should be prepared as Interim Deliverables for each site. The Workplan discussed in Chapter 2.2.1 should also describe the Standard Tables, Worksheets, and Supporting Information for a particular site. Exhibit 3-1 presents a list of the Interim Deliverables. Use of these deliverables for each site should improve standardization in risk assessment reporting by improving the transparency, clarity, consistency, and reasonableness of risk assessments.

3.1.1 STANDARD TABLES, WORKSHEETS, AND SUPPORTING INFORMATION

Standardized reporting of Superfund human health risk assessments will be achieved through the preparation of Standard Tables, Worksheets, and Supporting Information. These documents should be prepared as Interim Deliverables and reviewed by the EPA risk assessor prior to preparation of the Baseline Risk Assessment Report. After review and revision, as necessary, these documents should be included in the Baseline Risk Assessment Report.

This section describes the ten Standard Table formats for use in all future risk assessments. The Standard Table formats can not be altered (i.e., columns can not be added, deleted, or changed); however, rows and footnotes can be added as appropriate. Standardization of the Tables is needed to achieve Superfund program-wide reporting consistency and to accomplish electronic data transfer to the Superfund database. Note that multiple versions of some Standard Tables may be needed to address different Media, different Exposure Pathways, or different Exposures (i.e., reasonable maximum exposure [RME] versus central tendency [CT]). Exhibit 3-2 summarizes the relationship between five traditional risk assessment activities and the corresponding Standard Tables that standardize risk assessment reporting. The five risk assessment activities follow:

- Data collection
- Data evaluation
- Exposure assessment
- Toxicity assessment
- Risk characterization.

Copies of the blank Standard Tables are provided in both LOTUS® and Excel® spreadsheet formats on the electronic media enclosed with Part D guidance. Blank Standard Table templates and completed examples of typical
Standard Tables are provided in Appendix A. Detailed Instructions for the completion of the Standard Tables are provided in Appendix B.

In addition to the Standard Tables, a Data Useability Worksheet is provided in Exhibit 3-3 in this chapter, as well as in Appendix C and on the electronic media. Worksheets to document Lead and Radionuclide risk calculations are under development and will be provided in a future update to Part D. Use of the Worksheets is strongly encouraged to improve transparency, clarity, consistency, and reasonableness.

The Standard Tables and Worksheets document the majority of the data and assumptions used to evaluate risk, as well as the risks and hazards calculated. In most cases, other data and rationale are used to support the information presented in the Standard Tables. This additional Supporting Information should also be provided to the EPA risk assessor as an Interim Deliverable and later incorporated in the Baseline Risk Assessment Report.

Descriptions of the Standard Tables, Worksheets, and Supporting Information follow:

STANDARD TABLE 1: Selection of Exposure Pathways. The purposes of **Standard Table 1** are:

- To assist in project planning
- To accompany the site conceptual model
- To present possible Receptors, Exposure Routes, and Exposure Pathways
- To present the rationale for selection or exclusion of each Exposure Pathway
- To communicate risk information to interested parties outside EPA.

The information documented in **Standard Table 1** includes:

- Exposure Pathways that were examined and excluded from analysis
- Exposure Pathways that will be evaluated qualitatively or quantitatively in the risk assessment.

The data elements presented in **Standard Table 1** are listed in the Standard Table 1 highlight box.

Perform the following steps associated with the preparation of **Standard Table 1**:

1. Refine site conceptual model which identifies all potential sources of contamination, all potential Exposure Pathways, the Medium associated with

each, and the potentially exposed populations (Receptors).

2. Select realistic Exposure Pathways for detailed analyses.

3. Include rationale for exclusion of potential Exposure Pathways.

4. **Modify Standard Table 1, if necessary.**

5. **Standard Table 1** should later be incorporated in the Baseline Risk Assessment Report.

DATA ELEMENTS IN
STANDARD TABLE 1

Provide the following information: Scenario Timeframe, Medium, Exposure Medium, Exposure Point, Receptor Population, Receptor Age, Exposure Route, On-site/Off-site, Type of Analysis, Rationale for Selection or Exclusion of Exposure Pathway.

DATA USEABILITY WORKSHEET. Data quality is an important component of the risk assessment and the evaluation of data quality should be documented. The Data Useability Worksheet is included to address this need.

The EPA risk assessor and the EPA document *Guidance for Data Useability in Risk Assessment (Part A,* EPA 1990a*),* should be consulted before completing the Data Useability Worksheet. This Worksheet should be prepared as soon as all data validation reports have been completed for each medium. A media-specific Data Useability Worksheet should be completed only after the project team (i.e., lead chemist, lead hydrogeologist, risk assessor, etc.) has collectively discussed the data useability criteria. The Worksheet should be used to record and identify the impact of data quality issues as they relate to data useability. For example, deviations from approved site Workplans which occurred during sample collection, laboratory analysis, or data review should be assessed. Also refer to your regional office for guidance on data validation when preparing the Worksheet.

- **Complete the Data Useability Worksheet** for each Medium prior to screening of chemicals of potential concern (COPCs).
- The **Data Useability Worksheet** should later be incorporated in the Baseline Risk Assessment Report.

STANDARD TABLE 2: Occurrence, Distribution, and Selection of COPCs. The purposes of **Standard Table 2** are:

- To provide information useful for data evaluation of chemicals detected
- To provide adequate information so the user/reviewer gets a sense of the chemicals detected at the site and the potential magnitude of the potential problems at the site
- To provide chemical screening data and rationale for selection of COPCs.

The information documented in **Standard Table 2** includes:

- Statistical information about chemicals detected in each Medium
- The detection limits of chemicals analyzed
- The toxicity screening values for COPC selection
- The chemicals selected and deleted as COPCs.

The data elements presented in **Standard Table 2** are listed in the Standard Table 2 highlight box.

Perform the following steps associated with the preparation of **Standard Table 2**. Refer to the regional office for guidance when performing these steps.

DATA ELEMENTS IN
STANDARD TABLE 2

For each unique combination of Scenario Timeframe, Medium, Exposure Medium, and Exposure Point, provide the following information: CAS Number, Chemical, Minimum Concentration, Minimum Qualifier, Maximum Concentration, Maximum Qualifier, Units, Location of Maximum Concentration, Detection Frequency, Range of Detection Limits, Concentration Used for Screening, Background Value, Screening Toxicity Value, Potential ARAR/TBC Value, Potential ARAR/TBC Source, COPC Flag, Rationale for Contaminant Deletion or Selection.

1. Discuss selection criteria for COPCs; including toxicity screening values, frequency of

detection, and background comparison.

2. Perform screening; select COPCs that will be carried into the risk assessment (include comparison to regulatory standards and criteria where appropriate).

3. Use background information to determine COPCs, as appropriate.

4. **Submit Supporting Information to substantiate the available Background value shown for each chemical in Standard Table 2** and to enable verification of those values by EPA. The format of the summary will be determined by each region. The Supporting Information should provide relevant information for each chemical used to determine the background concentration, including (but not limited to) average, maximum, hypothesis testing of equality of the mean, upper tolerance limit (UTL) derivation, and other information that may be required to fully describe the background selection process.

5. The Background Supporting Information should later be incorporated in the Baseline Risk Assessment Report.

6. **Complete Standard Table 2** for each combination of Scenario Timeframe, Medium, Exposure Medium, and Exposure Point.

7. **Standard Table 2** should later be incorporated in the Baseline Risk Assessment Report.

STANDARD TABLE 3: Medium-Specific Exposure Point Concentration (EPC) Summary. The purposes of **Standard Table 3** are:

- To provide the reasonable maximum and central tendency medium-specific EPCs for measured and modeled values
- To provide statistical information on the derivation of the EPCs.

The information documented in **Standard Table 3** includes:

- Statistical information which was used to calculate the Medium EPCs for chemicals detected in each medium
- The RME Medium EPC and the CT Medium EPC selected
- The statistics which were used to make the determinations as well as the rationale for the selection of the statistics for each chemical (i.e., discuss statistical derivation of measured data or approach for modeled data).

The data elements presented in **Standard Table 3** are listed in the Standard Table 3 highlight box.

DATA ELEMENTS IN
STANDARD TABLE 3

For each unique combination of Scenario Timeframe, Medium, Exposure Medium, and Exposure Point, provide the following information: Chemical of Potential Concern, Units, Arithmetic Mean, 95% upper confidence level (UCL) of Normal Data, Maximum Detected Concentration, Maximum Qualifier, EPC Units, Reasonable Maximum Exposure (Medium EPC Value, Medium EPC Statistic, and Medium EPC Rationale), and Central Tendency (Medium EPC Value, Medium EPC Statistic, and Medium EPC Rationale).

Perform the following steps associated with the preparation **of Standard Table 3**.

1. Discuss how samples will be grouped (e.g., how hot spots in soil will be considered; how groundwater data will be combined; how temporal and chemical phases will be addressed; how upgradient, downgradient, and cross gradient samples will be addressed).

2. Discuss approach to determine how data are normally or log-normally distributed.

3. Discuss evaluation of lead, total chromium and any other special chemicals.

4. **Submit Supporting Information to document the EPC summary presented in Standard Table 3** and to enable verification of those values by EPA. The format of the summary will be determined by each region. The Supporting Information should discuss media-specific EPCs statistically derived from

measured data, including identification of the samples used in each calculation, results of distribution testing (Wilk-Shapiro, D'Agostino), mean (transformed if appropriate), maximum (transformed if appropriate), standard deviation (transformed if appropriate), t- or H-statistic, 95% UCL (including non-parametric methods, where applicable), and other protocols as required. The Supporting Information should also present information for route-specific EPCs, including derivation of modeled values, assumptions and values used, statistical derivation of measured values and associated calculations, and other protocols as required. These route-specific EPCs should be presented in Standard Table 7.

5. The **EPC Supporting Information** should later be incorporated in the Baseline Risk Assessment Report.

6. **Complete Standard Table 3** for each combination of Scenario Timeframe, Medium, Exposure Medium, and Exposure Point.

7. **Standard Table 3** should later be incorporated in the Baseline Risk Assessment Report.

STANDARD TABLE 4: Values Used for Daily Intake Calculations. The purposes of **Standard Table 4** are:

- To provide the exposure parameters used for RME and CT intake calculations for each Exposure Pathway (Scenario Timeframe, Medium, Exposure Medium, Exposure Point, Receptor Population, Receptor Age, and Exposure Route)
- To provide the intake equations or models used for each Exposure Route/Pathway.

The information documented in **Standard Table 4** includes:

- Values used for each intake equation for each Exposure Pathway and the reference/rationale for each
- Intake equation or model used to calculate the intake for each Exposure Pathway.

The data elements presented in **Standard Table 4** are listed in the Standard Table 4 highlight box.

DATA ELEMENTS IN STANDARD TABLE 4

For each unique combination of Scenario Timeframe, Medium, Exposure Medium, Exposure Point, Receptor Population, and Receptor Age, provide the following information: Exposure Route, Parameter Code, Parameter Definition, Units, RME Value, RME Rationale/Reference, CT Value, CT Rationale/Reference, and Intake Equation/Model Name.

Perform the following steps associated with the preparation of **Standard Table 4**.

1. Provide references for all exposure parameters.

2. **Submit Supporting Information to summarize the Modeled Intake Methodology and Parameters used to calculate modeled intake values** and to enable verification of those values by EPA. The Supporting Information should be limited to summary level information. The format of the summary should be structured to accommodate the variability and complexity associated with different models.

3. The **Modeled Intake Supporting Information** should later be incorporated in the Baseline Risk Assessment Report.

4. **Submit Supporting Information on Chemical-Specific Parameters**, which apply to all Standard Tables to be completed for the risk assessment and to enable verification of those values by EPA. The summary should identify and display chemical parameters and constants that are used to calculate risks and hazards, but are not included on Standard Tables. The format of the summary will be determined by each region. The values and constants that are used to calculate risk and hazards, including molecular weight, vapor pressure, K_{oc}, K_{ow}, dermal permeability constant, Henry's Law constant, and other information that the reader would find useful for understanding the risk assessment

discussion should be included.

5. The **Chemical-Specific Parameter Supporting Information** summary should later be incorporated into the Baseline Risk Assessment Report.

6. **Complete Standard Table 4** for each combination of Scenario Timeframe, Medium, Exposure Medium, Exposure Point, Receptor Population, and Receptor Age.

7. **Standard Table 4** should later be incorporated into the Baseline Risk Assessment Report.

STANDARD TABLES 5 AND 6: Non-Cancer and Cancer Toxicity Data. The purposes of **Standard Tables 5.1, 5.2, and 5.3** are:

- To provide information on reference doses (RfDs) target organs, and adjustment factors for chemicals
- To provide oral to dermal adjustment factors
- To verify references for non-cancer toxicity data
- To provide non-cancer toxicity information for "special-case" chemicals.

The information documented in **Standard Tables 5.1, 5.2, and 5.3** includes:

- The RfDs for each of the COPCs, as well as modifying factors and reference concentration (RfC) to RfD adjustments
- The organ effects of each of the COPCs
- References for RfCs and organ effects.

The data elements presented in **Standard Tables 5.1, 5.2, and 5.3** are listed in the Standard Tables 5.1, 5.2, and 5.3 highlight box.

DATA ELEMENTS IN
STANDARD TABLE 5.1

Provide the following information: Chemical of Potential Concern, Chronic/Subchronic, Oral RfD Value, Oral RfD Units, Oral to Dermal Adjustment Factor, Adjusted Dermal RfD, Units, Primary Target Organ, Combined Uncertainty/Modifying Factors, Sources of RfD:Target Organ, and Dates of RfD:Target Organ.

DATA ELEMENTS IN
STANDARD TABLE 5.2

Provide the following information: Chemical of Potential Concern, Chronic/Subchronic, Value Inhalation RfC, Units, Adjusted Inhalation RfD, Units, Primary Target Organ, Combined Uncertainty/Modifying Factors, Sources of RfC:RfD:Target Organ, and Dates.

DATA ELEMENTS IN
STANDARD TABLE 5.3

Provide the following information: Chemical of Potential Concern, Chronic/Subchronic, Value, Units, Primary Target Organ, Combined Uncertainty/Modifying Factors, Sources of Toxicity:Primary Target Organ, and Date.

The purposes of **Standard Tables 6.1, 6.2, and 6.3** are:

- To provide the oral, dermal, and inhalation cancer toxicity information (values and sources of information) for chemicals of potential concern

- To provide the methodology and adjustment factors used to convert oral cancer toxicity values to dermal toxicity values and to convert inhalation unit risks to inhalation cancer slope factors
- To provide weight of evidence/cancer guideline descriptions for each chemical of potential concern
- To provide cancer toxicity information for "special case" chemicals.

The information documented in **Standard Tables 6.1, 6.2, and 6.3** includes:

- Oral, dermal, and inhalation toxicity values for chemicals of potential concern
- Weight of evidence/cancer guidelines descriptions for chemicals of potential concern
- The source/reference for each toxicity value.

The data elements presented in **Standard Tables 6.1, 6.2, and 6.3** are listed in the Standard Tables 6.1, 6.2, and 6.3 highlight box.

Perform the following steps associated with the preparation of **Standard Tables 5 and 6.**

1. Ensure that chronic and subchronic toxicity values are applied correctly based on the duration of exposure. Provide rationale for selection of surrogate toxicity values not in IRIS or HEAST, or provided by NCEA.

DATA ELEMENTS IN STANDARD TABLE 6.1

Provide the following information: Chemical of Potential Concern, Oral Cancer Slope Factor, Oral to Dermal Adjustment Factor, Adjusted Dermal Cancer Slope Factor, Units, Weight of Evidence/Cancer Guideline Description, Source, and Date.

DATA ELEMENTS IN STANDARD TABLE 6.2

Provide the following information: Chemical of Potential Concern, Unit Risk, Units, Adjustment, Inhalation Cancer Slope Factor, Units, Weight of Evidence/Cancer Guideline Description, Source, and Date.

DATA ELEMENTS IN STANDARD TABLE 6.3

Provide the following information: Chemical of Potential Concern, Value, Units, Source, and Dates.

2. **Submit Supporting Information regarding Toxicity Data for Special Case Chemicals** (i.e., those chemicals with cancer risks and non-cancer hazards calculated using methods or toxicity parameters different from those presented on Standard Tables 5.1, 5.2, 6.1, or 6.2). The Supporting Information will be used to enable verification of those values by EPA. Examples include selection of potency factors for polychlorinated biphenyls (PCBs), use of relative potencies for polynuclear aromatic hydrocarbons (PAHs) and chlorinated dioxins and furans, and valence species assumptions for metals.

3. The **Special Case Chemicals Supporting Information** should later be incorporated in the Baseline Risk Assessment Report.

4. Refer to the end of Chapter 3.1.1 for instructions for lead and radionuclides.

5. **Complete Standard Tables 5 and 6** for the exposure routes and chemicals under evaluation.

   Standard Table 5.1: Non-Cancer Toxicity Data - Oral/Dermal
   Standard Table 5.2: Non-Cancer Toxicity Data - Inhalation
   Standard Table 5.3: Non-Cancer Toxicity Data - Special Case Chemicals

   Standard Table 6.1: Cancer Toxicity Data - Oral/Dermal
   Standard Table 6.2: Cancer Toxicity Data - Inhalation
   Standard Table 6.3: Cancer Toxicity Data - Special Case Chemicals.

6. **Standard Tables 5 and 6** should later be incorporated in the Baseline Risk Assessment Report.

STANDARD TABLES 7 AND 8: Calculation of Non-Cancer Hazards and Cancer Risks. The purposes of **Standard Tables 7 and 8** are:

- To provide a summary of the variables used to calculate non-cancer hazards and cancer risks
- To show the EPC (medium-specific or route-specific) and intake used in the non-cancer hazard and cancer risk calculations
- To present the result of the calculation for each Exposure Route/Pathway for each COPC
- To provide the total hazard index and cancer risks for all Exposure Routes/Pathways for the Scenario Timeframe, Exposure Medium, and Receptor presented in this table.

The information documented in **Standard Tables 7 and 8** includes:

- The non-cancer hazard quotient (HQ) and cancer risk value for each COPC for each Exposure Route/ Pathway
- The values used for EPC, non-cancer intake, cancer intake, reference doses and

concentrations, and cancer slope factor for each COPC for each Exposure Route.

The data elements presented in **Standard Tables 7 and 8** are listed in the Standard Tables 7 and 8 highlight boxes.

Perform the following steps associated with the preparation of **Standard Tables 7 and 8**.

1. Address non-cancer hazards and cancer risks including the calculations and supporting information by Exposure Route.

DATA ELEMENTS IN STANDARD TABLE 7

For each unique combination of Scenario Timeframe, Medium, Exposure Medium, Exposure Point, Receptor Population, and Receptor Age, provide the following information: Exposure Route, Chemical of Potential Concern, Medium EPC Value, Medium EPC Units, Route EPC Value, Route EPC Units, EPC Selected for Hazard Calculation, Intake (Non-Cancer), Intake (Non-Cancer) Units, Reference Dose, Reference Dose Units, Reference Concentration, Reference Concentration Units, and Hazard Quotient.

2. Include RME and CT results. Ensure that risks and hazards from multiple chemicals are combined appropriately across Pathways that affect the same individual or population subgroup, for all site-related chemicals.

3. Definitions of Standard Tables
   Standard Table 7.n.RME: Calculation of Non-Cancer Hazards (RME)
   Standard Table 7.n.CT: Calculation of Non-Cancer Hazards (CT)
   Standard Table 8.n.RME: Calculation of Cancer Risks (RME)
   Standard Table 8.n.CT: Calculation of Cancer Risks (CT)

4. **Submit Supporting Information that summarizes the approach used to perform Special Chemical Risk and Hazard Calculations** and to enable verification of those values by EPA. This summary should address the calculation of non-cancer hazards and cancer risks for chemicals that do not use RfD or cancer slope factor (CSF) values, respectively. The format of the summary will be determined by each region.

DATA ELEMENTS IN STANDARD TABLE 8

For each unique combination of Scenario Timeframe, Medium, Exposure Medium, Exposure Point, Receptor Population, and Receptor Age, provide the following information: Exposure Route, Chemical of Potential Concern, Medium EPC Value, Medium EPC Units, Route EPC Value, Route EPC Units, EPC Selected for Risk Calculation, Intake (Cancer), Intake (Cancer) Units, Cancer Slope Factor, Cancer Slope Factor Units, and Cancer Risk.

5. The **Special Chemical Risk and Hazard Calculations Supporting Information** should later be incorporated in the Baseline Risk Assessment Report.

6. **Complete Standard Tables 7 and 8** for each combination of Scenario Timeframe, Medium, Exposure Medium, Exposure Point, Receptor Population, and Receptor Age.

7. **Standard Tables 7 and 8** should later be incorporated in the Baseline Risk Assessment Report.

STANDARD TABLES 9 AND 10: Risks and Hazards. The purpose of **Standard Table 9** is:

- To provide a summary for each Receptor, by Medium, Exposure Route, and Exposure Point, of cancer risks and non-cancer hazards.

The purpose of **Standard Table 10** is:

- To provide a summary for each Receptor, by Medium, Exposure Route, and Exposure Point, of cancer risks and non-cancer hazards that may trigger the need for remedial action.

The information documented in **Standard Tables 9 and 10** includes:

- The cancer risk and non-cancer hazard to each Receptor for each COPC by Exposure Route and Exposure Point
- The total cancer risk and non-cancer hazard for each Exposure Pathway
- The total cancer risk and non-cancer hazard for each Medium across all Exposure Routes
- The primary target organs for non-carcinogenic hazard effects.

The data elements presented in **Standard Tables 9 and 10** are listed in the Standard Tables 9 and 10 highlight boxes.

DATA ELEMENTS IN STANDARD TABLE 9

For each unique combination of Scenario Timeframe, Receptor Population, and Receptor Age, provide the following information: Medium, Exposure Medium, Exposure Point, Chemical, Carcinogenic Risk (Ingestion, Inhalation, Dermal, and Exposure Routes Total), Chemical, and Non-Carcinogenic Hazard Quotient (Primary Target Organ, Ingestion, Inhalation, Dermal, and Exposure Routes Total).

DATA ELEMENTS IN STANDARD TABLE 10

For each unique combination of Scenario Timeframe, Receptor Population, and Receptor Age, provide the following information: Medium, Exposure Medium, Exposure Point, Chemical, Carcinogenic Risk (Ingestion, Inhalation, Dermal, and Exposure Routes Total), Chemical, and Non-Carcinogenic Hazard Quotient (Primary Target Organ, Ingestion, Inhalation, Dermal, and Exposure Routes Total).

Perform the following steps associated with the preparation of **Standard Tables 9 and 10**.

1. Address non-cancer hazards and cancer risks including the calculations and supporting information by Exposure Route.

2. Include RME and CT results. Ensure that risks and hazards from multiple chemicals are combined appropriately across Pathways that affect the same individual or population subgroup, for all site-related chemicals.

3. Definitions of Standard Tables
   Standard Table 9.n.RME: Summary of Receptor Risks and Hazards for COPCs (RME)
   Standard Table 9.n.CT: Summary of Receptor Risks and Hazards for COPCs (CT)
   Standard Table 10.n.RME: Risk Assessment Summary (RME)
   Standard Table 10.n.CT: Risk Assessment Summary (CT)

4. **Complete Standard Tables 9 and 10** for each combination of Scenario Timeframe, Receptor Population, and Receptor Age.

5. **Standard Tables 9 and 10** should later be incorporated in the Baseline Risk Assessment Report.

LEAD AND RADIONUCLIDES WORK-SHEETS. Perform the following steps associated with the preparation of **Lead and Radionuclides Worksheets**:

1. For lead, **complete the Lead Worksheets** for Screening Analysis, Child, and Adult **(to be developed)**. Also attach the appropriate graphs and results from the Integrated Exposure Uptake Biokinetic Model (IEUBK) model to the Child Worksheet.

2. For radionuclides, **complete the Radionuclide Worksheet (to be developed)**.

3. The **Lead and Radionuclide Worksheets** should later be incorporated in the Baseline Risk Assessment Report.

3.1.2 ASSESSMENT OF CONFIDENCE AND UNCERTAINTY

Uncertainty assessment is important in risk assessment. Although the risk assessment should indicate sources of variability and uncertainty

throughout the process, it will generally be appropriate to include a separate section of the Baseline Risk Assessment Report that also focuses on the uncertainties associated with data evaluation, toxicity assessment, exposure assessment, and risk characterization, as well as overall uncertainty of the final risk numbers. The region may choose to defer presentation of this specific section to the Draft Baseline Risk Assessment Report.

Summarize the Assessment of Confidence and Uncertainty. The Assessment of Confidence and Uncertainty should later be incorporated in the Baseline Risk Assessment Report.

3.1.3 PROBABILISTIC ANALYSIS INFORMATION

Based upon the results from a deterministic risk characterization calculation (Standard Tables 7 and 8), a decision should be made if a Probabilistic Analysis will be performed to calculate cancer risks and non-cancer hazards in accordance with Agency policy. If Probabilistic Analysis is performed, the information which follows should be addressed:

- The results from the initial evaluations (deterministic and sensitivity analyses) should be evaluated along with any additional exposure information to determine whether a Probabilistic Analysis is feasible.

- For those parameters determined in the initial evaluations to have the most uncertainty (described in Chapter 3.1.2) proceed to the Probabilistic Analysis. For this analysis, provide the exposure parameter distributions, their source and rationale for selection, and indicate which parameters are correlated. Indicate pertinent information such as the model to be used for the analysis, type of software, exposure equations, number of iterations, etc. The results of the Probabilistic Analysis should be presented as either a chapter in the Baseline Risk Assessment Report or as an appendix in accordance with regional preferences.

- As part of the Risk Characterization portion of the Baseline Risk Assessment Report, present a summary of the Probabilistic Analysis results including graphic displays, the CT and RME values, and a qualitative discussion of the results of the analysis and the representativeness of distribution data for the population of concern.

- The uncertainty associated with the CT and RME values, population risks, if appropriate, and the uncertainty associated with the Probabilistic Analysis should be summarized in the Risk Characterization section of the Baseline Risk Assessment Report.

- **Summarize the Probabilistic Analysis (if performed)**.

- The **Probabilistic Analysis** summary should will later be incorporated in the Baseline Risk Assessment Report.

3.2 DRAFT BASELINE RISK ASSESSMENT REPORT

Submit the Draft Baseline Risk Assessment Report after the completion and acceptance of the Interim Deliverables described above. EPA guidance should be consulted in preparing the Draft Baseline Risk Assessment Report. EPA anticipates that this report preparation will be greatly expedited, since it should incorporate the following Interim Deliverables:

- Standard Tables 1 through 10
- Worksheets on Data Useability, Lead and Radionuclides, as applicable
- Supporting Information
- The Assessment of Confidence and Uncertainty
- Probabilistic Analysis information.

However, the report should not consist exclusively of the Interim Deliverables, since additional narrative will be necessary for a clear and comprehensible Baseline Risk Assessment Report. For example, information such as definition of hazard indices and cancer slope factors, Toxicological Profiles for COPCs, and other information indicated by risk assessment guidance should be incorporated.

Risk assessments submitted to the Agency or

performed by the Agency should incorporate any current Agency guidance applicable on Risk Characterization.

3.3 FINAL BASELINE RISK ASSESSMENT REPORT

Submit the Final Baseline Risk Assessment Report as a revision of the draft, incorporating review comments as necessary and appropriate.

3.4 DATA TRANSFER TO CERCLIS 3

Upon the completion of the Final Baseline Risk Assessment Report, use the LOTUS® or EXCEL® version of the Standard Tables to **transfer summary level risk data to the CERCLIS 3 database.**

EXHIBIT 3-1

INTERIM DELIVERABLES FOR EACH SITE

Interim Deliverable	Scope of Deliverable
INTERIM DELIVERABLES ASSOCIATED WITH PLANNING TABLE 0	
TARA Schedule Worksheet	One Worksheet for each Risk Assessment.
Planning Table 0 - Site Risk Assessment Identification Information	One Planning Table for each Risk Assessment.
INTERIM DELIVERABLES ASSOCIATED WITH PLANNING TABLE 1	
Planning Table 1 - Selection of Exposure Pathways	One Planning Table for each Risk Assessment.
INTERIM DELIVERABLES ASSOCIATED WITH PLANNING TABLE 2	
Data Useability Worksheet	One Worksheet for each Medium.
Supporting Information on Background Values	Information for all Chemicals listed in Planning Table 2.
Planning Table 2 - Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)	One Planning Table for each unique combination of Scenario Timeframe, Medium, and Exposure Medium.
INTERIM DELIVERABLES ASSOCIATED WITH PLANNING TABLE 3	
Supporting Information on EPCs	Information for all EPCs presented in Planning Table 3.
Planning Table 3 - Exposure Point Concentration (EPC) Summary	One Planning Table for each unique combination of Scenario Timeframe, Medium, and Exposure Medium.
INTERIM DELIVERABLES ASSOCIATED WITH PLANNING TABLE 4	
Supporting Information on Modeled Intake Methodology and Parameters	Information for all Modeled Intake calculations that are not presented in Planning Table 4.
Supporting Information on Chemical-Specific Parameters	Information for all Chemical-Specific Parameters used.
Dermal Worksheet	Information for calculation of DA(event).
Planning Table 4 - Values Used for Daily Intake Calculations	One Planning Table for each unique combination of Scenario Timeframe, Medium, and Exposure Medium.
INTERIM DELIVERABLES ASSOCIATED WITH PLANNING TABLES 5 AND 6	
Supporting Information on Toxicity Data for Special Case Chemicals	Information for each Special Case Chemical.
Planning Table 5 - Non-Cancer Toxicity Data	Three Planning Tables - 5.1 for Oral/Dermal, 5.2 for Inhalation, and 5.3 for Special Case Chemicals.

EXHIBIT 3-1

INTERIM DELIVERABLES FOR EACH SITE (continued)

Interim Deliverable	Scope of Deliverable
Planning Table 6 - Cancer Toxicity Data	Four Planning Tables - 6.1 for Oral/Dermal, 6.2 for Inhalation, 6.3 for Special Case Chemicals, and 6.4 for External (Radiation).
INTERIM DELIVERABLES ASSOCIATED WITH PLANNING TABLES 7 AND 8	
Supporting Information on Special Chemical Risk and Hazard Calculations	Information for each Special Case Chemical.
Planning Table 7 - Calculation of Chemical Cancer Risks and Non-Cancer Hazards	One Planning Table for each unique combination of Scenario Timeframe, Receptor Population, and Receptor Age, for RME and for CT.
Radiation Dose Assessment Worksheet	One Worksheet for each unique combination of Scenario Timeframe, Receptor Population, and Receptor Age (as appropriate).
Planning Table 8 - Calculation of Radiation Cancer Risks	One Planning Table for each unique combination of Scenario Timeframe, Receptor Population and Receptor Age.
INTERIM DELIVERABLES ASSOCIATED WITH PLANNING TABLES 9 AND 10	
Planning Table 9 - Summary of Receptor Risks and Hazards for COPCs	One Planning Table for each unique combination of Scenario Timeframe, Receptor Population, and Receptor Age, for RME and CT.
Planning Table 10 - Risk Summary	One Planning Table for each unique combination of Scenario Timeframe, Receptor Population, and Receptor Age, for RME and CT.
INTERIM DELIVERABLES ASSOCIATED WITH LEAD	
Lead Worksheets (if applicable)	Separate Worksheets for Residential and Non-Residential Scenarios for each unique combination of Scenario Timeframe, Receptor Population, and Receptor Age.
INTERIM DELIVERABLES ASSOCIATED WITH UNCERTAINTY ASSESSMENT	
Assessment of Confidence and Uncertainty	One Assessment for each Risk Assessment.
INTERIM DELIVERABLES ASSOCIATED WITH PROBABILISTIC ANALYSIS	
Summary of Probabilistic Analysis (if applicable)	One Summary for each Risk Assessment.

EXHIBIT 3-1

INTERIM DELIVERABLES FOR EACH SITE (continued)

Interim Deliverable	Scope of Deliverable
INTERIM DELIVERABLES ASSOCIATED WITH THE ROD	
ROD Risk Worksheets	As appropriate to document (in draft form) the need for remedial action.

Notes:
1. Each Interim Deliverable should be reviewed and verified by EPA prior to submission of the Draft Baseline Risk Assessment Report.
2. Each Interim Deliverable should later be incorporated in the Draft and Final Baseline Risk Assessment Reports.
3. The Interim Deliverables are needed for each risk assessment to achieve standardization in risk assessment reporting.

EXHIBIT 3-2

STANDARDIZED RISK ASSESSMENT REPORTING

Risk Assessment Activity	Corresponding Planning Table/Worksheet
Data Collection	
Provide identification information for the risk assessment	Planning Table 0 - Site Risk Assessment Identification Information
Plan the risk assessment review process	TARA Schedule Worksheet
Develop a conceptual site model	Planning Table 1 - Selection of Exposure Pathways
Gather and report appropriate data	Planning Table 2 - Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Data Evaluation	
Evaluate detection frequency, background data, and site data	Data Useability Worksheet Planning Table 2 - Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Identify chemicals of potential concern and provide rationale for selection and deletion	Planning Table 2 - Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Exposure Assessment	
Characterize physical setting, identify potential pathways and exposed population	Planning Table 1 - Selection of Exposure Pathways
Identify exposure assumptions	Planning Table 4 - Values Used for Daily Intake Calculations Dermal Worksheet
Estimate exposure point concentrations	Planning Table 3 - Exposure Point Concentration Summary
Estimate exposure intakes	Planning Table 7 - Calculation of Chemical Cancer Risks and Non-Cancer Hazards Planning Table 8 - Calculation of Radiation Cancer Risks
Toxicity Assessment	
Determine toxicity values for carcinogenic and non-carcinogenic effects and provide source information	Planning Table 5 - Non-Cancer Toxicity Data Planning Table 6 - Cancer Toxicity Data

EXHIBIT 3-2

STANDARDIZED RISK ASSESSMENT REPORTING (continued)

Risk Assessment Activity	Corresponding Planning Table/Worksheet
Risk Characterization	
Quantify cancer and non-cancer risk by pathway	Planning Table 7 - Calculation of Chemical Cancer Risks and Non-Cancer Hazards Planning Table 8 - Calculation of Radiation Cancer Risks Radiation Dose Assessment Worksheet
Combine risks by media for different receptors	Planning Table 9 - Summary of Receptor Risks and Hazards for COPCs
Summarize risk drivers for different receptors	Planning Table 10 - Risk Summary
Prepare draft risk documentation for ROD	ROD Risk Worksheets

EXHIBIT 3-3

SUMMARY OF RAGS PART D
REVISION 1 CHANGES

PLANNING TABLE/WORKSHEET	REVISION 1 CHANGES
Planning Table 0	This is a new Planning Table.
TARA Schedule Worksheet	This is a new Worksheet.
Planning Table 1	Revision 1 does not include the On-Site/Off-Site field from Revision 0.
Data Useability Worksheet	The Revision 1 Worksheet is the same as the Revision 0 Worksheet.
Planning Table 2	Exposure Point was moved from the last row of the Summary Box (Revision 0) to the first column of the table (Revision 1). This may reduce the number of versions of Planning Table 2 needed for some sites. The Qualifier information for Minimum and Maximum Concentrations has been moved to the corresponding Concentration fields.
Planning Table 3	In Revision 1, separate versions of this table should be prepared for RME and CT. Exposure Point was moved from the last row of the Summary Box (Revision 0) to the first column of the table (Revision 1). This may reduce the number of versions of Planning Table 3 needed for some sites. The Qualifier information has been moved to the corresponding Maximum Concentration field.
Planning Table 4	In Revision 1, separate versions of this table should be prepared for RME and CT. Receptor Population, Receptor Age, and Exposure Point were moved from the Summary Box (Revision 0) to columns in Revision 1. This may reduce the number of versions of Planning Table 4 needed for some sites.
Planning Tables 5.1, 5.2, and 5.3	The Revision 1 Planning Tables are essentially the same as Revision 0. Some column headings have been slightly reworded, but the data needs are the same.
Planning Table 6.1, 6.2, 6.3, and 6.4	The Revision 1 Planning Tables 6.1, 6.2, and 6.3 are essentially the same as Revision 0. Some column headings have been slightly reworded, but the data needs are the same. Revision 1 Planning Table 6.4 for radionuclides was not included in Revision 0.

EXHIBIT 3-3

SUMMARY OF RAGS PART D
REVISION 1 CHANGES (continued)

PLANNING TABLE/WORKSHEET	REVISION 1 CHANGES
Planning Table 7	Medium, Exposure Medium, and Exposure Point were moved from the Summary Box (Revision 0) to columns in the table (Revision 1). This may reduce the number of versions of Planning Table 7 needed for some sites. Planning Table 7, which previously contained only non-cancer information (Revision 0), now presents cancer and non-cancer information for chemicals.
Planning Table 8	Planning Table 8 (Revision 1) focuses exclusively on the calculation of radiation cancer risks. Planning Table 8 (Revision 0) focused on cancer risk calculations for all chemicals. Medium, Exposure Medium, and Exposure Point were moved from the Summary Box (Revision 0) to columns in the table (Revision 1). This may reduce the number of versions of Planning Table 8 needed for some sites. Medium EPC and Route EPC information (Revision 0) was replaced by EPC information (Revision 1).
Radiation Dose Assessment Worksheet	This is a new Worksheet.
Planning Tables 9 and 10	A column for Exposure Route External (Radiation) has been added to the cancer calculations in Revision 1. The second COPC (Planning Table 9) or Chemical (Planning Table 10) column from Revision 0 has been deleted in Revision 1. Accommodations have been made for summing risks and hazards at the Exposure Point, Exposure Medium, Medium, and Receptor Levels.
Lead Worksheets	These are new Worksheets.
ROD Risk Worksheets (ROD Risk Highlights)	These are new Worksheets that copy the ROD Guidance (U.S. EPA, 1999a) Risk Highlights.

CHAPTER 4

RISK EVALUATIONS DURING THE FEASIBILITY STUDY

4.1 INTRODUCTION

The following are FS activities, which during development, should involve EPA risk assessor input. Continuous involvement of the EPA risk assessor during the FS has the benefit of: 1) supporting the development of remedial action objectives (RAOs) and PRGs, and 2) supporting comparison of risks associated with various remedial alternatives. For these reasons, EPA risk assessor involvement in FS preparation and review is strongly encouraged.

The purpose of the FS is to evaluate waste management remedial alternatives. The *National Oil and Hazardous Substance Pollution Contingency Plan (NCP)* (EPA 1990c) specifies that a detailed analysis be performed that involves nine criteria. The NCP specifies that for screening of remedial alternatives, the long-term and short-term aspects of three criteria - effectiveness, implementability, and cost - should be used to guide the development and screening of remedial alternatives. Consideration of effectiveness involves evaluating the long-term and short-term human health risks. Long-term risks associated with a remedial alternative are those risks that will remain after the remedy is complete; short-term risks associated with a remedial alternative are those risks that occur during implementation of the remedial alternative.

Evaluating long-term risks ideally includes an assessment of the risks associated with treatment of residuals and untreated wastes for a treatment-based remedy, or an evaluation of the remedy's ability to provide protectiveness over time for a containment-based remedy. For short-term human health risks associated with a remedial alternative, a risk assessor may need to evaluate the risks that occur during implementation of the remedial alternative (e.g., risks associated with emissions from an onsite air stripper). Because some remedies may take many years to complete, some "short-term" risks may actually occur over a period of many years. Populations that may be exposed to chemicals during remedy implementation include people who live and work in the vicinity of the site.

The NCP also requires that RAOs and remediation goals be developed. These serve as objectives and goals that can be used to identify and assess remedial alternatives at Superfund sites. The remainder of this chapter defines and discusses RAOs and remediation goals.

4.1.1 REMEDIAL ACTION OBJECTIVES

As discussed in the NCP, RAOs describe, in general terms, what any remedial action needs to accomplish in order to be protective of human health and the environment. They are typically narrative statements that specify the contaminants and environmental media of concern, the potential exposure pathways to be addressed by remedial actions, the exposed populations and environmental receptors to be protected, and the acceptable contaminant concentrations or concentration ranges (remediation goals) in each environmental medium.

4.1.2 REMEDIATION GOALS

Remediation goals are a subset of the RAOs. They provide the acceptable contaminant concentrations in each medium for remedial actions to meet.

EPA explained in the preamble to the final NCP that remediation goals are based on ARARs unless ARARs are not available or are not protective. ARARs do not always exist for all chemicals and all environmental media.

SELECTION OF REMEDIATION GOALS

The NCP [EPA 1990c; Section 300.430(e)(2)(I)] states that the selection of remediation goals should consider the following:

"...remediation goals shall establish acceptable exposure levels that are protective of human health and the environment and shall be developed considering the following...

ARARs under Federal environmental or State environmental or facility siting laws, if available, and the following factors:

1. For systemic toxicants, acceptable exposure levels shall represent concentration levels to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety;

2. For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{6} using information on the relationship between dose and response. The 10^{-6} risk level shall be used as the point of departure for determining remediation goals for alternatives when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure;

3. Factors related to technical limitations such as detection/quantification limits for contaminants;

4. Factors related to uncertainty; and

5. Other pertinent information."

Therefore, according to the NCP, there are two major sources for the acceptable exposure levels used for remediation goals: a) concentrations found in Federal and State ARARs and, if these are not available or not protective, (b) risk-based concentrations that are determined to be protective of human health and the environment. These risk-based concentrations are calculated using, at a minimum, the criteria sited in numbers 1 and 2 in the Remediation Goals highlight box. Other factors mentioned in the highlight box [i.e., limits of detection (number 3), uncertainty (number 4), and background concentration levels (number 5)] are also considered.

Risk-based concentrations may need to be developed for all chemicals even if ARARs are available to ensure that these ARARs are protective of human health and the environment.

ARAR-Based Remediation Goals. Potential chemical-specific ARARs include concentration limits set by Federal environmental regulations such as Maximum Contaminant Levels (MCLs) established under the Safe Drinking Water Act (SDWA), ambient water quality criteria established under the Clean Water Act (CWA), and State regulations (e.g., State drinking water laws). Action-specific and location-specific ARARs must also be complied with according to the NCP.

Risk-Based Remediation Goals. In general, remediation goals based on risk-based calculations are determined using cancer or non-cancer toxicity values with specific exposure assumptions. For chemicals with carcinogenic effects, the NCP has described the development of remediation goals, as a practical matter, as a two-step process [EPA 1990c, Section 300.430(e)(2)(I)(D)]. A concentration equivalent to a lifetime cancer risk of $1x10^{-6}$ is first established as a point of departure. Then, other factors are taken into account to determine where within the acceptable range the remediation goals for a given contaminant at a specific site will be established.

The NCP discusses a generally acceptable risk range of $1x10^{-4}$ to $1x10^{6}$. EPA has further clarified the extent of the acceptable risk range by stating that the upper boundary is not a discrete line at $1x10^{-4}$. Risks slightly greater than $1x10^{-4}$ may be considered to be acceptable (i.e., protective) if justified based on site-specific conditions, including any uncertainties about the nature and extent of contamination and associated risks. [See *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions* (EPA 1991d)]

For non-cancer effects, the NCP states that an acceptable exposure level must be defined (using reliable toxicity information such as EPA's RfD). According to EPA guidance, (RAGS Part A, EPA 1989c), generally, if the Hazard Index (HI) (Intake/RfD) is above 1 (i.e., the site exposure is estimated to be above the RfD) there may be a concern for potential non-cancer effects [see *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions* (EPA 1991d]. Therefore, in calculating remediation goals at a site to protect for non-cancer effects, remediation goals are generally set a at a Hazard Index at or below 1.

4.1.3 PRELIMINARY REMEDIATION GOALS

As discussed in the NCP, final remediation goals are not determined until a final remedy for the site is selected in the ROD. However, PRGs for a site are established as early in the RI/FS process as possible during project scoping (see Chapter 2). These initial PRGs can then be modified as necessary during the FS, based on site-specific information from the baseline risk assessment. The PRGs will then be used to establish the goals to be met by the remedial alternatives in the FS. The PRGs also guide the development of the Proposed Plan for remedial action and the selection of remediation levels in the Record of Decision.

Risk-based PRGs (non-ARARs) may be modified within the acceptable risk range during the remedy selection process based on a balancing of the major trade-offs among the alternatives as well as the public and Agency comments on the Proposed Plan (RAGS Part B). Such balancing among alternatives and consideration of community and State acceptance will establish the specific level of protection the remedy will achieve (i.e., the final remediation levels).

The dialogue begun during Scoping between the EPA risk assessor and the EPA RPM should continue during the FS and beyond to ensure that risk assessment information is used appropriately in the risk management decision process.

The primary guidance on development of the FS is available in *"Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*(EPA 1988). RAGS Part B (EPA 1991a) also presents guidance for the role of risk assessment in the FS. The EPA RPM should follow appropriate National and regional guidance.

4.2 DEVELOP REMEDIAL ACTION OBJECTIVES

The risk assessor should be involved in the preparation or review of the following:

- A narrative description of the Medium, Exposure Point and Exposure Routes, and chemicals exceeding the risk range
- A narrative identifying the remedial action objectives for prevention of exposure and restoration of each contaminated Medium (e.g., restoring groundwater to a potable water source)
- A format such as Example Table 1 in Exhibit 4-1 may be a useful approach to present these data for each Medium.

4.3 DEVELOP REMEDIATION GOALS

The risk assessor should be involved in the preparation or review of a short narrative or tables which provide the goals of the remediation. First, all values considered as PRGs should be identified. Then the PRGs selected for each chemical to be used in the FS should be presented.

4.3.1 IDENTIFY VALUES CONSIDERED AS PRELIMINARY REMEDIATION GOALS

- Identify ARAR-based PRGs and associated risks/hazards.
- If ARAR-based PRGs are not protective, calculate risk-based PRGs using EPA methods.
- Identify other values to consider as PRGs [e.g., background, detection limits, Procedure Quantitation Limits (PQLs)].
- A format such as Example Table 2 in Exhibit 4-

1 may be a useful approach to present these values, for each Medium and Receptor Population combination.

4.3.2 SELECT PRELIMINARY REMEDIATION GOALS

- Select PRG(s) for each chemical from among the values considered (e.g., risk-based for cancer and non-cancer, ARAR-based, other), modifying values as appropriate. Note that the PRG should be ARAR-based unless there is no ARAR available or the ARAR is not protective.

- Provide the rationale for the selected PRG. Include the source of the value.

- A format such as Example Table 3 in Exhibit 4-1 may be a useful approach to present these values for each Medium and Receptor Population combination.

4.4 SUMMARIZE RISKS AND HAZARDS ASSOCIATED WITH PRELIMINARY REMEDIATION GOALS

The risk assessor should be involved in the preparation or review of a short narrative or tables which summarize the risks and hazards associated with the PRGs.

- Identify the chemical of concern, maximum concentration, PRG, basis of PRG, and calculated risks and hazards associated with the PRG for each Medium and Receptor Population.

- Summarize the total risk and total hazard among all chemicals for each Medium and Receptor Population combination.

- A format such as Example Table 3 in Exhibit 4-1 may be a useful approach to present these values for each Medium and Receptor Population combination.

4.5 EVALUATE REMEDIAL TECHNOLOGIES AND ALTERNATIVES FOR RISK CONSIDERATIONS

The risk assessor may provide input in the process of evaluating remedial technologies and alternatives for risk considerations beginning in the development and screening stage of the FS and extending into the detailed analysis stage. The major goal for the risk evaluation during these steps is to provide the FS team and the EPA RPM with specific long-term and short-term human health risk information to consider when identifying and screening technologies and alternatives and performing detailed analysis of alternatives.

The long-term human health risks associated with a remedial technology or alternative are those risks that will remain after the remedy is complete (i.e., residual risks). The risk issues to be considered may include an assessment of the risks associated with treatment residuals, untreated wastes, or contained wastes.

The short-term human health risks associated with a remedial technology or alternative are those risks that occur during implementation of the technology or alternative, which may occur over a period of years. Populations to be considered include people who live and work in the vicinity of the site and workers involved in site remediation.

4.5.1 IDENTIFICATION AND SCREENING OF TECHNOLOGIES AND ALTERNATIVES

The risk assessor may contribute to the identification and screening of technologies and alternatives and focus on evaluating associated short-term and long-term human health risks to ensure that they meet RAOs and PRGs. The goal of the risk assessor is to assist in identifying, and eliminating from further consideration, technologies and/or alternatives with clearly unacceptable risks. This evaluation is typically

qualitative, based on simplifying assumptions and professional judgement rather than detailed analysis. The risk assessor's evaluation is associated with the consideration of effectiveness, one of three criteria specified by the NCP. (Implementability and cost are the other two criteria evaluated at this screening stage, but they do not typically involve risk assessor

participation.)

4.5.2 DETAILED ANALYSIS OF ALTERNATIVES

The overall objective of the risk assessor's role in the detailed analysis of alternatives is to support the preparation and evaluation of the risk information needed for RPMs to select a remedial alternative for a site. The risk assessor contributes to the analysis of three of the nine criteria specified by the NCP:

- Overall Protection of Human Health and the Environment
- Long-term Effectiveness and Permanence
- Short-term Effectiveness.

The detailed analysis of short-term and long-term risks may be qualitative or quantitative depending on the "perceived risk" associated with the alternative based on both professional judgement and community concerns. The risk analysis follows the same general steps as the baseline risk assessment; however, the steps will typically not be conducted in the same level of detail for the FS.

The detailed analysis of short-term risks includes the following components for each alternative:

- Evaluate short-term exposure.
- Evaluate short-term toxicity.
- Characterize short-term risks to the community (including people who live or work on or near the site).
- Characterize short-term risks to remediation workers (a qualitative assessment may be appropriate if the risks to remediation workers are addressed adequately in the site-specific Health and Safety Plan).

The detailed analysis of long-term risks includes the following components for each alternative.

- Evaluate residual risk.
- Evaluate protectiveness over time.

EXHIBIT 4-1
EXAMPLE TABLES TO STANDARDIZE REPORTING OF FS RISK EVALUATIONS

Example Table 1
REMEDIAL ACTION OBJECTIVES

Medium:

Exposure Point	Chemical	Exposure Route	Receptor Population	Remedial Action Objectives

Example Table 2
VALUES CONSIDERED AS PRGs

Medium:
Receptor Population:

Chemical	Most Restrictive ARAR	Most Restrictive ARAR Source	Risk/Hazard at ARAR	Risk-Based PRG Cancer*	Risk-Based PRG Non-Cancer*	Other Value**	Other Value** Source

*Provide the associated risk and hazard levels in the footnotes.
**(e.g., detection limits, background)

Example Table 3
RISKS AND HAZARDS ASSOCIATED WITH PRGs

Medium:
Receptor Population:

Chemical	Site Concentration	PRG	Basis for PRG*	Risk at PRG: Cancer	Hazard at PRG: Non-Cancer	Target Endpoint
			Totals			

*TBC (Federal ARARs, State ARARs), Risk-based.
Background Concentrations, method detection limits

CHAPTER 5

RISK EVALUATIONS AFTER THE FEASIBILITY STUDY

EPA risk assessor involvement in risk evaluations, after completion of the FS, should be conducted as necessary to support the EPA RPM in ensuring that the remedy is protective. While these risk evaluations may not always require a significant level of quantitation, continuous involvement of EPA risk assessors is essential to ensure consistency in risk evaluation and risk communication. Post-FS activities benefitting from EPA risk assessor involvement typically include the Proposed Plan, the Record of Decision (ROD), the Remedial Design/Remedial Action, and Five-Year Reviews.

5.1 RISK EVALUATION FOR THE PROPOSED PLAN

The Proposed Plan should include sufficient risk assessment information to support the basis for the proposed remedial action. EPA risk assessor support is recommended during the preparation of the Proposed Plan to ensure the consistency of risk information with the Baseline Risk Assessment Report and the FS Report. The level of detail in the Proposed Plan should be appropriate to the needs of the community. Additional EPA risk assessor support required at this time may be qualitative or quantitative, typically focusing on refinement of previous analyses, based on newly developed information.

5.2 DOCUMENTATION OF RISKS IN THE RECORD OF DECISION

To support the preparation of the Record of Decision, the EPA risk assessor should prepare or review a summary of the Baseline Risk Assessment Report which supports the basis for the remedial action. The primary focus should be on those exposure pathways and chemicals of concern found to pose actual or potential threats to human health or the environment. Chemicals included in the risk assessment but determined not to contribute significantly to an unacceptable risk need not be included in the Risk Assessment Summary in the ROD (e.g., chemicals with risk levels less than $1x10^{-6}$ or HQ less than 0.1) unless they are needed to justify a No Action ROD.

The Risk Assessment Summary prepared for the ROD should include, at a minimum, a summary table completed for those exposure scenarios and chemicals that trigger the need for cleanup. Other risk information may also be included in the ROD depending upon the level of detail preferred. Information related to values used for intake calculations and non-cancer and cancer toxicity data and exposure point concentrations are summarized on Standard Tables 4, 5, 6, 7, and 8, which could be placed in appendices to the ROD. In addition, the risk assessor should prepare/review the following information related to the selected alternative:

- Document short-term risks that may occur during remedy implementation.
- Document risks that may remain after completion of the remedy (including residual risk from untreated waste remaining at the site).
- Determine the need for five-year reviews.

Refer to *Interim Final Guidance on Preparing Superfund Decision Documents* (EPA 1989b) for a recommended format for summarizing human health risk assessment information in the ROD. Also refer to the upcoming *Guidance on Preparing Superfund Decision Documents*, which will be available by the end of fiscal year 1998.

5.3 RISK EVALUATION DURING REMEDIAL DESIGN AND REMEDIAL ACTION

The EPA risk assessor's role during remedial design and remedial action may be qualitative or quantitative depending on the site and phase of the project. During the remedial design, short-term and long-term risks may be assessed through refinement of previous analyses and identification of the need for engineering controls or other measures to mitigate risk.

During the remedial action, the EPA risk assessor is more likely to provide quantitative risk evaluation support. Short-term risk evaluation may address impacts to remediation workers and neighboring communities. Long-term risk evaluations typically focus on the following:

- Whether remediation levels specified in the ROD have been attained
- Whether residual risk after completion of the remedy ensures protectiveness.

5.4 RISK EVALUATION ASSOCIATED WITH EXPLANATIONS OF SIGNIFICANT DIFFERENCES (ESDs) AND AMENDED RODs

When conditions relevant to a site change following the signing of a ROD, it is sometimes necessary to prepare an ESD or amended ROD. Examples of conditions causing this situation may include, but are not limited to, the following:

- Toxicity values change.
- Additional technology performance information becomes available.
- ARARs change (e.g., Land Disposal Restrictions).

EPA risk assessor involvement with RPM evaluations of ESDs and Amended RODs focuses on evaluating whether clean-up standards are still protective when considering new ARARs, new parameters for risk and hazard calculations, new technology information, and other new information. Any new information and revised risk evaluations should be thoroughly documented.

5.5 RISK EVALUATION DURING FIVE-YEAR REVIEWS

CERCLA provides for reviews of certain remedies at least every five years to assure that human health and the environment are being protected by the remedial alternative implemented. EPA risk assessor involvement with RPM evaluations during Five-Year Reviews are generally quantitative and focus on the following two goals:

- Confirm that the remedy remains protective (including any engineering or institutional controls).

- Evaluate whether clean-up standards are still protective by considering new ARARs, new parameters for risk and hazard calculations, and other new information.

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APPENDIX A

STANDARD TABLES

-Blank Standard Tables
-Example Standard Tables

Blank Standard Tables

The Standard Table formats can not be altered (i.e., columns can not be added, deleted, or changed); however, rows and footnotes can be added as appropriate.

TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION

Site Name

Site Name/OU:
Region:
EPA ID Number:
State:
Status:
Federal Facility (Y/N):
EPA Project Manager:
EPA Risk Assessor:
Prepared by (Organization):
Prepared for (Organization):
Document Title:
Document Date:
Probabilistic Risk Assessment (Y/N):
Comments:

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

Site Name

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

Site Name

Scenario Timeframe:
Medium:
Exposure Medium:

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (N/C) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)

Footnote Instructions:

(1) Define the "(Qualifier)" codes used for the "Minimum Concentration" and "Maximum Concentration".

(2) Specify source(s) for the "Concentration Used for Screening".

(3) Specify source(s) for the "Background Value".

(4) Specify source(s) for the "Screening Toxicity Value".

(5) Define the codes used for the "Rationale for Selection or Deletion".

TABLE 3.1.CT

EXPOSURE POINT CONCENTRATION SUMMARY

CENTRAL TENDENCY

Site Name

Scenario Timeframe:
Medium:
Exposure Medium:

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale

Footnote Instructions:

-Specify any assumptions made in calculating the "95% UCL" term.

(1) Define the codes describing the type of distribution for the "95% UCL" term.

(2) Define the codes used for the "EPC Statistic".

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

Site Name

Scenario Timeframe:
Medium:
Exposure Medium:

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution) (1)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic (2)	Rationale

Footnote Instructions:

-Specify any assumptions made in calculating the "95% UCL" term.

(1) Define the codes describing the type of distribution for the "95% UCL" term.

(2) Define the codes used for the "EPC Statistic".

TABLE 4.1.CT

VALUES USED FOR DAILY INTAKE CALCULATIONS

CENTRAL TENDENCY

Site Name

Scenario Timeframe:

Medium:

Exposure Medium:

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)

Footnote Instructions:

(1) Reference the section of the risk assessment text where information regarding modeled intake development can be found.

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

Site Name

Scenario Timeframe:
Medium:
Exposure Medium:

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name (1)

Footnote Instructions:

(1) Reference the section of the risk assessment text where information regarding modeled intake development can be found.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

Site Name

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)

Footnote Instructions:

(1) Specify the source of the "Oral Absorption Efficiency for Dermal" in footnote.

-Specify the section of the risk assessment text where the derivation of the "Oral Absorption Efficiency for Dermal" can be found.

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

Site Name

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)

Footnote Instructions:

-Specify the section of the risk assessment text where the derivation of the "Extrapolated RfD" can be found.

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

Site Name

Chemical of Potential Concern	Chronic/ Subchronic	Parameter			Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	Parameter:Target Organ(s)	
		Name	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

Site Name

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)

Footnote Instructions:

-Specify the section of the risk assessment text where the derivation of the "Absorbed Cancer Slope Factor for Dermal" can be found.

(1) Specify the source of "Oral Absorption Efficiency for Dermal" in footnote.

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

Site Name

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)

TABLE 6.3

CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

Site Name

Chemical of Potential Concern	Parameters			Source(s)	Date(s) (MM/DD/YYYY)
	Name	Value	Units		

TABLE 6.4

CANCER TOXICITY DATA -- EXTERNAL (RADIATION)

Site Name

Chemical of Potential Concern	Cancer Slope Factor		Source(s)	Date(s) (MM/DD/YYYY)
	Value	Units		

TABLE 7.1.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY

Site Name

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
			Exp. Route Total													
			Exp. Route Total													
		Exposure Point Total														
	Exposure Medium Total															
			Exp. Route Total													
		Exposure Point Total														
	Exposure Medium Total															
Medium Total																
			Exp. Route Total													
		Exposure Point Total														
			Exp. Route Total													
			Exp. Route Total													
		Exposure Point Total														
	Exposure Medium Total															
Medium Total																
Total of Receptor Risks Across All Media												Total of Receptor Hazards Across All Media				

TABLE 7a.1.CT

CALCULATION OF CHEMICAL CANCER RISKS

CENTRAL TENDENCY

Site Name

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
			Exp. Route Total								
			Exp. Route Total								
		Exposure Point Total									
	Exposure Medium Total										
			Exp. Route Total								
		Exposure Point Total									
	Exposure Medium Total										
Medium Total											
			Exp. Route Total								
		Exposure Point Total									
			Exp. Route Total								
			Exp. Route Total								
	Exposure Medium Total	Exposure Point Total									
Medium Total											
Total of Receptor Risks Across All Media											

TABLE 7b.1.CT

CALCULATION OF CHEMICAL NON-CANCER HAZARDS

CENTRAL TENDENCY

Site Name

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
			Exp. Route Total								
			Exp. Route Total								
		Exposure Point Total									
	Exposure Medium Total										
			Exp. Route Total								
		Exposure Point Total									
	Exposure Medium Total										
Medium Total											
			Exp. Route Total								
		Exposure Point Total									
			Exp. Route Total								
			Exp. Route Total								
		Exposure Point Total									
	Exposure Medium Total										
Medium Total											
Total of Receptor Hazards Across All Media											

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site Name

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
			Exp. Route Total													
			Exp. Route Total													
		Exposure Point Total														
	Exposure Medium Total															
			Exp. Route Total													
		Exposure Point Total														
	Exposure Medium Total															
Medium Total																
			Exp. Route Total													
		Exposure Point Total														
			Exp. Route Total													
			Exp. Route Total													
		Exposure Point Total														
	Exposure Medium Total															
Medium Total																
											Total of Receptor Risks Across All Media					Total of Receptor Hazards Across All Media

TABLE 7a.1.RME

CALCULATION OF CHEMICAL CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

Site Name

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk
							Value	Units	Value	Units	
			Exp. Route Total								
			Exp. Route Total								
		Exposure Point Total									
	Exposure Medium Total										
			Exp. Route Total								
		Exposure Point Total									
	Exposure Medium Total										
Medium Total											
			Exp. Route Total								
		Exposure Point Total									
			Exp. Route Total								
			Exp. Route Total								
		Exposure Point Total									
	Exposure Medium Total										
Medium Total											
Total of Receptor Risks Across All Media											

TABLE 7b.1.RME

CALCULATION OF CHEMICAL NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Site Name

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units	
			Exp. Route Total								
			Exp. Route Total								
		Exposure Point Total									
	Exposure Medium Total										
			Exp. Route Total								
		Exposure Point Total									
	Exposure Medium Total										
Medium Total											
			Exp. Route Total								
		Exposure Point Total									
			Exp. Route Total								
			Exp. Route Total								
		Exposure Point Total									
	Exposure Medium Total										
Medium Total											
Total of Receptor Hazards Across All Media											

TABLE 8.1.CT

CALCULATION OF RADIATION CANCER RISKS

Central Tendency

Site Name

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												

Total of Receptor Risks Across All Media

TABLE 8.1.RME

CALCULATION OF RADIATION CANCER RISKS

Reasonable Maximum Exposure

Site Name

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
	Exposure Medium Total											
Medium Total												

Total of Receptor Risks Across All Media

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY

Site Name

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
Receptor Total							Receptor Risk Total					Receptor HI Total	

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Site Name

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
Receptor Total				Receptor Risk Total					Receptor HI Total				

Total Organ 1 HI Across All Media =

Total Organ 2 HI Across All Media =

TABLE 10.1.CT
RISK SUMMARY
CENTRAL TENDENCY
Site Name

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
Receptor Total							Receptor Risk Total					Receptor HI Total	

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

TABLE 10.1.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

Site Name

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
			Chemical Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
			Chemical Total										
			Radionuclide Total										
		Exposure Point Total											
	Exposure Medium Total												
Medium Total													
Receptor Total							Receptor Risk Total					Receptor HI Total	

Total Organ 1 HI Across All Media =	
Total Organ 2 HI Across All Media =	

Example Standard Tables

TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION

The Dean Company

Site Name/OU: The Dean Company
Region: III
EPA ID Number: PAD123456789
State: PA
Status: Fund Lead Remedial Investigation
Federal Facility (Y/N): N
EPA Project Manager: John Smith
EPA Risk Assessor: Jane Doe
Prepared by (Organization): Eris Consulting Engineers
Prepared for (Organization): EPA
Document Title: Human Health Risk Assessment for the Dean Company Site
Document Date: August 8, 2001
Probabilistic Risk Assessment (Y/N): N
Comments: This site is contaminated with volatile organic compounds, pesticides, and metals. Lead evaluation was conducted.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

Site Name

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The Dean Company

Scenario Timeframe: Future

Medium: Groundwater

Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
Aquifer 1 - Tap Water	117817	Bis(2-ethylhexyl)phthalate	2 J	5 J	ug/l	GW3D	4 / 12	3 - 4	5	NA	4.8 C	6	MCL	Y	ASL
	67663	Chloroform	0.6 J	9	ug/l	GW3D	3 / 12	1 - 1	9	NA	0.063 C	100	MCL	Y	ASL
	75150	Carbon Disulfide	0.3 J	4.5	ug/l	GW3D	3 / 12	1 - 1	4.5	NA	100 N	NA	NA	N	BSL
	76448	Heptachlor	2 J	33 J	ug/l	GW4D	6 / 12	0.01 - 0.01	33	NA	0.015 C	0.4	MCL	Y	ASL
	108883	Toluene	0.1 J	0.2 J	ug/l	GW3D	3 / 12	1 - 1	0.2	NA	75 N	1000	MCL	N	BSL
	7429905	Aluminum	134 J	1340	ug/l	GW3D	2 / 12	29 - 38.2	1340	NA	3700 N	50 - 200	SMCL	N	BSL
	7440393	Barium	65 J	489	ug/l	GW1D	6 / 12	0.2 - 1	489	NA	260 N	2000	MCL	Y	ASL
	7440417	Beryllium	0.2 K	1.5 K	ug/l	GW2D	3 / 12	0.1 - 1	1.5	NA	7.3 N	4	MCL	N	BSL
	7439921	Lead	6 J	35 J	ug/l	GW3D	4 / 12	0.1 - 1	35	NA	15	15	MCL	Y	ASL
	7439965	Manganese	1900	12500	ug/l	GW1D	6 / 12	0.3 - 1	12500	NA	73 N	50	SMCL	Y	ASL
	7440020	Nickel	0.9 J	1.5 J	ug/l	GW4D	3 / 12	0.9 - 7	1.5	NA	73 N	NA	NA	N	BSL

(1) Maximum concentration used for screening.

(2) To date, no background study has been completed.

(3) All compounds were screened against the Risk-Based Concentration (RBC) Table, U.S. EPA Region III, May 8, 2001 for tap water (cancer benchmark = 1E-06; HQ = 0.1). Lead was screened against the action level of 15 ug/l.

(4) Rationale Codes:

Selection Reason: Above Screening Level (ASL)

Deletion Reason: Below Screening Level (BSL)

Definitions: NA = Not Applicable
MCL = Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
J = Estimated Value
K = Estimated Value - Biased High
C = Carcinogen
N = Noncarcinogen

TABLE 2.2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The Dean Company

Scenario Timeframe: Future

Medium: Groundwater

Exposure Medium: Air

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
Water Vapors from Showerhead	117817	Bis(2-ethylhexyl)phthalate	2 J	5 J	ug/l	GW3D	4 / 12	3 - 4	5	NA	4.8 C	6	MCL	Y	ASL
	67663	Chloroform	0.6 J	9	ug/l	GW3D	3 / 12	1 - 1	9	NA	0.063 C	100	MCL	Y	ASL
	75150	Carbon Disulfide	0.3 J	4.5	ug/l	GW3D	3 / 12	1 - 1	4.5	NA	100 N	NA	NA	N	BSL
	76448	Heptachlor	2 J	33 J	ug/l	GW4D	6 / 12	0.01 - 0.01	33	NA	0.015 C	0.4	MCL	Y	ASL
	108883	Toluene	0.1 J	0.2 J	ug/l	GW3D	3 / 12	1 - 1	0.2	NA	75 N	1000	MCL	N	BSL
	7429905	Aluminum	134 J	1340	ug/l	GW3D	2 / 12	29 - 38.2	1340	NA	3700 N	50 - 200	SMCL	N	BSL
	7440393	Barium	65 J	489	ug/l	GW1D	6 / 12	0.2 - 1	489	NA	260 N	2000	MCL	Y	ASL
	7440417	Beryllium	0.2 K	1.5 K	ug/l	GW2D	3 / 12	0.1 - 1	1.5	NA	7.3 N	4	MCL	N	BSL
	7439921	Lead	6 J	35 J	ug/l	GW3D	4 / 12	0.1 - 1	35	NA	15	15	MCL	Y	ASL
	7439965	Manganese	1900	12500	ug/l	GW1D	6 / 12	0.3 - 1	12500	NA	73 N	50	SMCL	Y	ASL
	7440020	Nickel	0.9 J	1.5 J	ug/l	GW4D	3 / 12	0.9 - 7	1.5	NA	73 N	NA	NA	N	BSL

(1) Maximum concentration used for screening.

(2) To date, no background study has been completed.

(3) All compounds were screened against the Risk-Based Concentration (RBC) Table, U.S. EPA Region III, May 8, 2001 for tap water (cancer benchmark = 1E-06; HQ = 0.1). Lead was screened against the action level of 15 ug/l.

(4) Rationale Codes:

Selection Reason: Above Screening Level (ASL)

Deletion Reason: Below Screening Level (BSL)

Definitions: NA = Not Applicable
MCL = Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
J = Estimated Value
K = Estimated Value - Biased High
C = Carcinogen
N = Noncarcinogen

TABLE 2.3

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The Dean Company

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
Soil at Site 1	11096825	Aroclor-1260	15 J	110 J	ug/kg	SS03	6 / 29	33 - 300	110	NA	320 C	NA	NA	N	BSL
	56553	Benzo(a)anthracene	120 J	230 J	ug/kg	SS03	16 / 29	330 - 700	230	NA	870 C	NA	NA	N	BSL
	50328	Benzo(a)pyrene	48 J	70 J	ug/kg	SS03	17 / 29	30 - 70	70	NA	87 C	NA	NA	N	BSL
	75150	Carbon Disulfide	2 J	33	ug/kg	SB07	4 / 29	10 - 16	33	NA	780000 N	NA	NA	N	BSL
	72548	4,4'-DDD	1 J	4200	ug/kg	SS09	22 / 29	3.3 - 1900	4200	NA	2700 C	NA	NA	Y	ASL
	72559	4,4'-DDE	0.44 J	7200 J	ug/kg	SS09	28 / 29	2.2 - 700	7200	NA	1900 C	NA	NA	Y	ASL
	50293	4,4'-DDT	0.69 J	290000 J	ug/kg	SB08	29 / 29	3.3 - 700	290000	NA	1900 C	NA	NA	Y	ASL
	108883	Toluene	1 J	2 J	ug/kg	SS08	2 / 29	10 - 16	2	NA	1600000 N	NA	NA	N	BSL
	7429905	Aluminum	1960	21700	mg/kg	SB07	29 / 29	6.3 - 11	21700	NA	7800 N	NA	NA	Y	ASL
	7440417	Beryllium	0.1 J	13.4	mg/kg	SS06	23 / 29	0.02 - 0.21	13.4	NA	16 N	NA	NA	N	BSL
	7439921	Lead	56 J	750 J	mg/kg	SS03	16 / 29	10 - 16	750	NA	400	NA	NA	Y	ASL
	7439965	Manganese	5.9	688	mg/kg	SS03	29 / 29	0.05 - 0.5	688	NA	160 N	NA	NA	Y	ASL
	7782492	Selenium	0.53 J	1	mg/kg	SS02	9 / 29	0.43 - 0.75	1	NA	39 N	NA	NA	N	BSL
Soil at Site 2	67641	Acetone	9 J	170	ug/kg	SB01	16 / 40	10 - 22	170	NA	780000 N	NA	NA	N	BSL
	56553	Benzo(a)anthracene	48 J	100 J	ug/kg	SS26	31 / 40	340 - 700	100	NA	870 C	NA	NA	N	BSL
	50328	Benzo(a)pyrene	47 J	60 J	ug/kg	SS26	29 / 40	34 - 70	60	NA	87 C	NA	NA	N	BSL
	75150	Carbon Disulfide	2 J	17 J	ug/kg	SB07	13 / 40	10 - 22	17	NA	780000 N	NA	NA	N	BSL
	72559	4,4'-DDE	0.14 J	4700 J	ug/kg	SS35	28 / 40	3.3 - 600	4700	NA	1900 C	NA	NA	Y	ASL
	50293	4,4'-DDT	0.11 J	3100 J	ug/kg	SS32	27 / 40	3.3 - 600	3100	NA	1900 C	NA	NA	Y	ASL
	84662	Diethylphthalate	30 J	170 J	ug/kg	SS12	10 / 40	340 - 3400	170	NA	6300000 N	NA	NA	N	BSL
	7440417	Beryllium	0.08 J	1.5 J	mg/kg	SB07	34 / 40	0.02 - 0.36	1.5	NA	16 N	NA	NA	N	BSL
	7440484	Cobalt	0.31 J	36	mg/kg	SB02	28 / 40	0.08 - 2.9	36	NA	160 N	NA	NA	N	BSL
	7440508	Copper	0.9 J	6470	mg/kg	SS01	26 / 40	0.17 - 2.2	6470	NA	310 N	NA	NA	Y	ASL
	7439896	Iron	371	120000	mg/kg	SS01	24 / 40	2.7 - 13.5	120000	NA	2300 N	NA	NA	Y	ASL
	7782492	Selenium	0.49 J	1.6 J	mg/kg	SS23	12 / 40	0.4 - 1.1	1.6	NA	39 N	NA	NA	N	BSL

(1) Maximum concentration used for screening.
(2) To date, no background study has been completed.
(3) All compounds were screened against the Risk-Based Concentration (RBC) Table, U.S. EPA Region III, May 8, 2001 for residential soil (cancer benchmark = 1E-06; HQ = 0.1). Lead was screened against the U.S. EPA screening value of 400 mg/kg.
(4) Rationale Codes:
Selection Reason: Above Screening Level (ASL)
Deletion Reason: Below Screening Level (BSL)

Definitions: NA = Not Applicable
J = Estimated Value
C = Carcinogen
N = Noncarcinogen

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Groundwater

Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Aquifer 1 - Tap Water	Bis(2-ethylhexyl)phthalate	ug/l	4	5.5 (T)	5 J	5	ug/l	Max	W-Test (1)
	Chloroform	ug/l	1.9	14.9 (T)	9	9	ug/l	Max	W-Test (1)
	Heptachlor	ug/l	27	30 (T)	33 J	30	ug/l	95% UCL - T	W - Test (2)
	Barium	ug/l	224	2835 (T)	489	489	ug/l	Max	W-Test (1)
	Lead	ug/l	21	32 (T)	35 J	32	ug/l	95% UCL - T	W - Test (2)
	Manganese	ug/l	6052	33449 (T)	12500	12500	ug/l	Max	W-Test (1)

Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T)

T = Transformed

(1) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

J = Estimated Value

(2) Shapiro-Wilk W Test indicates data are log-normally distributed.

TABLE 3.2.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Groundwater

Exposure Medium: Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Water Vapors from Showerhead	Bis(2-ethylhexyl)phthalate	ug/l	4	5.5 (T)	5 J	5	ug/l	Max	W-Test (1)
	Chloroform	ug/l	1.9	14.9 (T)	9	9	ug/l	Max	W-Test (1)
	Heptachlor	ug/l	27	30 (T)	33 J	30	ug/l	95% UCL - T	W - Test (2)

Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T)

(1) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

(2) Shapiro-Wilk W Test indicates data are log-normally distributed.

T = Transformed

J = Estimated Value

TABLE 3.3.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Soil

Exposure Medium: Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Soil at Site 1	4,4'-DDD	ug/kg	239	452 (T)	4200	452	ug/kg	95 % UCL -T	W - Test (2)
	4,4'-DDE	ug/kg	596	6793 (T)	7200 J	6793	ug/kg	95% UCL - T	W - Test (2)
	4,4'-DDT	ug/kg	11007	28619 (N)	290000 J	28619	ug/kg	95% UCL - N	W - Test (1)
	Aluminum	mg/kg	7450	9964 (T)	21700	9964	mg/kg	95% UCL - T	W - Test (2)
	Lead	mg/kg	210	345 (T)	750 J	345	mg/kg	95% UCL - T	W - Test (2)
	Manganese	mg/kg	116	201 (T)	688	201	mg/kg	95% UCL - T	W - Test (2)
Soil at Site 2	4,4'-DDE	ug/kg	230	496	4700 J	496	ug/kg	95 % UCL - T	W - Test (2)
	4,4'-DDT	ug/kg	183	322 (T)	3100 J	322	ug/kg	95% UCL - T	W - Test (2)
	Copper	mg/kg	173	245 (T)	6470	245	mg/kg	95% UCL - T	W - Test (2)
	Iron	mg/kg	19518	32230 (T)	120000	32230	mg/kg	95% UCL - T	W - Test (2)

Statistics: 95% UCL of Normal Data (95% UCL - N); 95% UCL of Transformed Data (95% UCL - T)

(1) Shapiro-Wilk W Test indicates data are normally distributed.

(2) Shapiro-Wilk W Test indicates data are log-normally distributed.

N = Normal

T = Transformed

J = Estimated Value

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Groundwater

Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	Aquifer 1 - Tap Water	CW	Chemical Concentration in Water	See Table 3.1	mg/l	See Table 3.1	Chronic Daily Intake (CDI) (mg/kg/day) =
				IR-W	Ingestion Rate of Water	2	l/day	EPA, 1991	CW x IR-W x EF x ED x 1/BW x 1/AT
				EF	Exposure frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989a	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 1989a	
		Child	Aquifer 1 - Tap Water	CW	Chemical Concentration in Water	See Table 3.1	mg/l	See Table 3.1	CDI (mg/kg/day) =
				IR-W	Ingestion Rate of Water	1	l/day	EPA, 1989b	CW x IR-W x EF x ED x 1/BW x 1/AT
				EF	Exposure frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989a	
				AT-N	Averaging Time - Non-Cancer	2,190	days	EPA, 1989a	
Dermal	Resident	Adult	Aquifer 1 - Tap Water	CW	Chemical Concentration in Water	See Table 3.1	mg/l	See Table 3.1	Dermally Absorbed Dose (DAD) (mg/kg-day) =
				FA	Fraction Absorbed Water	Chemical Specific	- -	EPA, 2001	DA-event x EV x ED x EF x SA x 1/BW x 1/AT
				Kp	Permeability Constant	Chemical Specific	cm/hr	EPA, 2001	where for organic compounds,
				SA	Skin Surface Area	18,000	cm2	EPA, 2001	Absorbed Dose per Event (DA-event) (mg/cm2-event) =
				tau-event	Lag time per event	Chemical Specific	hours/event	EPA, 2001	2 FA x Kp x CW x CF x SQRT{(6 x tau-event x t-event)/pi}
				t-event	Event Duration	0.58	hours/event	EPA, 2001	or
				B	Ratio of permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis	Chemical Specific	- -	EPA, 2001	DA-event = FA x Kp x CW x {(t-event/(1 + B)) + 2 x tau-event x ((1 + (3 x B) + (3 x B x B))/(1 + B)2)} and where for inorganic compounds, DA-event = Kp x CW x CF x t-event
				EV	Event Frequency	1	events/day	EPA, 2001	
				EF	Exposure Frequency	350	days/year	EPA, 2001	
				ED	Exposure Duration	24	years	EPA, 1991	

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Groundwater

Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal (continued)	Resident (continued	Adult (continued)	Aquifer 1 - Tap Water	CF	Volumetric Conversion Factor for Water	0.001	l/cm3	- -	
				BW	Body Weight	70	kg	EPA, 2001	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 2001	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 2001	
		Child	Aquifer 1 - Tap Water	CW	Chemical Concentration in Water	See Table 3.1	mg/l	See Table 3.1	DAD (mg/kg-day) =
				FA	Fraction Absorbed Water	Chemical Specific	- -	EPA, 2001	DA-event x EV x ED x EF x SA x 1/BW x 1/AT
				Kp	Permeability Constant	Chemical Specific	cm/hr	EPA, 2001	where for organic compounds,
				SA	Skin Surface Area	6,600	cm2	EPA, 2001	DA-event (mg/cm2-event) =
				tau-event	Lag time per event	Chemical Specific	hours/event	EPA, 2001	2 FA x Kp x CW x CF x SQRT{(6 x tau-event x t-event)/pi}
				t-event	Event Duration	1	hours/event	EPA, 2001	or
				B	Ratio of permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis	Chemical Specific	- -	EPA, 2001	DA-event = FA x Kp x CW x {(t-event/(1 + B)) + 2 x tau-event x ((1 + (3 x B) + (3 x B x B))/(1 + B)2)} and where for inorganic compounds, DA-event = Kp x CW x CF x t-event
				EV	Event Frequency	1	events/day	EPA, 2001	
				EF	Exposure Frequency	350	days/year	EPA, 2001	
				ED	Exposure Duration	6	years	EPA, 2001	
				CF	Volumetric Conversion Factor for Water	0.001	l/cm3	- -	
				BW	Body Weight	15	kg	EPA, 2001	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 2001	
				AT-N	Averaging Time - Non-Cancer	2,190	days	EPA, 2001	

EPA 1989a: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual, Part A. OERR EPA/540/1-89/002.

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EPA 1997: Exposure Factors Handbook, Volume 1. EPA/600/P-95/002Fa.

EPA 2001: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim.

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Groundwater

Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation (1)	Resident	Adult	Water Vapors from Showerhead	(1)	(1)	(1)	(1)	(1)	Foster and Chrostowski Model

(1) Refer to the Risk Assessment text for details on the modeled intake methodology and parameters used to calculate modeled intake values for the Foster and Chrostowski Shower Model.

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Soil

Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	100	mg/day	EPA, 1991	CS x IR x FI x EF x ED x CF1 x 1/BW x 1/AT
				FI	Fraction Ingested	1	- -	Professional Judgment	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
				CF1	Conversion Factor	1E-06	kg/mg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 1989	
			Soil at Site 2	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	CDI (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	100	mg/day	EPA, 1991	CS x IR x FI x EF x ED x CF1 x 1/BW x 1/AT
				FI	Fraction Ingested	1	- -	Professional Judgment	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
				CF1	Conversion Factor	1E-06	kg/mg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 1989	
		Child	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	CDI (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	200	mg/day	EPA, 1991	CS x IR x FI x EF x ED x CF1 x 1/BW x 1/AT
				FI	Fraction Ingested	1	- -	Professional Judgment	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	
				CF1	Conversion Factor	1E-06	kg/mg	- -	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	
				AT-N	Averaging Time - Non-Cancer	2,190	days	EPA, 1989	

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Soil

Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion (continued)	Resident (continued)	Child (continued)	Soil at Site 2	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	CDI (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	200	mg/day	EPA, 1991	CS x IR x FI x EF x ED x CF1 x 1/BW x 1/AT
				FI	Fraction Ingested	1	- -	Professional Judgment	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	
				CF1	Conversion Factor	1E-06	kg/mg	- -	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	
				AT-N	Averaging Time - Non-Cancer	2,190	days	EPA, 1989	
Dermal	Resident	Adult	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	Dermal Absorbed Dose (DAD) (mg/kg-day) =
				CF	Conversion Factor	1E-06	kg/mg	- -	DA-event x EF x ED x EV x SA X 1/BW x 1/AT
				SA	Skin Surface Area Available for Contact	5,700	cm2	EPA, 2001	where
				AF	Soil to Skin Adherence Factor	0.07	mg/cm2-event	EPA, 2001	Absorbed Dose per Event (DA-event) (mg/cm2-event) =
				ABS-d	Dermal Absorption Factor	chemical-specific	unitless	EPA, 2001	CS x CF x AF x ABS-d
				EV	Event Frequency	1	events/day	EPA, 2001	
				EF	Exposure Frequency	350	days/year	EPA, 2001	
				ED	Exposure Duration	24	years	EPA, 1991	
				BW	Body Weight	70	kg	EPA, 2001	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 2001	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 2001	

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Soil

Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal (continued)	Resident (continued)	Adult (continued)	Soil at Site 2	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	DAD (mg/kg-day) =
				CF	Conversion Factor	1E-06	kg/mg	- -	DA-event x EF x ED x EV x SA X 1/BW x 1/AT
				SA	Skin Surface Area Available for Contact	5,700	cm2	EPA, 2001	where
				AF	Soil to Skin Adherence Factor	0.07	mg/cm2-event	EPA, 2001	DA-event (mg/cm2-event) =
				ABS-d	Dermal Absorption Factor	chemical-specific	unitless	EPA, 2001	CS x CF x AF x ABS-d
				EV	Event Frequency	1	events/day	EPA, 2001	
				EF	Exposure Frequency	350	days/year	EPA, 2001	
				ED	Exposure Duration	24	years	EPA, 1991	
				BW	Body Weight	70	kg	EPA, 2001	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 2001	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 2001	
		Child	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	DAD (mg/kg-day) =
				CF	Conversion Factor	1E-06	kg/mg	- -	DA-event x EF x ED x EV x SA X 1/BW x 1/AT
				SA	Skin Surface Area Available for Contact	2,800	cm2	EPA, 2001	where
				AF	Soil to Skin Adherence Factor	0.2	mg/cm2-event	EPA, 2001	DA-event (mg/cm2-event) =
				ABS-d	Dermal Absorption Factor	chemical-specific	unitless	EPA, 2001	CS x CF x AF x ABS-d
				EV	Event Frequency	1	events/day	EPA, 2001	
				EF	Exposure Frequency	350	days/year	EPA, 2001	
				ED	Exposure Duration	6	years	EPA, 2001	
				BW	Body Weight	15	kg	EPA, 2001	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 2001	
				AT-N	Averaging Time - Non-Cancer	2,190	days	EPA, 2001	

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Soil

Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal (continued)	Resident (continued)	Child (continued)	Soil at Site 2	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	DAD (mg/kg-day) =
				CF	Conversion Factor	1E-06	kg/mg	- -	DA-event x EF x ED x EV x SA X 1/BW x 1/AT
				SA	Skin Surface Area Available for Contact	2,800	cm2	EPA, 2001	where
				AF	Soil to Skin Adherence Factor	0.2	mg/cm2-event	EPA, 2001	DA-event (mg/cm2-event) =
				ABS-d	Dermal Absorption Factor	chemical-specific	unitless	EPA, 2001	CS x CF x AF x ABS-d
				EV	Event Frequency	1	events/day	EPA, 2001	
				EF	Exposure Frequency	350	days/year	EPA, 2001	
				ED	Exposure Duration	6	years	EPA, 2001	
				BW	Body Weight	15	kg	EPA, 2001	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 2001	
				AT-N	Averaging Time - Non-Cancer	2,190	days	EPA, 2001	

EPA 1989: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual, Part A. OERR EPA/540/1-89/002.

EPA 1991: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER 9285.6-03.

EPA 1995: Assessing Dermal Exposure from Soil, Technical Guidance Manual, Region III, EPA/903-K-95-003.

EPA 1997: Exposure Factors Handbook, Volume 1. EPA/600/P-95/002Fa.

EPA 2001: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

The Dean Company

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absoprtion Efficiency for Dermal (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
4,4'-DDD	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
4,4'-DDT	Chronic	5.0E-004	mg/kg/day	1	5.0E-004	mg/kg/day	Liver	100	IRIS	06/21/2001
4,4'-DDT	Subchronic	5.0E-004	mg/kg/day	1	5.0E-004	mg/kg/day	Liver	100	HEAST	07/01/1997
Bis(2-ethylhexyl)phthalate	Chronic	2.0E-02	mg/kg/day	1	2.0E-02	mg/kg/day	Liver	1000	IRIS	06/21/2001
Bis(2-ethylhexyl)phthalate	Subchronic	2.0E-02	mg/kg/day	1	2.0E-02	mg/kg/day	Liver	1000	HEAST	07/01/1997
Chloroform	Chronic	1.0E-02	mg/kg/day	1	1.0E-02	mg/kg/day	Liver	1000	IRIS	06/21/2001
Chloroform	Subchronic	1.0E-02	mg/kg/day	1	1.0E-02	mg/kg/day	Liver	1000	HEAST	07/01/1997
Heptachlor	Chronic	5.0E-04	mg/kg/day	1	5.0E-04	mg/kg/day	Liver	300	IRIS	06/21/2001
Heptachlor	Subchronic	5.0E-04	mg/kg/day	1	5.0E-04	mg/kg/day	Liver	300	HEAST	07/01/1997
Aluminum	Chronic	1.0E+00	mg/kg/day	1	1.0E+00	mg/kg/day	Central Nervous System	100	NCEA	06/21/2001
Barium	Chronic	7.0E-02	mg/kg/day	0.07	4.9E-03	mg/kg/day	Heart	3	IRIS	02/02/2001
Barium	Subchronic	7.0E-02	mg/kg/day	0.07	4.9E-03	mg/kg/day	Heart	3	HEAST	07/01/1997
Copper	Chronic	3.7E-02	mg/kg/day	1	3.7E-02	mg/kg/day	Gastrointestinal	NA	HEAST	07/01/1997
Copper	Subchronic	3.7E-02	mg/kg/day	1	3.7E-02	mg/kg/day	Gastrointestinal	NA	HEAST	07/01/1997
Iron	Chronic	3.0E-01	mg/kg/day	1	3.0E-01	mg/kg/day	Gastrointestinal	1	NCEA	06/21/2001
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese (nonfood)	Chronic	2.0E-02	mg/kg/day	0.04	8.0E-04	mg/kg/day	Central Nervous System	1	IRIS	06/21/2001

(1) Source: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. Section 4.2 and Exhibit 4-1.

(2) See Risk Assessment text for the derivation of the "Absorbed RfD for Dermal".

Definitions: NA = Not Available

IRIS = Integrated Risk Information System

HEAST = Health Effects Assessment Summary Table, July 1997

NCEA = National Center for Environmental Assessment

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

The Dean Company

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
4,4'-DDD	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	Chronic	3.0E-04	mg/m3	8.6E-05	mg/kg/day	Nasal	1000	NCEA	06/21/2001
Chloroform	Subchronic	3.0E-03	mg/m3	8.6E-4	mg/kg/day	Nasal	100	NCEA	06/21/2001
Heptachlor	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aluminum	Chronic	5.0E-03	mg/m3	1.4E-03	mg/kg/day	Central Nervous System	300	NCEA	06/21/2001
Barium	Chronic	5.0E-04	mg/m3	1.4E-04	mg/kg/day	Fetus	1000	HEAST	07/01/1997
Barium	Subchronic	5.0E-03	mg/m3	1.4E-03	mg/kg/day	Fetus	100	HEAST	07/01/1997
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese (nonfood)	Chronic	5.0E-05	mg/m3	1.4E-05	mg/kg/day	Central Nervous System	1000	IRIS	06/21/2001

(1) See Risk Assessment text for the derivation of the "Extrapolated RfD".

Definitions: NA = Not Available

IRIS = Integrated Risk Information System

HEAST = Health Effects Assessment Summary Table, July 1997

NCEA = National Center for Environmental Assessment

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

The Dean Company

Chemical of Potential Concern	Chronic/ Subchronic	Parameter			Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	Parameter:Target Organ(s)	
		Name	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
Not Applicable								

There are no special case chemicals in this risk assessment. As a result, the table is blank.

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

The Dean Company

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
4,4'-DDD	2.4E-01	1/mg/kg/day	1	2.4E-01	1/mg/kg/day	B2	IRIS	06/21/2001
4,4'-DDE	3.4E-01	1/mg/kg/day	1	3.4E-01	1/mg/kg/day	B2	IRIS	06/21/2001
4,4'-DDT	3.4E-001	1/mg/kg/day	1	3.4E-001	1/mg/kg/day	B2	IRIS	06/21/2001
Bis(2-ethylhexyl)phthalate	1.4E-02	1/mg/kg/day	1	1.4E-02	1/mg/kg/day	B2	IRIS	06/21/2001
Chloroform	6.1E-03	1/mg/kg/day	1	6.1E-03	1/mg/kg/day	B2	IRIS	06/21/2001
Heptachlor	4.5E+00	1/mg/kg/day	1	4.5E+00	1/mg/kg/day	B2	IRIS	06/21/2001
Aluminum	NA	NA	1	NA	NA	NA	NA	NA
Barium	NA	NA	0.07	NA	NA	NA	NA	NA
Copper	NA	NA	1	NA	NA	NA	NA	NA
Iron	NA	NA	1	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA
Manganese (nonfood)	NA	NA	0.04	NA	NA	NA	NA	NA

(1) Source: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. Section 4.2 and Exhibit 4-1.

(2) See Risk Assessment text for the derivation of the "Absorbed Cancer Slope Factor for Dermal".

Definitions: NA = Not Available

IRIS = Integrated Risk Information System

B2 = Probable Human Carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

The Dean Company

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
4,4'-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	9.7E-005	1/ug/m3	3.4E-001	1/mg/kg/day	B2	IRIS	06/21/2001
Bis(2-ethylhexyl)phthalate	NA	NA	NA	NA	NA	NA	NA
Chloroform	2.3E-05	1/ug/m3	8.1E-02	1/mg/kg/day	B2	IRIS	06/21/2001
Heptachlor	1.3E-03	1/ug/m3	4.5E+00	1/mg/kg/day	B2	IRIS	06/21/2001
Aluminum	NA	NA	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA
Manganese (nonfood)	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA

Definitions: NA = Not Available

IRIS = Integrated Risk Information System

B2 = Probable Human Carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

TABLE 6.3

CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

The Dean Company

Chemical of Potential Concern	Parameters			Source(s)	Date(s) (MM/DD/YYYY)
	Name	Value	Units		
Not Applicable					

There are no special case chemicals in this risk assessment. As a result, this table is blank.

TABLE 6.4

CANCER TOXICITY DATA -- EXTERNAL (RADIATION)

The Dean Company

Chemical of Potential Concern	Cancer Slope Factor		Source(s)	Date(s) (MM/DD/YYYY)
	Value	Units		
Not Applicable				

There are no radionuclides in this risk assessment. As a result, this table is blank.

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Receptor Population: Resident

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Aquifer 1 - Tap Water	Ingestion	Bis(2-ethylhexyl)phthalate	0.005	mg/l	4.7E-05	mg/kg/day	1.4E-02	1/mg/kg/day	7E-07	1.4E-04	mg/kg/day	2.0E-02	mg/kg/day	0.007
				Chloroform	0.009	mg/l	8.5E-05	mg/kg/day	6.1E-03	1/mg/kg/day	5E-07	2.5E-04	mg/kg/day	1.0E-02	mg/kg/day	0.03
				Heptachlor	0.03	mg/l	2.8E-04	mg/kg/day	4.5E-00	1/mg/kg/day	1E-03	8.1E-04	mg/kg/day	5.0E-04	mg/kg/day	2
				Barium	0.489	mg/l	4.6E-03	mg/kg/day	NA	NA	NA	1.3E-02	mg/kg/day	7.0E-02	mg/kg/day	0.2
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	12.5	mg/l	1.2E-01	mg/kg/day	NA	NA	NA	3.4E-01	mg/kg/day	2.0E-02	mg/kg/day	17
			Exp. Route Total								1E-03					19
			Dermal	Bis(2-ethylhexyl)phthalate	0.005	mg/l	7.2E-05	mg/kg/day	1.4E-02	1/mg/kg/day	1E-06	2.1E-04	mg/kg/day	2.2E-02	mg/kg/day	0.01
				Chloroform	0.009	mg/l	1.7E-04	mg/kg/day	6.1E-03	1/mg/kg/day	1E-06	4.9E-04	mg/kg/day	1.0E-02	mg/kg/day	0.05
				Heptachlor	0.03	mg/l	1.3E-04	mg/kg/day	4.5E-00	1/mg/kg/day	6E-04	3.9E-04	mg/kg/day	5.0E-04	mg/kg/day	0.8
				Barium	0.489	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	12.5	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Exp. Route Total								6E-04					0.9
		Exposure Point Total									2E-03					20
	Exposure Medium Total										2E-03					20
	Air	Water Vapors from	Inhalation	Bis(2-ethylhexyl)phthalate	0.005	mg/l	2.3E-06	mg/kg/day	NA	NA	NA	3.6E-06	mg/kg/day	NA	NA	NA
		Showerhead		Chloroform	0.009	mg/l	1.3E-04	mg/kg/day	8.1E-02	1/mg/kg/day	1E-05	3.9E-04	mg/kg/day	8.6E-05	mg/kg/day	5
				Heptachlor	0.03	mg/l	2.6E-04	mg/kg/day	4.5E-00	1/mg/kg/day	1E-03	7.7E-04	mg/kg/day	NA	NA	NA
			Exp. Route Total								1E-03					5
		Exposure Point Total									1E-03					5
	Exposure Medium Total										1E-03					5
Groundwater Total											3E-03					25
Soil	Soil	Soil at Site 1	Ingestion	4,4'-DDD	0.452	mg/kg	2.1E-07	mg/kg/day	2.4E-01	1/mg/kg/day	5E-08	6.2E-07	mg/kg/day	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	3.2E-06	mg/kg/day	3.4E-01	1/mg/kg/day	1E-06	9.3E-06	mg/kg/day	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	1.3E-05	mg/kg/day	3.4E-01	1/mg/kg/day	5E-06	3.9E-05	mg/kg/day	5.0E-04	mg/kg/day	0.08
				Aluminum	9964	mg/kg	4.7E-03	mg/kg/day	NA	NA	NA	1.4E-02	mg/kg/day	1.0E+00	mg/kg/day	0.01
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	201	mg/kg	9.5E-05	mg/kg/day	NA	NA	NA	2.8E-04	mg/kg/day	1.4E-01	mg/kg/day	0.002
			Exp. Route Total								6E-06					0.09
			Dermal	4,4'-DDD	0.452	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	1.6E-06	mg/kg/day	3.4E-01	1/mg/kg/day	5E-07	4.7E-06	mg/kg/day	5.0E-04	mg/kg/day	0.009
				Aluminum	9964	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	201	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Exp. Route Total								5E-07					0.009
		Exposure Point Total									7E-06					0.1

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Receptor Population: Resident

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (continued)	Soil (continued)	Soil at Site 2	Ingestion	4,4'-DDE	0.496	mg/kg	2.3E-07	mg/kg/day	3.4E-01	1/mg/kg/day	8E-08	6.8E-07	mg/kg/day	NA	NA	NA
				4,4'-DDT	0.322	mg/kg	1.5E-07	mg/kg/day	3.4E-01	1/mg/kg/day	5E-08	4.4E-07	mg/kg/day	5.0E-04	mg/kg/day	0.0009
				Copper	245	mg/kg	1.2E-04	mg/kg/day	NA	NA	NA	3.4E-04	mg/kg/day	3.7E-02	mg/kg/day	0.009
				Iron	32230	mg/kg	1.5E-02	mg/kg/day	NA	NA	NA	4.4E-02	mg/kg/day	3.0E-01	mg/kg/day	0.1
			Exp. Route Total								1E-07					0.1
			Dermal	4,4'-DDE	0.496	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				4,4'-DDT	0.322	mg/kg	1.8E-08	mg/kg/day	3.4E-01	1/mg/kg/day	6E-09	5.3E-08	mg/kg/day	5.0E-04	mg/kg/day	0.0001
				Copper	245	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	32230	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Exp. Route Total								6E-09					0.0001
		Exposure Point Total									1E-07					0.1
	Exposure Medium Total										7E-06					0.2
Soil Total											7E-06					0.2
										Total of Receptor Risks Across All Media	3E-03				Total of Receptor Hazards Across All Media	25

(1) Lead is evaluated for the resident using the IEUBK model. See Risk Assessment text for discussion of results and appendix for the lead modeling run results.

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Receptor Population: Resident

Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Aquifer 1 - Tap Water	Ingestion	Bis(2-ethylhexyl)phthalate	0.005	mg/l	2.7E-05	mg/kg/day	1.4E-02	1/mg/kg/day	4E-07	3.2E-04	mg/kg/day	2.0E-02	mg/kg/day	0.02
				Chloroform	0.009	mg/l	4.9E-05	mg/kg/day	6.1E-03	1/mg/kg/day	3E-07	5.8E-04	mg/kg/day	1.0E-02	mg/kg/day	0.06
				Heptachlor	0.03	mg/l	1.6E-04	mg/kg/day	4.5E-00	1/mg/kg/day	7E-04	1.9E-03	mg/kg/day	5.0E-04	mg/kg/day	4
				Barium	0.489	mg/l	2.7E-03	mg/kg/day	NA	NA	NA	3.1E-02	mg/kg/day	7.0E-02	mg/kg/day	0.4
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	12.5	mg/l	6.8E-02	mg/kg/day	NA	NA	NA	8.0E-01	mg/kg/day	2.0E-02	mg/kg/day	40
			Exp. Route Total								7E-04					44
			Dermal	Bis(2-ethylhexyl)phthalate	0.005	mg/l	3.1E-05	mg/kg/day	1.4E-02	1/mg/kg/day	4E-07	3.6E-04	mg/kg/day	2.2E-02	mg/kg/day	0.02
				Chloroform	0.009	mg/l	7.2E-05	mg/kg/day	6.1E-03	1/mg/kg/day	4E-07	8.4E-04	mg/kg/day	1.0E-02	mg/kg/day	0.08
				Heptachlor	0.03	mg/l	5.7E-05	mg/kg/day	4.5E-00	1/mg/kg/day	3E-04	6.7E-04	mg/kg/day	5.0E-04	mg/kg/day	1
				Barium	0.489	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	12.5	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Exp. Route Total								3E-04					1
		Exposure Point Total									1E-03					45
	Exposure Medium Total										1E-03					45
Groundwater Total											1E-03					45
Soil	Soil	Soil at Site 1	Ingestion	4,4'-DDD	0.452	mg/kg	5.0E-07	mg/kg/day	2.4E-01	1/mg/kg/day	1E-07	5.8E-06	mg/kg/day	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	7.4E-06	mg/kg/day	3.4E-01	1/mg/kg/day	3E-06	8.7E-05	mg/kg/day	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	3.1E-05	mg/kg/day	3.4E-01	1/mg/kg/day	1E-05	3.7E-04	mg/kg/day	5.0E-04	mg/kg/day	0.7
				Aluminum	9964	mg/kg	1.1E-02	mg/kg/day	NA	NA	NA	1.3E-01	mg/kg/day	1.0E-00	mg/kg/day	0.1
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	201	mg/kg	2.2E-04	mg/kg/day	NA	NA	NA	2.6E-03	mg/kg/day	1.4E-01	mg/kg/day	0.02
			Exp. Route Total								1E-05					0.8
			Dermal	4,4'-DDD	0.452	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	2.6E-06	mg/kg/day	3.4E-01	1/mg/kg/day	9E-07	3.1E-05	mg/kg/day	5.0E-04	mg/kg/day	0.06
				Aluminum	9964	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	201	mg/kg	NA	NA	NA	NA	NA	NA	NA	MA	NA	NA
			Exp. Route Total								9E-07					0.06
		Exposure Point Total									1E-05					0.9

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Receptor Population: Resident

Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil (continued)	Soil (continued)	Soil at Site 2	Ingestion	4,4'-DDE	0.496	mg/kg	5.4E-07	mg/kg/day	3.4E-01	1/mg/kg/day	2E-07	6.3E-06	mg/kg/day	NA	NA	NA
				4,4'-DDT	0.322	mg/kg	3.5E-07	mg/kg/day	3.4E-01	1/mg/kg/day	1E-07	4.1E-06	mg/kg/day	5.0E-04	mg/kg/day	0.008
				Copper	245	mg/kg	2.7E-04	mg/kg/day	NA	NA	NA	3.1E-03	mg/kg/day	3.7E-02	mg/kg/day	0.08
				Iron	32230	mg/kg	3.5E-02	mg/kg/day	NA	NA	NA	4.1E-01	mg/kg/day	3.0E-01	mg/kg/day	1
			Exp. Route Total								3E-07					1
			Dermal	4,4'-DDE	0.496	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				4,4'-DDT	0.322	mg/kg	3.0E-08	mg/kg/day	3.4E-04	1/mg/kg/day	1E-08	3.5E-007	mg/kg/day	5.0E-004	mg/kg/day	0.0007
				Copper	245	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Iron	32230	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Exp. Route Total								1E-08					0.0007
		Exposure Point Total									3E-07					1
	Exposure Medium Total										1E-05					2
Soil Total											1E-05					2
									Total of Receptor Risks Across All Media		1E-03			Total of Receptor Hazards Across All Media		47

(1) Lead is evaluated for the resident using the IEUBK model. See Risk Assessment text for discussion of results and appendix for the lead modeling run results.

TABLE 8.1.RME

CALCULATION OF RADIATION CANCER RISKS

The Dean Company

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/Activity		CSF		Cancer Risk
								Value	Units	Value	Units	
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
				Not Applicable								
			Exp. Route Total									
		Exposure Point Total										
			Exp. Route Total									
			Exp. Route Total									
		Exposure Point Total										
											Total of Receptor Risks Across All Media	

There are no radionuclides in this risk assessment. As a result, this table is blank.

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Aquifer 1 - Tap Water	Bis(2-ethylhexyl)phthalate	7E-07	- -	1E-06	- -	2E-06	Liver	0.007	- -	0.01	0.02
			Chloroform	5E-07	- -	1E-06	- -	2E-06	Liver	0.03	- -	0.05	0.08
			Heptachlor	1E-03	- -	6E-04	- -	2E-03	Liver	2	- -	0.8	3
			Barium	- -	- -	- -	- -	- -	Heart	0.2	- -	- -	0.2
			Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Manganese	- -	- -	- -	- -	- -	Central Nervous System	17	- -	- -	17
			Chemical Total	1E-03	- -	6E-04	- -	2E-03		19	- -	0.9	20
			Radionuclide Total										
		Exposure Point Total						2E-03					20
	Exposure Medium Total							2E-03					20
	Air	Water Vapors from	Bis(2-ethylhexyl)phthalate	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
		Showerhead	Chloroform	- -	1E-05	- -	- -	1E-05	Liver	- -	5	- -	5
			Heptachlor	- -	1E-03	- -	- -	1E-03	- -	- -	- -	- -	- -
			Barium	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Manganese	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Chemical Total	- -	1E-03	- -	- -	1E-03		- -	5	- -	5
			Radionuclide Total										
		Exposure Point Total						1E-03					5
	Exposure Medium Total							1E-03					5
Groundwater Total								3E-03					25

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Soil at Site 1	4,4'-DDD	5E-08	- -	- -	- -	5E-08	- -	- -	- -	- -	- -
			4,4'-DDE	1E-06	- -	- -	- -	1E-06	- -	- -	- -	- -	- -
			4,4'-DDT	5E-06	- -	5E-07	- -	6E-06	Liver	0.08	- -	0.009	0.09
			Aluminum	- -	- -	- -	- -	- -	Central Nervous System	0.01	- -	- -	0.01
			Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Manganese	- -	- -	- -	- -	- -	Central Nervous System	0.002	- -	- -	0.002
			Chemical Total	6E-06	- -	5E-07	- -	7E-06		0.09	- -	0.009	0.1
			Radionuclide Total										
		Exposure Point Total						7E-06					0.1
		Soil at Site 2	4,4'-DDE	8E-08	- -	- -	- -	8E-08	- -	- -	- -	- -	- -
			4,4'-DDT	5E-08	- -	6E-09	- -	6E-08	Liver	0.0009	- -	0.0001	0.001
			Copper	- -	- -	- -	- -	- -	Gastrointestinal	0.009	- -	- -	0.009
			Iron	- -	- -	- -	- -	- -	Gastrointestinal	0.1	- -	- -	0.1
			Chemical Total	1E-07	- -	6E-09	- -	1E-07		0.1	- -	0.0001	0.1
			Radionuclide Total										
		Exposure Point Total						1E-07					0.1
	Exposure Medium Total							7E-06					0.2
Soil Total								7E-06					0.2
Receptor Total								3E-03					26

Total Risk Across All Media = 3E-03

Total Hazard Across All Media 26

Total Liver HI Across All Media = 8

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total

(1) Lead is evaluated for the resident using the IEUBK model. See Risk Assessment text for discussion of results and appendix for the lead modleing run results.

Total Central Nervous System HI Across All Media = 17

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Aquifer 1 - Tap Water	Bis(2-ethylhexyl)phthalate	4E-07	- -	4E-07	- -	8E-07	Liver	0.02	- -	0.02	0.04
			Chloroform	3E-07	- -	4E-07	- -	7E-07	Liver	0.06	- -	0.08	0.1
			Heptachlor	7E-04	- -	3E-04	- -	1E-03	Liver	4	- -	1	5
			Barium	- -	- -	- -	- -	- -	Heart	0.4	- -	- -	0.4
			Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Manganese	- -	- -	- -	- -	- -	Central Nervous System	40	- -	- -	40
			Chemical Total	7E-04	- -	3E-04	- -	1E-03		44	- -	1	45
			Radionuclide Total										
		Exposure Point Total						1E-03					45
	Exposure Medium Total							1E-03					45
Groundwater Total								1E-03					45
Soil	Soil	Soil at Site 1	4,4'-DDD	1E-07	- -	- -	- -	1E-07	- -	- -	- -	- -	- -
			4,4'-DDE	3E-06	- -	- -	- -	3E-06	- -	- -	- -	- -	- -
			4,4'-DDT	1E-05	- -	9E-07	- -	1E-05	Liver	0.7	- -	0.06	0.8
			Aluminum	- -	- -	- -	- -	- -	Central Nervous System	0.1	- -	- -	0.1
			Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Manganese	- -	- -	- -	- -	- -	Central Nervous System	0.02	- -	- -	0.02
			Chemical Total	1E-05	- -	9E-07	- -	1E-05		0.8	- -	0.06	0.9
			Radionuclide Total										
		Exposure Point Total						1E-05					0.9

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil (continued)	Soil (continued)	Soil at Site 2	4,4'-DDE	2E-07	- -	- -	- -	2E-07	- -	- -	- -	- -	- -
			4,4'-DDT	1E-07	- -	1E-08	- -	1E-07	Liver	0.008	- -	0.0007	0.008
			Copper	- -	- -	- -	- -	- -	Gastrointestinal	0.08	- -	- -	0.08
			Iron	- -	- -	- -	- -	- -	Gastrointestinal	1	- -	- -	1
			Chemical Total	3E-07	- -	1E-08	- -	3E-07		1	- -	0.0007	1
			Radionuclide Total										
		Exposure Point Total						3E-07					1
	Exposure Medium Total							1E-05					2
Soil Total								1E-05					2
Receptor Total								1E-03					47

Total Risk Across All Media = 1E-03

Total Hazard Across All Media 47

Total Liver HI Across All Media = 6

Total Central Nervous System HI Across All Media = 40

Total Gastrointestinal HI Across All Media = 1

TABLE 10.1.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Aquifer 1 - Tap Water	Bis(2-ethylhexyl)phthalate	7E-07	- -	1E-06	- -	2E-06	Liver	0.007	- -	0.01	0.02
			Chloroform	5E-07	- -	1E-06	- -	2E-06	Liver	0.03	- -	0.05	0.08
			Heptachlor	1E-03	- -	6E-04	- -	2E-03	Liver	2	- -	0.8	3
			Manganese	- -	- -	- -	- -	- -	Central Nervous System	17	- -	- -	17
			Chemical Total	1E-03	- -	6E-04	- -	2E-03		19	- -	0.8	20
		Exposure Point Total						2E-03					20
	Exposure Medium Total							2E-03					20
	Air	Water Vapors from Showerhead	Chloroform	- -	1E-05	- -	- -	1E-05	Liver	- -	5	- -	5
			Heptachlor	- -	1E-03	- -	- -	1E-03	- -	- -	- -	- -	- -
			Chemical Total	- -	1E-03	- -	- -	1E-03		- -	5	- -	5
		Exposure Point Total						1E-03					5
	Exposure Medium Total							1E-03					5
Groundwater Total								3E-03					25
Soil	Soil	Soil at Site 1	4,4'-DDE	1E-06	- -	- -	- -	1E-06	- -	- -	- -	- -	- -
			4,4'-DDT	5E-06	- -	5E-07	- -	6E-06	- -	- -	- -	- -	- -
			Chemical Total	6E-06	- -	5E-07	- -	7E-06		- -	- -	- -	- -
		Exposure Point Total						7E-06					- -
	Exposure Medium Total							7E-06					- -
Soil Total								7E-06					- -
Receptor Total								3E-03					25
							Total Risk Across All Media	3E-03				Total Hazard Across All Media	25

The information in this example table is for illustration only. The site screening threshold was determined by the RPM.

Total Liver HI Across All Media =	8
Total Central Nervous System HI Across All Media =	17

TABLE 10.2.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Aquifer 1 - Tap Water	Heptachlor	7E-04	- -	3E-04	- -	1E-03	Liver	4	- -	1	5
			Manganese	- -	- -	- -	- -	- -	Central Nervous System	40	- -	- -	40
			Chemical Total	7E-04	- -	3E-04	- -	1E-03		44	- -	1	45
		Exposure Point Total						1E-03					45
	Exposure Medium Total							1E-03					45
Groundwater Total								1E-03					45
Soil	Soil	Soil at Site 1	4,4'-DDE	3E-06	- -	- -	- -	3E-06	- -	- -	- -	- -	- -
			4,4'-DDT	1E-05	- -	9E-07	- -	1E-05	- -	- -	- -	- -	- -
			Chemical Total	1E-05	- -	9E-07	- -	1E-05		- -	- -	- -	- -
		Exposure Point Total						1E-05					
		Soil at Site 2	Iron	- -	- -	- -	- -	- -	Gastrointestinal	1	- -	- -	1
			Chemical Total	- -	- -	- -	- -	- -		1	- -	- -	1
		Exposure Point Total						- -					1
	Exposure Medium Total							1E-05					1
Soil Total								1E-05					1
Receptor Total								1E-03					46
				Total Risk Across All Media				1E-03		Total Hazard Across All Media			46

Total Liver HI Across All Media =	5
Total Central Nervous System HI Across All Media =	40
Total Gastrointestinal HI Across All Media =	1

The information in this example table is for illustration only. The site screening threshold was determined by the RPM.

APPENDIX B

INSTRUCTIONS FOR COMPLETION OF THE STANDARD TABLES

INSTRUCTIONS FOR TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION

PURPOSE OF THE TABLE: • To uniquely identify the risk assessment • To identify the relevant contacts for the risk assessment.	
INFORMATION DOCUMENTED: • Site information • Contact information . • Risk assessment document information.	
TABLE NUMBERING INSTRUCTIONS: • Complete one copy of this table for each risk assessment or Set of Planning Tables. • Number it Table 0. .	
HOW TO COMPLETE/INTERPRET THE TABLE	
Row 1 - Site Name/OU	
Definition: • The name of the site or operable unit (OU) to which this risk assessment applies.	
Instructions: • Enter the name of the site or operable unit.	
Row 2 - Region	
Definition: • The EPA Region in which the site is located.	
Instructions: • Enter the EPA Region in which the site is located.	
Row 3 - EPA ID Number	
Definition: • The EPA number assigned to identify the site.	

Instructions: • Enter the EPA ID Number. The ID can be found either in the site files or in the CERCLIS database.	

INSTRUCTIONS FOR TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION (continued)

Row 4 - State	
Definition: • The state in which the site is located.	
Instructions: • Enter the state or commonwealth in which the site is located.	
Row 5 - Status	
Definition: • The current status of the site.	
Instructions: • Enter the site status.	
Row 6 - Federal Facility (Y/N):	
Definition: • A flag indicating whether or not the site is a Federal Facility.	
Instructions: • Enter 'Y' if the site is a Federal Facility; enter 'N' otherwise.	Y N
Row 7 - EPA Project Manager	
Definition: • The EPA manager responsible for all activity concerning the site.	
Instructions: • Enter the EPA manager responsible for the site.	
Row 8 - EPA Risk Assessor	
Definition: • The risk assessor at EPA responsible for this risk assessment.	
Instructions: • Enter the name of the EPA risk assessor responsible for this risk assessment.	
Row 9 - Prepared by (Organization):	
Definition: • The name of the organization that prepared this risk assessment.	
Instructions: • Enter the name of the organization that prepared this risk assessment.	

INSTRUCTIONS FOR TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION (continued)

Row 10 - Prepared for (Organization):	
Definition: • The name of the organization for whom this risk assessment was prepared.	
Instructions: • Enter the name of the organization for whom this risk assessment was prepared	
Row 11 - Document Title	
Definition: • The title of this risk assessment document.	
Instructions: • Enter the title of this risk assessment document.	
Row 12 - Document Date	
Definition: • The date this risk assessment document was completed or approved.	
Instructions: • Record the date the document was completed or approved in the MM/DD/YYYY format.	
Row 13 - Probabilistic Risk Assessment (Y/N):	
Definition: • A flag indicating whether or not a probabilistic risk assessment was done for this risk assessment.	
Instructions: • Enter 'Y' if a probabilistic risk assessment was done; enter 'N' otherwise.	Y N
Row 14 - Comments	
Definition: • Any additional information provided about the risk assessment.	
Instructions: • Enter any additional information about the risk assessment.	

INSTRUCTIONS FOR TABLE 1

SELECTION OF EXPOSURE PATHWAYS

PURPOSE OF THE TABLE: • To assist in project planning • To accompany the site conceptual model • To present possible Receptors, Exposure Routes, and Exposure Pathways • To present the rationale for selection or exclusion of each Exposure Pathway • To communicate risk information to interested parties outside EPA • To establish a framework for the generation of subsequent Planning Tables. All subsequent tables should be built from the information contained in Table 1.	
INFORMATION DOCUMENTED: • Exposure Pathways that were examined and excluded from analysis • Exposure Pathways that will be qualitatively and quantitatively evaluated in the risk assessment.	
TABLE NUMBERING INSTRUCTIONS • Complete one copy of this table for each risk assessment. Consult the EPA risk assessor to determine if the risk assessment applies to an entire site, a single operable unit, or some other division of the site. • Number it Table 1. • The table should show each Exposure Pathway considered.	***In the Planning Tables, an Exposure Pathway is defined as each unique combination of Scenario Timeframe, Medium, Exposure Medium, Exposure Point, Receptor Population, Receptor Age, and Exposure Route.***
HOW TO COMPLETE/INTERPRET THE TABLE	
Column 1 - Scenario Timeframe	
Definition: • The time period (current and/or future) being considered for the Exposure Pathway.	
Instructions: • Choose from the picklist to the right. If two Exposure Pathways are identical, Current/Future can be used to describe a future and a current pathway.	***Current*** ***Future*** ***Current/Future*** ***Not Documented***
Column 2 - Medium	
Definition: • The substance (e.g., air, water, soil) that is a potential source of contaminants in the Exposure Medium. (The Medium will sometimes = the Exposure Medium.) Usually, the Medium is that targeted for possible remediation.	

INSTRUCTIONS FOR TABLE 1

SELECTION OF EXPOSURE PATHWAYS (continued)

Instructions: • Choose from the picklist to the right.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Surface Soil*** ***Subsurface Soil*** ***Other***
Column 3 - Exposure Medium	
Definition: • The contaminated environmental medium to which an individual may be exposed. This includes the transfer of contaminants from one Medium to another. ***For example:*** ***1) Contaminants in Groundwater (the Medium) remain in Groundwater (the Exposure Medium) and are available for exposure to receptors.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and are available for exposure to receptors.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and are available for exposure to receptors.***	
Instructions: • Choose from the picklist to the right. ***Note: In the case of two media transferring contamination to the same Exposure Medium, two separate Exposure Pathways should be included in Table 1. See Example Scenario No. 5.***	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Plant Tissue*** ***Animal Tissue*** ***Fish Tissue*** ***Spring Water*** ***Surface Soil*** ***Subsurface Soil*** ***Particulates*** ***Vapors*** ***Other***

INSTRUCTIONS FOR TABLE 1

SELECTION OF EXPOSURE PATHWAYS (continued)

Column 4 - Exposure Point	
Definition: • An exact location of potential contact between a person and a chemical or radionuclide within an Exposure Medium. ***For example:*** ***1) Contaminants are in Groundwater (the Medium and the Exposure Medium) and exposure to Aquifer 1 - Tap Water (the Exposure Point) is evaluated.*** ***2 Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and exposure to Aquifer 1 - Water Vapors at Showerhead (the Exposure Point) is evaluated.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and Trout from Dean's Creek (the Exposure Point) is evaluated.***	
Instructions: • Describe the Exposure Point as text in the table. Multiple Exposure Points may be recorded in the same cell/row if all other aspects of their Exposure Pathways (Scenario Timeframe, Medium, Exposure Medium, Receptor Population, Receptor Age, and Exposure Route) are the same. See Example Scenario No. 1.	
Column 5 - Receptor Population	
Definition: • The exposed individual relative to the Exposure Pathway considered.	***For example, a resident (Receptor Population) who drinks contaminated groundwater.***
Instructions: • Choose from the picklist to the right. ***Note: If there are multiple Trespassers/Visitors of different ages, the use Receptor Age (see Column 6) to distinguish between the different receptors. For example, use Trespasser/Visitor with Adolescent (or Child) to indicate youthful trespassers, and Trespasser/Visitor with Adult for adult visitors.***	***Resident*** ***Industrial Worker*** ***Commercial Worker*** ***Construction Worker*** ***Other Worker*** ***Golfer*** ***Jogger*** ***Fisher*** ***Hunter*** ***Fisher/Hunter*** ***Swimmer*** ***Other Recreational Person*** ***Child at School/Daycare/ Playground*** ***Trespasser/Visitor*** ***Farmer*** ***Gardener*** ***Gatherer*** ***Other***

INSTRUCTIONS FOR TABLE 1

SELECTION OF EXPOSURE PATHWAYS (continued)

Column 6 - Receptor Age	
Definition: • The description of the exposed individual as defined by the EPA Region or dictated by the site. ***For example, an adult (Receptor Age) resident (Receptor Population) who drinks contaminated groundwater.***	
Instructions: • Choose from the picklist to the right.	***Child*** ***Adult*** ***Adolescents (teens)*** ***Pre-Adolescents*** ***Not Documented*** ***Child/Adult*** ***Geriatric*** ***Sensitive*** ***Other*** ***Infant*** ***Toddler*** ***Pregnant***
Column 7 - Exposure Route	
Definition: • The way a chemical or radionuclide comes in contact with a person (e.g., by ingestion, inhalation, dermal contact).	
Instructions: • Choose from the picklist to the right.	***Inhalation*** ***Ingestion*** ***Combined*** **(Inhalation and Ingestion)** ***Dermal*** ***Not Documented*** ***External (Radiation)***
Column 8 - Type of Analysis	
Definition: • The level of evaluation (quantitative or qualitative) to be performed for the Exposure Pathway based on site-specific analysis.	
Instructions: • Choose from the picklist to the right. ***Note: Present pathways that were not further analyzed (Type of Analysis = None) along with the rationale for their exclusion to document that the pathway was considered.***	***Quant*** **(Quantitative)** ***Qual*** **(Qualitative)** ***None***

INSTRUCTIONS FOR TABLE 1

SELECTION OF EXPOSURE PATHWAYS (continued)

Column 9 - Rationale for Selection or Exclusion of Exposure Pathway	
Definition: • The reason the Exposure Pathway was selected or not selected for quantitative or qualitative analysis.	
Instructions: • Document the reason for selecting or excluding an Exposure Pathway for analysis. Provide a narrative rationale for each Exposure Pathway.	***Consult the EPA risk assessor for the rationale codes.***

INSTRUCTIONS FOR TABLE 2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

PURPOSE OF THE TABLE: • To provide information useful for data evaluation of chemicals and radionuclides detected • To provide adequate information so the user/reviewer gets a sense of the chemicals and radionuclides detected at the site and the potential magnitude of the potential problems at the site • To provide chemical screening data and rationale for selection of COPCs.	
INFORMATION DOCUMENTED: • Statistical information about chemicals and radionuclides detected in each Medium • The detection limits of chemicals and radionuclides analyzed • The screening toxicity values for COPC selection • The chemicals and radionuclides selected or deleted as COPCs.	
TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS: • Complete one copy of Table 2 for each unique combination of the following three fields that will be quantitatively evaluated in the risk assessment: Scenario Timeframe, Medium, and Exposure Medium. • Enter each combination of these three fields in the Summary Box in the upper left corner of the table. • Number each table uniquely, beginning with 2.1 and ending with 2.n, where "n" represents the total number of combinations of the three key fields.	***It is possible that some Planning Tables may contain the same data associated with different descriptions in the Summary Box in the upper left corner.*** ***Separate tables may be necessary to ensure transparency in data presentation for each Exposure Pathway. Replication of information is readily accomplished using spreadsheet software.*** ***Consult the EPA risk assessor for alternatives (e.g., footnotes) to preparing multiple tables with the same data.***
HOW TO COMPLETE/INTERPRET THE TABLE	
SUMMARY BOX IN UPPER LEFT CORNER	
Row 1 - Scenario Timeframe	
Definition: • The time period (current and/or future) being considered for the exposure pathway.	
Instructions: • Choose from the picklist to the right.	***Current*** ***Future*** ***Current/Future*** ***Not Documented***

INSTRUCTIONS FOR TABLE 2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN (continued)

Row 2 - Medium	
Definition: • The substance (e.g., air, water, soil) that is a potential source of contaminants in the Exposure Medium. (The Medium will sometimes = the Exposure Medium.) Usually, the Medium is that targeted for possible remediation.	
Instructions: • Choose from the picklist to the right.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Surface Soil*** ***Subsurface Soil*** ***Other***
Row 3 - Exposure Medium	
Definition: • The contaminated environmental medium to which an individual may be exposed. Includes the transfer of contaminants from one medium to another. ***For example:*** ***1) Contaminants in Groundwater (the Medium) remain in Groundwater (the Exposure Medium) and are available for exposure to receptors.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and are available for exposure to receptors.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and are available for exposure to receptors.***	

INSTRUCTIONS FOR TABLE 2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN (continued)

Instructions: • Choose from the picklist to the right.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Plant Tissue*** ***Animal Tissue*** ***Fish Tissue*** ***Spring Water*** ***Surface Soil*** ***Subsurface Soil*** ***Particulates*** ***Vapors*** ***Other***
BODY OF THE TABLE	
Column 1 - Exposure Point	
Definition: • An exact location of potential contact between a person and a chemical or radionuclide within an exposure medium. ***For example:*** ***1) Contaminants are in Groundwater (the Medium and the Exposure Medium) and exposure to Aquifer 1 - Tap Water (the Exposure Point) is evaluated.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and exposure to Aquifer 1 - Water Vapors at Showerhead (the Exposure Point) is evaluated.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and Trout from Dean's Creek (the Exposure Point) is evaluated.***	
Instructions: • Provide the information as text in the table.	***Exposure Points should be defined the same way as was done in Planning Table 1.***
Column 2 - CAS Number	
Definition: • The Chemical Abstract Registry Number, a unique standardized number which is assigned to chemicals and radionuclides.	

INSTRUCTIONS FOR TABLE 2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN (continued)

Instructions: • Provide the CAS Number for each chemical detected in the samples for the Medium. ***Note: If the CAS number is not available, be sure to enter the Chemical Name in Column 3 and consult the EPA risk assessor.***	***Include dashes in the CAS number. CAS numbers can be arranged in the order that the risk assessor prefers.***
Column 3 - Chemical	
Definition: • The name of the compound detected in samples for the Medium.	
Instructions: • Provide the names of the chemicals which were detected in the sample for the Medium.	***Chemicals can be grouped in the order that the risk assessor prefers. Class descriptions (e.g., PAHs, VOCs, inorganics) can be included as a row before a group of chemicals.***
Column 4 - Minimum Concentration (Qualifier)	
Definition: • Minimum Concentration - The lowest detected concentration of the chemical or radionuclide in the medium. • Qualifier - The alpha-numeric code assigned to the concentration value by the analytical chemist during data validation for the Minimum Concentration value.	
Instructions: • Enter the minimum detected concentration for the medium. If there is a detected minimum, enter that as the Minimum Concentration. If the concentration is not detected, enter 'ND' as the Minimum and Maximum Concentrations and record the detection limits in the Range of Detection Limits column. • Enter the qualifier associated with the minimum concentration for each chemical or radionuclide in parentheses () after the Minimum Concentration value. Multiple qualifiers should be separated by commas. • Provide the definition of each qualifier in the table footnotes.	
Column 5 - Maximum Concentration (Qualifier)	

INSTRUCTIONS FOR TABLE 2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN (continued)

Definition: • Maximum Concentration - The highest detected concentration of the chemical or radionuclide in the Medium at the current Exposure Point which is above the sample quantitation limit. • Qualifier - The alpha-numeric code assigned to the concentration value by the analytical chemist during data validation for the Maximum Concentration value.	
Instructions: • Enter the maximum detected concentration for the medium. • Enter the qualifier associated with the Maximum Concentration for each chemical or radionuclide. • Provide the definition of each qualifier in the table footnotes.	

INSTRUCTIONS FOR TABLE 2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN (continued)

Column 6 - Units	
Definition: • The concentration units for each chemical or radionuclide detected.	
Instructions: • Enter the concentration units for each chemical or radionuclide. Units may vary among matrices/media.	***Consult with the EPA risk assessor to determine if there is a preference regarding the units used for different matrices (e.g., mg/kg for soil, µg/L for groundwater). Choices include:*** ***mg/l µg/l ng/l*** ***pg/l % ppm*** ***ppb ppt g/kg*** ***mg/kg µg/kg ng/kg*** ***µg/g mg/m³ µg/m³*** ***fibers/l fibers/m³ fibers/kg*** ***lbs/day µg/100cm² mg/cm²*** ***µRem/hr Rem/yr pCi/g*** ***pCi/kg pCi/m³ pCi/l*** ***pCi/m²/sec Other*** ***Not Documented***
Column 7 - Location of Maximum Concentration	
Definition: • The sample number that identifies the location where the highest concentration sample was taken.	
Instructions: • Enter the sample identifier which corresponds to the location where the sample was taken.	
Column 8 - Detection Frequency	
Definition: • The number of times the chemical or radionuclide was detected versus the number of times it was analyzed, expressed as the "fraction" X/Y.	***For example, 5/9 indicates that a chemical was detected in 5 out of 9 samples.***
Instructions: • Indicate the number of times the chemical or radionuclide was detected versus the number of times it was analyzed as the "fraction" X/Y.	***Consult the EPA risk assessor for an explanation of how Detection Frequency should be interpreted and applied.***
Column 9 - Range of Detection Limits	

INSTRUCTIONS FOR TABLE 2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN (continued)

Definition: • The lowest and highest detection limits.	***Consult the EPA risk assessor for definitions of detection limits.***
Instructions: • Enter the lowest and highest detection limit for the chemical or radionuclide in the medium separated by a dash (-). Consult with the EPA risk assessor if detection limits are not reported	
Column 10 - Concentration Used for Screening	
Definition: • The detected concentration which was used to compare to the screening value.	
Instructions: • Enter a concentration for each chemical being evaluated for the Medium. • Use a footnote to specify the source(s) of the Concentration Used for Screening.	***Consult the EPA risk assessor when determining this value. For example, maximum or average.***
Column 11 - Background Value	
Definition: • The background value for the chemical or radionuclide in that Medium as defined by guidance. ***If a "t-test" or other test which requires backup information is required, this supporting information is should be provided separately.***	
Instructions: • Enter the numerical value in the column. • Specify the source(s)/derivation of the Background Value in table footnotes. For example, literature value, data from a nearby site, statistical tool.	***Consult the EPA risk assessor for how background values are determined and whether and how background values are considered for COPC screening.***
Column 12 - Screening Toxicity Value (N/C)	
Definition: • The screening level used to compare detected concentrations of chemicals and radionuclides. Screening Toxicity Values are usually risk-based media concentrations (e.g., RBCs, SSLs, PRGs).	

INSTRUCTIONS FOR TABLE 2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN (continued)

Instructions: • Enter the Screening Toxicity Value. • Also indicate, with (N) or (C) whether the value is based on non-cancer or cancer effects, respectively. • To enter both the cancer and non-cancer screening toxicity values, either (1) record both in the same cell separated by a "/" (e.g., 15C/3.8N), or record one value in Column 12 and one in Column 13. • Use a footnote to provide a reference/explanation for the source of the screening values used.	***Consult the EPA risk assessor for the source of the screening value and for guidance on comparing the screening value to detected concentrations.***
Column 13 - Potential ARAR/TBC Value	
Definition: • Potential applicable or relevant and appropriate requirements (ARAR) and to be considered (TBC) values.	***For example, MCL values, soil cleanup level values, or other values to be considered.***
Instructions: • If multiple values exist, then enter the most conservative ARAR or TBC value.	***Consult the EPA risk assessor regarding the requirements for this column.***
Column 14 - Potential ARAR/TBC Source	
Definition: • The type or source of the ARAR/TBC value entered into the previous column.	***For example, MCL or SMCL.***
Instructions: • Enter the type or source of ARAR/TBC value which corresponds to the value in the previous column.	
Column 15 - COPC Flag (Y/N)	
Definition: • A code which identifies whether the chemical or radionuclide has been selected as a chemical of potential concern.	
Instructions: • Enter "Y" or "N" to indicate whether the chemical has been retained as a COPC.	***Y*** ***N***

INSTRUCTIONS FOR TABLE 2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN (continued)

Column 16 - Rationale for Selection or Deletion	
Definition: • The reason that the chemical or radionuclide was selected or not selected for quantitative or qualitative analysis.	***Consult the EPA risk assessor for the rationale codes.***
Instructions: • Enter the rationale codes for selection/deletion of chemicals of potential concern. Separate multiple codes with commas. • Define the codes for the "Rationale for Selection or Deletion" column in a footnote on this table.	***The example data table provides rationale codes for example purposes only.***

INSTRUCTIONS FOR TABLE 3

EXPOSURE POINT CONCENTRATION SUMMARY

PURPOSE OF THE TABLE: • To provide the Exposure Point Concentrations (EPCs) for measured and modeled values • To provide statistical information on the derivation of the EPCs.	
INFORMATION DOCUMENTED: • Statistical information which was used to calculate the EPCs for chemicals and radionuclides detected in each Medium • Exposure Point Concentrations (RME and/or CT) • The statistics which were used to make the determinations as well as the rationale for the selection of the statistics for each chemical or radionuclide (i.e., discuss statistical derivation of measured data or approach for modeled data).	
TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS: • Follow the instructions below to create separate sets of Table 3 for RME and CT when appropriate. • Complete one copy of Table 3 for each unique combination of the following three fields that will be quantitatively evaluated: Scenario Timeframe, Medium, and Exposure Medium. • Enter each combination of these three fields in the Summary Box in the upper left corner of the table. • Number each table uniquely, beginning with 3.1 and ending with 3.n, where "n" represents the total number of combinations of the three key fields. Add the extension .RME or .CT to the table number to indicate reasonable maximum exposure or central tendency. • Add the line "Reasonable Maximum Exposure" or "Central Tendency" to the table title.	***It is possible that some tables may contain the same data associated with different descriptions in the Summary Box in the upper left corner.*** ***Separate tables may be necessary to ensure transparency in data presentation for each Exposure Pathway. Replication of information is readily accomplished using spreadsheet software.*** ***Consult the EPA risk assessor for alternatives (e.g., footnotes) to preparing multiple tables with the same data.***

INSTRUCTIONS FOR TABLE 3

EXPOSURE POINT
CONCENTRATION SUMMARY (continued)

GENERAL NOTES/INSTRUCTIONS FOR THIS TABLE: • Attach supporting documentation regarding how the EPC was calculated. • Attach an example calculation so the methodology used to develop EPCs is clear to a reviewer. • Attach supporting information regarding how the concentration term was selected. • Consult the EPA risk assessor concerning use of decimals or scientific notation for data. • For certain media, all columns will not be completed.	***This information should be of sufficient detail that a reviewer can check and verify the calculations which were performed and obtain the same results as listed in this table.*** ***It is possible that the 95% UCL may not need to be calculated, for example, if only one data point is being considered.*** ***As another example, in some regions, the arithmetic average of concentrations measured from the center of the plume is used as the RME. In this case, the 95% UCL column does not need to be completed.***

INSTRUCTIONS FOR TABLE 3

EXPOSURE POINT CONCENTRATION SUMMARY (continued)

HOW TO COMPLETE/INTERPRET THE TABLE	
SUMMARY BOX IN UPPER LEFT CORNER	
Row 1 - Scenario Timeframe	
Definition: • The time period (current and/or future) being considered for the exposure pathway.	
Instructions: • Choose from the picklist to the right.	***Current*** ***Future*** ***Current/Future*** ***Not Documented***
Row 2 - Medium	
Definition: • The substance (e.g., air, water, soil) that is a potential source of contaminants in the Exposure Medium. (The Medium will sometimes = the Exposure Medium.) Usually, the Medium is that targeted for possible remediation.	
Instructions: • Choose from the picklist to the right.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Other*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Surface Soil*** ***Subsurface Soil***

INSTRUCTIONS FOR TABLE 3

EXPOSURE POINT CONCENTRATION SUMMARY (continued)

Row 3 - Exposure Medium	
Definition: • The contaminated environmental medium to which an individual may be exposed. Includes the transfer of contaminants from one medium to another. ***For example:*** ***1) Contaminants in Groundwater (the Medium) remain in Groundwater (the Exposure Medium) and are available for exposure to receptors.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and are available for exposure to receptors.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and are available for exposure to receptors.***	
Instructions: • Choose from the picklist to the right.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Other*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Plant Tissue*** ***Animal Tissue*** ***Fish Tissue*** ***Spring Water*** ***Surface Soil*** ***Subsurface Soil*** ***Particulates*** ***Vapors***

INSTRUCTIONS FOR TABLE 3

EXPOSURE POINT CONCENTRATION SUMMARY (continued)

BODY OF THE TABLE	
Column 1 - Exposure Point	
Definition: • An exact location of potential contact between a person and a chemical or radionuclide within an Exposure Medium. ***For example:*** ***1) Contaminants are in Groundwater (the Medium and the Exposure Medium) and exposure to Aquifer 1 - Tap Water (the Exposure Point) is evaluated.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and exposure to Aquifer 1 - Water Vapors at Showerhead (the Exposure Point) is evaluated.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and Trout from Dean's Creek (the Exposure Point) is evaluated.***	
Instructions: • Provide the information as text in the table.	***Exposure Point should be defined the same way as was done in Planning Table 1.***
Column 2 - Chemical of Potential Concern	
Definition: • A chemical or radionuclide that is potentially site-related, with data of sufficient quality, that has been retained for quantitative analysis as a result of the screening documented in Table 2.	
Instructions: • Enter the names of the chemicals which were selected as COPCs from Table 2.	***Chemicals can be grouped in the order that the risk assessor prefers. Class descriptions (e.g., PAHs, VOCs, inorganics) can be included as a row before a group of chemicals.***
Column 3 - Units	
Definition: • The concentration units for each chemical and radionuclide detected.	

INSTRUCTIONS FOR TABLE 3

EXPOSURE POINT
CONCENTRATION SUMMARY (continued)

Instructions: • Enter units for each chemical and radionuclide. Units may vary among matrices/media.	***Consult with the EPA risk assessor to determine if there is a preference regarding the units used for different matrices (e.g., mg/kg for soil, µg/L for groundwater). Choices include:*** ***mg/l µg/l ng/l*** ***pg/l % ppm*** ***ppb ppt g/kg*** ***mg/kg µg/kg ng/kg*** ***µg/g mg/m³ µg/m³*** ***fibers/l fibers/m³ fibers/kg*** ***lbs/day µg/100cm² mg/cm²*** ***µRem/hr Rem/yr pCi/g*** ***pCi/kg pCi/m³ pCi/l*** ***pCi/m²/sec Other*** ***Not Documented***
Column 4 - Arithmetic Mean	
Definition: • The arithmetic average of detected concentrations. This is the sum of the data divided by the number of data points.	
Instructions: • Enter the arithmetic average of detected concentrations.	***For duplicate samples, multiple rounds of sampling, and other data evaluation questions, consult the EPA risk assessor.***
Column 5 - 95% UCL (Distribution)	
Definition: • The statistic for the 95% Upper Confidence Limit on the arithmetic mean, and the type of distribution.	***Consult National guidance (Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive: 9285.7-08I, May 1992 or most recent updates) and the EPA risk assessor for calculating this term.***
Instructions: • Enter the 95% UCL for each COPC. • Indicate the distribution of the 95% UCL with (N) or (T) after the value as follows: N is Normal, T is Transformed (lognormal), NP is Nonparametric, O is Other. Define the codes describing the type of distribution in a footnote. • Specify any assumptions made in calculating the term in footnotes on this table. • Supporting information should be provided in the risk assessment.	***For example, for non-detects, ½ the sample quantitation limit is sometimes used as a proxy concentration. For duplicate sample results, the average value is sometimes used in the calculation.***

INSTRUCTIONS FOR TABLE 3

EXPOSURE POINT CONCENTRATION SUMMARY (continued)

Column 6 - Maximum Concentration (Qualifier)	
Definition: • Maximum Concentration - The highest detected concentration of the chemical or radionuclide in the Medium at the current Exposure Point which is above the sample quantitation limit. • Maximum Qualifier - The alpha-numeric code assigned to the concentration value by the analytical chemist during data validation for the maximum concentration value.	
Instructions: • Enter the maximum concentration value. • Enter the qualifier associated with the maximum concentration.	***Provide the definitions of each qualifier in the table footnotes or in supporting information.***
Column 7 - Exposure Point Concentration Value	
Definition: • The EPC, based on either a statistical derivation of measured data or modeled data, that represents an estimate of the chemical or radionuclide concentration available from a particular Medium or route of exposure. This EPC value will be used to quantify potential cancer risks and non-cancer hazards. ***For example,*** ***the EPC value may be statistically derived by calculating the 95% UCL of measured groundwater contaminant concentrations from multiple residential wells. Alternatively, the EPC value may be selected as a single measured value, if one data point is used to calculate the risk for each residential well individually. In some cases, the EPC value may be a modeled value (e.g., if upgradient groundwater contaminant concentrations are used to model groundwater concentrations, a downgradient exposure point, or if sediment concentrations are used to model fish tissue concentrations)***	***The EPC Value may be calculated, measured, or modeled.***
Instructions: • Enter the value in the column. • When using modeled data, enter the Exposure Point, COPC, EPC Value, and EPC Rationale, and include a reference to the location of backup information that show how the data were modeled in the risk assessment document.	***Consult the EPA risk assessor concerning how to determine this value.***
Column 8 - Exposure Point Concentration Units	

INSTRUCTIONS FOR TABLE 3

EXPOSURE POINT CONCENTRATION SUMMARY (continued)

Definition: • The units of the data being used to calculate the EPC.	
Instructions: • Enter the units for the data being used to calculate the EPC.	***Consult the EPA risk assessor for preferences for different media (e.g., ug/L for groundwater; mg/kg for soil).***
Column 9 - Exposure Point Concentration Statistic	
Definition: • The statistic selected to represent the EPC Value based on the distribution of the data, number of data points, etc., and consultation with the EPA risk assessor.	***Often, this is 95% UCL of the log-transformed data.***
Instructions: • Enter the statistic used by choosing from the picklist to the right. • Define the codes used for the EPC Statistic column in table footnotes. If the statistic used is not on the picklist, enter an abbreviation in Column 9 and provide a description of the statistic in the footnotes of the table.	***Max (Maximum)*** ***95% UCL - N (95% UCL of Normal Data)*** ***95% UCL- T (95% UCL of Log-transformed Data)*** ***95% UCL - NP (Mean of Nonparametric Data)*** ***Mean - N (Mean of Normal Data)*** ***Mean - T (Mean of Log-transformed Data)*** ***Mean - NP (Mean of Nonparametric Data)***
Column 10 - Exposure Point Concentration Rationale	
Definition: • The reason the cited statistic was used to represent the EPC.	
Instructions: • Enter the rationale for the selection. Footnotes can be used.	

INSTRUCTIONS FOR TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

PURPOSE OF THE TABLE: • To provide the exposure parameters used for intake calculations for each Exposure Pathway (Scenario Timeframe, Medium, Exposure Medium, Exposure Point, Receptor Population, Receptor Age, and Exposure Route) • To provide the intake equations or models used for each Exposure Route/Pathway.	
INFORMATION DOCUMENTED: • Values used for each intake equation for each Exposure Pathway and the reference/rationale for each • Intake equation or model used to calculate the intake for each Exposure Pathway.	
TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS: • Follow the instructions below to create separate sets of Table 4 for RME and CT where appropriate. • Complete one copy of Table 4 for each unique combination of the following three fields that will be quantitatively evaluated: Scenario Timeframe, Medium, and Exposure Medium. • Enter each combination of these three fields in the Summary Box in the upper left corner of the table. • Number each table uniquely, beginning with 4.1 and ending with 4.n, where "n" represents the total number of combinations of the three key fields. • Add the line "Reasonable Maximum Exposure" or "Central Tendency" to the table title. Add the extension .RME or .CT to the table number to the line indicate reasonable maximum exposure or central tendency.	***Information regarding intake calculations is specific to an Exposure Pathway. Thus, the Summary Box contains the first three identifiers used to specify an exposure pathway: Scenario Timeframe, Medium, and Exposure Medium.*** ***It is possible that some tables may contain the same data associated with different descriptions in the Summary Box in the upper left corner.*** ***Separate tables may be necessary to ensure transparency in data presentation for each Exposure Pathway. Replication of information is readily accomplished using spreadsheet software.*** ***Consult the EPA risk assessor for alternatives (e.g., footnotes) to preparing multiple tables with the same data.***
HOW TO COMPLETE/INTERPRET THE TABLE	
SUMMARY BOX IN UPPER LEFT CORNER	
Row 1 - Scenario Timeframe	
Definition: • The time period (current and/or future) being considered for the Exposure Pathway.	

INSTRUCTIONS FOR TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS (continued)

Instructions: • Choose from the picklist to the right.	***Current*** ***Future*** ***Current/Future*** ***Not Documented***

INSTRUCTIONS FOR TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS (continued)

Row 2 - Medium	
Definition: • The substance (e.g., air, water, soil) that is a potential source of contaminants in the Exposure Medium. (The Medium will sometimes = the Exposure Medium.) Usually, the Medium is that targeted for possible remediation. .	
Instructions: • Choose from the picklist to the right.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Other*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Surface Soil*** ***Subsurface Soil***
Row 3 - Exposure Medium	
Definition: • The contaminated environmental medium to which an individual may be exposed. Includes the transfer of contaminants from one Medium to another. ***For example:*** ***1) Contaminants in Groundwater (the Medium) remain in Groundwater (the Exposure Medium) and are available for exposure to receptors.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and are available for exposure to receptors.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and are available for exposure to receptors.***	

INSTRUCTIONS FOR TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS (continued)

Instructions: • Choose from the picklist to the right.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Other*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Plant Tissue*** ***Animal Tissue*** ***Fish Tissue*** ***Spring Water*** ***Surface Soil*** ***Subsurface Soil*** ***Particulates*** ***Vapors***

INSTRUCTIONS FOR TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS (continued)

BODY OF THE TABLE	
Column 1 - Exposure Route	
Definition: • The way a chemical or radionuclide comes in contact with a person (e.g., by ingestion, inhalation, dermal contact).	
Instructions: • Choose from the picklist to the right.	***Inhalation*** ***Ingestion*** ***Combined (***i.e., Inhalation and Ingestion) ***Dermal*** ***Not Documented*** ***External (Radiation)***
Column 2 - Receptor Population	
Definition: • The exposed individual relative to the Exposure Pathway considered.	***For example, a resident (Receptor Population) who drinks contaminated groundwater.***
Instructions: • Choose from the picklist to the right.	***Resident*** ***Industrial Worker*** ***Commercial Worker*** ***Construction Worker*** ***Other Worker*** ***Golfer*** ***Jogger*** ***Fisher*** ***Hunter*** ***Fisher/Hunter*** ***Swimmer*** ***Other Recreational Person*** ***Child at School/Daycare/ Playground*** ***Trespasser/Visitor*** ***Farmer*** ***Gardener*** ***Gatherer*** ***Other***
Column 3 - Receptor Age	
Definition: • The description of the exposed individual as defined by the EPA Region or dictated by the site.	***For example, a resident (Receptor Population) who drinks contaminated groundwater.***

INSTRUCTIONS FOR TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS (continued)

Instructions: • Choose from the picklist to the right.	***Child*** ***Adult*** ***Adolescents (teens)*** ***Pre-Adolescents*** ***Not Documented*** ***Child/Adult*** ***Geriatric*** ***Sensitive*** ***Other*** ***Infant*** ***Toddler*** ***Pregnant***
Column 4 - Exposure Point	
Definition: • An exact location of potential contact between a person and a chemical or radionuclide within an Exposure Medium. ***For example:*** ***1) Contaminants are in Groundwater (the Medium and the Exposure Medium) and exposure to Aquifer 1 - Tap Water (the Exposure Point) is evaluated.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and exposure to Aquifer 1 - Water Vapors at Showerhead (the Exposure Point) is evaluated.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and Trout in Dean's Creek (the Exposure Point) is evaluated.***	
Instructions: • Provide the information as text in the table. Multiple Exposure Points may be recorded in the same cell/row in this table if all other aspects of their Exposure Pathways (Scenario Timeframe, Medium, Exposure Medium, Exposure Route, Receptor Population and Receptor Age) are the same.	***Exposure Points should be defined the same way ad was done in Planning Table 1.***
Column 5 - Parameter Code	
Definition: • The code used for parameters (exposure factors) in the intake equation.	

INSTRUCTIONS FOR TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS (continued)

Instructions:

- Enter the appropriate code for the intake parameter from the picklist below.
- Develop additional intake parameter codes as necessary; be sure that additional codes are unique and defined in this table.

Parameter Code	*Parameter Definition*	*Units*
CS	*Chemical Concentration in Soil*	*mg/kg*
CW	*Chemical Concentration in Water*	*ug/l*
IR-W	*Ingestion Rate of Water*	*liters/day*
EF	*Exposure Frequency*	*days/year*
ED	*Exposure Duration*	*years*
CF1	*Conversion Factor 1*	*mg/ug*
BW	*Body Weight*	*kg*
AT-C	*Averaging Time (Cancer)*	*days*
AT-N	*Averaging Time (Non-Cancer)*	*days*
KP	*Permeability Constant (Dermal for Liquids)*	*cm/hr*
ET	*Exposure Time*	*hr/day*
CF2	*Conversion Factor 2*	*l/cm3*
SA	*Skin Surface Area Available for Contact*	*cm2*
IN	*Inhalation Rate*	*m^3/hr*
IR-SM	*Ingestion Rate (Swimming)*	*l/hr*
IR-S	*Ingestion Rate of Soil*	*mg/day*
DABS	*Dermal Absorption Factor (Solid)*	*--*
SSAF	*Soil to Skin Adherence Factor*	*mg/cm^2/event*
IR-F	*Ingestion Rate of Food*	*kg/meal*
EF-F	*Exposure Frequency (Food)*	*meals/year*

Do not provide detailed information regarding parameter modeled intakes in this table. This information should be provided separately. Column 10 of this table should list the name of the model or the equation used with a footnote referencing supporting information regarding modeled intake development.

Column 6 - Parameter Definition

Definition:

- The name of the exposure factor (e.g., ingestion rate, body weight) used in the intake equation corresponding to the parameter entered in Column 5..

Instructions:

- Enter the parameter definition, consistent with the picklist defined under the Parameter Code column.
- Develop additional intake parameter definitions as necessary.

Do not provide detailed parameter information regarding modeled intakes in this table. This information should be provided separately. (See instructions for Column 5).

Column 7 - Value

Definition:

- The numeric value of the parameter recorded in Column 6 used for the intake calculation.

INSTRUCTIONS FOR TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS (continued)

Instructions: • Enter the values used for intake calculations. • For the CS and CW (chemical concentrations in soil and water, respectively) parameters, refer to Table 3.n or supporting documentation, as appropriate.	***Consult the EPA risk assessor for intake parameter values appropriate for each Exposure Pathway.***

INSTRUCTIONS FOR TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS (CONTINUED)

Column 8 - Units	
Definition: • The units for the parameter code used in the intake equation.	
Instructions: • Enter the units for each parameter code consistent with the picklist defined under Column 5. • Develop additional intake parameter units as necessary.	***Consult with the EPA risk assessor to determine if there is a preference regarding the units used for different matrices (e.g., mg/kg for soil, µg/L for groundwater). Choices include:*** ***mg/l µg/l ng/l*** ***pg/l % ppm*** ***ppb ppt g/kg*** ***mg/kg µg/kg ng/kg*** ***µg/g mg/m³ µg/m³*** ***fibers/l fibers/m³ fibers/kg*** ***lbs/day µg/100cm² mg/cm²*** ***µRem/hr Rem/yr pCi/g*** ***pCi/kg pCi/m³ pCi/l*** ***pCi/m²/sec Other*** ***Not Documented***
Column 9 - Rationale/Reference	
Definition: • The reason and reference for the parameter value used.	***This rationale may be based upon guidance or consultation with the EPA risk assessor.***
Instructions: • Enter the rationale and reference for the value. • If the value used is inconsistent with guidance values, provide a detailed explanation of the rationale and a complete reference for the value used.	***Provide sufficient detail that the reviewer can easily substantiate the value.***
Column 10 - Intake Equation/Model Name	
Definition: • The calculation, equation, or model used for intake estimates for each Exposure Route.	
Instructions: • Enter the intake calculation, equation, and/or model name. • Include a footnote providing a reference to the section of the risk assessment where information regarding modeled intake development is presented.	***For modeled intakes, the table should list the name of the model or the equation used.***

INSTRUCTIONS FOR TABLE 5.1

NON-CANCER TOXICITY DATA - ORAL/DERMAL

PURPOSE OF THE TABLE: • To provide information on RfDs, target organs, and adjustment factors for chemicals • To provide oral to dermal adjustment factors • To verify references for non-cancer toxicity data.	
INFORMATION DOCUMENTED: • The RfDs for each of the COPCs, as well as modifying factors and oral to dermal adjustments • The organ effects of each of the COPCs • References for RfDs and organ effects.	***Surrogate toxicity values can also be entered in this table and indicated in the Source(s) column or with a footnote.***
TABLE NUMBERING INSTRUCTIONS: • Complete one copy of this table only. • Number it Table 5.1. • The table should contain a row for each COPC considered.	***If chronic and subchronic effects are listed for the same COPC, two rows will be required.***
GENERAL NOTES/INSTRUCTIONS FOR THIS TABLE: • Table 5.1 does not replace the toxicological profiles for the individual chemicals that will be presented in the risk assessment.	***It may be necessary to refer to RAGS, the risk assessment technical approach, and the EPA risk assessor to complete the table.***
HOW TO COMPLETE/INTERPRET THE TABLE	
Column 1 - Chemical of Potential Concern	
Definition: • Chemicals that are potentially site-related, with data of sufficient quality, that have been retained for quantitative analysis as a result of the screening documented in Table 2.	
Instructions: • Enter the names of the chemicals that were selected as COPCs from Table 2.	***Chemicals can be grouped in the order that the risk assessor prefers. Class descriptions (e.g., PAHs, VOCs, inorganics) can be included as a row before a group of chemicals.***
Column 2 - Chronic/Subchronic	
Definition: • Identifies whether the RfD for a particular chemical is for chronic (long-term) and/or subchronic (short-term) exposure.	

INSTRUCTIONS FOR TABLE 5.1

NON-CANCER TOXICITY DATA - ORAL/DERMAL (continued)

Instructions: • Enter either "Chronic" or "Subchronic" in the field. Both values may be available for an individual COPC. • Subchronic values may not be available or necessary for an individual COPC. If that is the case, enter only "Chronic" in Column 2.	***Chronic*** ***Subchronic***
Column 3 - Oral RfD Value	
Definition: • The oral RfD value for each of the COPCs.	
Instructions: • Enter the value for the chronic and/or subchronic oral RfD (as appropriate).	
Column 4 - Oral RfD Units	
Definition: • The oral RfD units for each COPC.	
Instructions: • Enter units for each oral RfD value as necessary.	***Consult the EPA risk assessor to determine if there is a preference regarding the units to be used.***
Column 5 - Oral Absorption Efficiency Value for Dermal	
Definition: • The adjustment factor used to convert oral RfD values to dermal RfD values. This value is an oral absorption factor.	
Instructions: • Enter the adjustment factor in this column. • Use a footnote to indicate the source of the Oral Absorption Efficiency for Dermal. Also, specify the section of the risk assessment text where the derivation of the Oral Absorption Efficiency for Dermal can be found.	
Column 6 - Absorbed RfD for Dermal Value	
Definition: • The adjusted RfD for each COPC detected that is derived from the oral RfD.	

INSTRUCTIONS FOR TABLE 5.1

NON-CANCER TOXICITY DATA - ORAL/DERMAL (continued)

Instructions: • Enter the value that was derived from the adjustment factor in Column 5. • In a footnote on this table, reference the section of the risk assessment text where the derivation of the Absorbed RfDs for Dermal can be found.	***Derivations of the Absorbed RfD for Dermal should be performed in as directed by the EPA risk assessor.***
Column 7 - Absorbed RfD for Dermal Units	
Definition: • The units associated with the Absorbed RfD for Dermal value for each COPC.	
Instructions: • Enter units for each Absorbed RfD for Dermal value as necessary.	***Consult the EPA risk assessor to determine if there is a preference regarding the units to be used.***
Column 8 - Primary Target Organ(s)	
Definition: • The organ(s) most affected (i.e., experiences critical effects) by chronic or subchronic exposure to the specific COPC, and upon which the RfD is based.	
Instructions: • Enter the name of the most affected organ or organ system in the column. If the critical effect (the one on which the RfD is based) involves multiple target organs, they should be shown, separated by a '/.' Target organs that are affected at higher doses should not be shown.	
Column 9 - Combined Uncertainty/Modifying Factors	
Definition: • The factors applied to the critical effect level to account for areas of uncertainty inherent in extrapolation from available data.	***Refer to IRIS, HEAST, or other source for these values. Examples of uncertainty to be addressed include:*** ***- variations in the general population*** ***- interspecies variability between humans and animals*** ***- use of subchronic data for chronic evaluation*** ***- extrapolation from LOAELs to NOAELs.***
Instructions: • Enter number obtained from IRIS, HEAST, or other source.	***Refer to IRIS, HEAST, or other source for these values.***

INSTRUCTIONS FOR TABLE 5.1

NON-CANCER TOXICITY DATA - ORAL/DERMAL (continued)

Column 10 - RfD: Target Organ(s) Source(s)	
Definition: • The source of the RfD and target organ information.	
Instructions: • Enter the source of the RfD and target organ information. Use a colon to delineate multiple sources if the sources of information are different for RfD and target organ.	***IRIS*** ***HEAST*** ***NCEA*** ***OTHER***
Column 11 - RfD: Target Organ(s) Dates (MM/DD/YYYY)	
Definition: • The date of the source that was consulted for the RfD and target organ information in MM/DD/YYYY format.	***The MM/DD/YYYY format refers to month/day/year.***

Instructions:
• Enter the date, in MM/DD/YYYY format, for both RfD and target organ information. Use a colon to delineate multiple dates if the dates of information are different for RfD and target organ.
  • ***For IRIS references, provide the date IRIS was searched.***
  • ***For HEAST references, provide the date of the HEAST reference.***
  • ***For NCEA references, provide the date of the information provided by NCEA.***
	For example, the MM/DD/YYYY version of the date March 30, 1995 is 03/30/1995.

INSTRUCTIONS FOR TABLE 5.2

NON-CANCER TOXICITY DATA - INHALATION

PURPOSE OF THE TABLE: • To provide information on RfCs, RfDs, target organs, and adjustment factors for chemicals • To provide RfC to RfD adjustment factors • To verify references for non-cancer toxicity data.	
INFORMATION DOCUMENTED: • The RfDs for each of the COPCs, as well as modifying factors and RfC to RfD adjustments • The primary target organ effects of each of the COPCs • References for RfCs and organ effects.	***Surrogate toxicity values can also be entered in this table and indicated in the Source(s) column or with a footnote.***
TABLE NUMBERING INSTRUCTIONS: • Complete one copy of this table only. • Number it Table 5.2. • The table should contain a row for each COPC considered.	***If chronic and subchronic effects are listed for the same COPC, two rows will be required.***
GENERAL NOTES/INSTRUCTIONS FOR THIS TABLE: • Table 5.2 does not replace the toxicological profiles for the individual chemicals that will be presented in the risk assessment.	***It may be necessary to refer to RAGS, the risk assessment technical approach, and EPA Regional guidance to complete the table.***
HOW TO COMPLETE/INTERPRET THE TABLE:	
Column 1 - Chemical of Potential Concern	
Definition: • Chemicals that are potentially site-related, with data of sufficient quality, that have been retained for quantitative analysis as a result of the screening documented in Table 2.	
Instructions: • Enter the names of the chemicals that were selected as COPCs from Table 2.	***Chemicals can be grouped in the order that the risk assessor prefers. Class descriptions can be included as a row before a group of chemicals.***
Column 2 - Chronic/Subchronic	
Definition: • Identifies whether the RfC or RfD for a particular chemical is for chronic (long-term) and/or subchronic (short-term) exposure.	
Instructions: • Enter either “Chronic” or “Subchronic” in the field. Both values may be available for an individual chemical. • “Subchronic” values may not be available or necessary for an individual COPC. If that is the case, enter “Chronic” in Column 2.	***Chronic*** ***Subchronic***

INSTRUCTIONS FOR TABLE 5.2

NON-CANCER TOXICITY DATA - INHALATION (continued)

Column 3 - Inhalation RfC Value	
Definition: • The RfC value for each of the COPCs.	
Instructions: • Enter the value for the chronic and/or subchronic oral RfC (as appropriate).	
Column 4 - Inhalation RfC Units	
Definition: • The RfC units for each chemical detected.	
Instructions: • Enter units for each RfC as necessary.	***Consult the EPA risk assessor to determine if there is a preference regarding the units to be used.***
Column 5 - Extrapolated RfD Value	
Definition: • The inhalation RfD for each COPC that is derived from the RfC value if an RfD is used to calculate risk instead of the RfC.	***The derivation of the RfD from an RfC should be performed as directed by the EPA risk assessor.***
Instructions: • Enter the derived RfD factor in this column. • In a footnote on this table, reference the section of the risk assessment text where the derivation of the adjusted RfDs can be found.	***The equation to derive the RfD from the RfC is to be included as a footnote in the table.***
Column 6 - Extrapolated RfD Units	
Definition: • The Extrapolated RfD units for each COPC.	
Instructions: • Enter units for each Extrapolated RfD value as necessary.	***Consult the EPA risk assessor to determine if there is a preference regarding the units to be used.***
Column 7 - Primary Target Organ(s)	
Definition: • The organ that is most affected (i.e., experiences critical effects) by chronic or subchronic exposure to the specific COPC, and upon which the RfD/RfC is based.	

INSTRUCTIONS FOR TABLE 5.2

NON-CANCER TOXICITY DATA - INHALATION (continued)

Instructions: • Enter the name of the most affected organ or organ system in the column. • If the critical effect (the one on which the RfD/RfC is based) involves multiple target organs, they should all be shown, separated by '/.' Target organs affected at higher doses should not be shown.	
Column 8 - Combined Uncertainty/Modifying Factors	
Definition: • The factors applied to the critical effect level to account for areas of uncertainty inherent in extrapolation from available data.	***Refer to IRIS, HEAST, or other source for these values. Examples of uncertainty to be addressed include:*** ***- variations in the general population*** ***- interspecies variability between humans and animals*** ***- use of subchronic data for chronic evaluation*** ***- extrapolation from LOAELs to NOAELs.***
Instructions: • Enter number obtained from IRIS, HEAST, or other source.	***Refer to IRIS, HEAST, or other source for these values.***
Column 9 - RfC: Target Organ(s) Source(s)	
Definition: • The sources of the RfC and target organ information.	
Instructions: • Enter the sources of the RfC and target organ information. Use a colon to delineate between multiple information sources if the sources of information are different for RfC and target organ.	***IRIS*** ***HEAST*** ***NCEA*** ***OTHER***
Column 10 - RfC: Target Organ(s) Date(s) (MM/DD/YYYY)	
Definition: • The dates of the documents that were consulted for the RfC and target organ information in MM/DD/YYYY format.	***The MM/DD/YYYY format refers to month/day/year.***

Instructions: • Enter the dates, in MM/DD/YYYY format, for RfC and target organ information. Use a colon to delineate between multiple dates if the dates of information are different for RfC and target organ. • ***For IRIS references, provide the date IRIS was searched.*** • ***For HEAST references, provide the date of the HEAST reference.*** • ***For NCEA references, provide the date of the information provided by NCEA.***	***For example, the MM/DD/YYYY version of the date March 30, 1995 is 03/30/1995.***

INSTRUCTIONS FOR TABLE 5.3

NON-CANCER TOXICITY DATA - SPECIAL CASE CHEMICALS

PURPOSE OF THE TABLE: • To provide information on toxicity values, target organs, and adjustment factors for unusual chemicals or circumstances or surrogate chemicals that are not covered by Tables 5.1 or 5.2. Table 5.3 is not required if there are not such chemicals or circumstances. • To verify references for non-cancer toxicity data.	***For example, a toxicity factor derived specifically for an individual risk assessment should be documented in Table 5.3.***
INFORMATION DOCUMENTED: • The toxicity values for each of the COPCs, as well as modifying factors • The organ effects of each of the COPCs • References for toxicity values and organ effects.	
TABLE NUMBERING INSTRUCTIONS: • Complete one copy of this table only. • Number it Table 5.3. • The table should contain a row for each COPC considered.	***If chronic and subchronic effects are listed for the same COPC, two rows will be required.***
GENERAL NOTES/INSTRUCTIONS FOR THIS TABLE: • Table 5.3 does not replace the toxicological profiles for the individual chemicals that will be presented in the risk assessment.	***Refer to RAGS, the risk assessment technical approach, and the EPA risk assessor to complete the table.***
HOW TO COMPLETE/INTERPRET THE TABLE	
Column 1 - Chemical of Potential Concern	
Definition: • Chemicals that are potentially site-related, with data of sufficient quality, that have been retained for quantitative analysis as a result of the screening documented in Table 2.	
Instructions: • Enter the names of the chemicals that were selected as COPCs from Table 2.	***Chemicals can be grouped in the order that the risk assessor prefers. Class descriptions (e.g., PAHs, VOCs, inorganics) can be included as a row before a group of chemicals.***
Column 2 - Chronic/Subchronic	
Definition: • Identifies whether the toxicity value for a particular chemical is for chronic (long-term) and/or subchronic (short-term) exposure.	

INSTRUCTIONS FOR TABLE 5.3

NON-CANCER TOXICITY DATA -SPECIAL CASE CHEMICALS (continued)

Instructions: • Enter either "Chronic" or "Subchronic" in the field. Both values may be available for an individual COPC. • "Subchronic" values may not be available or necessary for an individual chemical. If that is the case, enter only "Chronic" in the column.	***Chronic*** ***Subchronic***
Column 3 - Parameter Name	
Definition: • The name of parameter/toxicity factor being recorded for each COPC.	***Toxicity factors derived specifically for an individual risk assessment should be recorded here.***
Instructions: • Enter the name of parameter/toxicity factor.	
Column 4 - Parameter Value	
Definition: • The toxicity parameter value for each COPC.	
Instructions: • Enter the value for the chronic and/or subchronic toxicity values (as appropriate).	
Column 5 - Parameter Units	
Definition: • The units associated with the toxicity value for each COPC.	
Instructions: • Enter units for each reference as necessary.	***Consult the EPA risk assessor to determine if there is a preference regarding the units to be used.***
Column 6 - Primary Target Organ(s)	
Definition: • The organ(s) most affected (i.e., experiences critical effects) by chronic or subchronic exposure to the specific COPC, and upon which the RfD is based.	
Instructions: • Enter the name of the most affected organ or organ system in the column. If the critical effect (the one that the RfD is based on) involves multiple target organs, they should all be shown, separated by a '/.' Target organs affected at higher doses should not be shown.	

INSTRUCTIONS FOR TABLE 5.3

NON-CANCER TOXICITY DATA -SPECIAL CASE CHEMICALS (continued)

Column 7 - Combined Uncertainty/Modifying Factors	
Definition: • The factors applied to the critical effect level to account for areas of uncertainty inherent in extrapolation from available data.	***Refer to IRIS, HEAST, or other source for these values. Examples of uncertainty to be addressed include:*** ***- variations in the general population*** ***- interspecies variability between humans and animals*** ***- use of subchronic data for chronic evaluation*** ***- extrapolation from LOAELs to NOAELs.***
Instructions: • Enter number obtained from IRIS, HEAST, or other source.	***Refer to IRIS, HEAST, or other source for these values.***
Column 8 - Parameter: Target Organ(s) Sources	
Definition: • The sources of the toxicity and target organ information.	
Instructions: • Enter the sources of the toxicity and target organ information. Use a colon to delineate multiple sources if the sources of information for toxicity and target organ are different.	***IRIS*** ***HEAST*** ***NCEA*** ***OTHER***
Column 9 - Parameter: Target Organ(s) Date(s) (MM/DD/YYYY)	
Definition: • The dates of the sources that were consulted for the toxicity information and the target organ information in MM/DD/YYYY format.	***The MM/DD/YYYY format refers to month/day/year.***
Instructions: • Enter the dates, in MM/DD/YYYY format, for the toxicity and target organ information. Use a colon to delineate between multiple dates if the sources of information are different for toxicity and target organ. • ***For IRIS references, provide the date IRIS was searched.*** • ***For HEAST references, provide the date of the HEAST reference.*** • ***For NCEA references, provide the date of the information provided by NCEA.***	***For example, the MM/DD/YYYY version of the date March 30, 1995 is 03/30/1995.***

INSTRUCTIONS FOR TABLE 6.1

CANCER TOXICITY DATA - ORAL/DERMAL

PURPOSE OF THE TABLE: • To provide the oral and dermal cancer toxicity information (values and sources of information) for chemicals of potential concern • To provide the methodology and adjustment factors used to convert oral cancer toxicity values to dermal toxicity values • To provide weight of evidence/cancer guideline descriptions for each chemical of potential concern.	
INFORMATION DOCUMENTED: • Oral and dermal toxicity values for chemicals of potential concern • Weight of evidence/cancer guidelines descriptions for chemicals of potential concern • The source/reference for each toxicity value.	***Surrogate toxicity values can also be entered in this table and indicated in the 'Source(s)' column or with a footnote.***
GENERAL NOTES/INSTRUCTIONS FOR THIS TABLE: • Table 6.1 does not replace toxicological profiles for the individual chemicals that will be presented in the risk assessment.	***It may be necessary to refer to RAGS, the risk assessment technical approach, and the EPA risk assessor to complete the table.***
HOW TO COMPLETE/INTERPRET THE TABLE	
Column 1 - Chemical of Potential Concern	
Definition: • Chemicals that are potentially site-related, with data of sufficient quality, that have been retained for quantitative analysis as a result of the screening documented in Table 2.	
Instructions: • Enter the names of the chemicals that were selected as COPCs from Table 2.	***Chemicals may be grouped in the order that the risk assessor chooses. Class descriptions can be included as a row before a group of chemicals.***
Column 2 - Oral Cancer Slope Factor Value	
Definition: • Cancer slope factor for ingestion.	
Instructions: • Enter the oral cancer slope factor value for each of the COPCs.	***Refer to IRIS and HEAST. If toxicity information is not available, contact EPA's National Center for Environmental Assessment (NCEA) office.***

INSTRUCTIONS FOR TABLE 6.1

CANCER TOXICITY DATA - ORAL/DERMAL (continued)

Column 3 - Oral Cancer Slope Factor Units	
Definition: • Units for the cancer slope factor for ingestion.	
Instructions: • Enter units for each oral cancer slope factor.	***Consult the EPA risk assessor to determine if there is a preference regarding the units to be used.***
Column 4 - Oral Absorption Efficiency for Dermal	
Definition: • The absorbed factor used to convert the oral RfD values to dermal RfD values.	
Instructions: • Enter the oral to dermal adjustment factor. • Use a footnote to indicate the source of the Oral Absorption Efficiency for dermal.	.
Column 5 - Absorbed Cancer Slope Factor for Dermal Value	
Definition: • The absorbed dermal cancer slope factor for each chemical of potential concern which typically is derived from the oral cancer slope factor.	***Derivation of the dermal cancer slope factor should be performed in consultation with the EPA risk assessor.***
Instructions: • Enter the derived dermal cancer slope factor. • Use a footnote to specify the section of the risk assessment text where the derivation of the Absorbed Cancer Slope Factor for Dermal can be found.	
Column 6 - Absorbed Cancer Slope Factor for Dermal Units	
Definition: • The units associated with each Absorbed Cancer Slope Factor for Dermal.	
Instructions: • Enter the units for the Absorbed Cancer Slope Factors for Dermal.	***Typically $(mg/kg\text{-}day)^{-1}$. Consult with the EPA risk assessor to determine if there is a preference regarding the units to be used.***
Column 7 - Weight of Evidence/Cancer Guideline Description	

INSTRUCTIONS FOR TABLE 6.1

CANCER TOXICITY DATA - ORAL/DERMAL (continued)

Definition: • An EPA classification system for characterizing the extent to which the available data indicate that an agent is a human carcinogen.	
Instructions: • Provide the weight of evidence or cancer guideline description. • Choose from the categories to the right.	***Weight of Evidence:*** ***A - Human carcinogen*** ***B1 - Probable human carcinogen - indicates that limited human data are available.*** ***B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans.*** ***C - Possible human carcinogen*** ***D - Not classifiable as a human carcinogen*** ***E - Evidence of noncarcinogenicity*** ***Cancer Guideline Description:*** ***Known/Likely*** ***Cannot be Determined*** ***Not Likely***
Column 8 - Oral CSF Source(s)	
Definition: • A reference for the oral cancer slope factor.	
Instructions: • Enter the reference for the toxicity information.	***For example:*** ***IRIS*** ***HEAST*** ***NCEA***
Column 9 -Oral CSF Date(s) (MM/DD/YYYY)	
Definition: • The date of the document that was consulted for the cancer toxicity data in MM/DD/YYYY format.	***The MM/DD/YYYY format refers to month/day/year.***

Instructions:
• Enter the date in MM/DD/YYYY format.
  • ***For IRIS references, provide the date IRIS was searched.***
  • ***For HEAST references, provide the date of the HEAST reference.***
  • ***For NCEA references, provide the date of the information provided by NCEA.***
	For example, the MM/DD/YYYY version of the date March 30, 1995 is 03/30/1995.

INSTRUCTIONS FOR TABLE 6.2

CANCER TOXICITY DATA - INHALATION

PURPOSE OF THE TABLE: • To provide the inhalation cancer toxicity information (values and sources of information) for chemicals of potential concern • To provide the methodology and adjustment factors used to convert inhalation unit risks to inhalation cancer slope factors • To provide weight of evidence/cancer guideline descriptions for each chemical of potential concern.	
INFORMATION DOCUMENTED: • Inhalation toxicity values for chemicals of potential concern • Weight of evidence/cancer guidelines descriptions for chemicals of potential concern • The source/reference for each toxicity value.	***Surrogate toxicity values can also be entered in this table and indicated in the 'Source(s)' column or with a footnote.***
GENERAL NOTES/INSTRUCTIONS FOR THIS TABLE: • Table 6.2 does not replace toxicological profiles for the individual chemicals that will be presented in the risk assessment.	***It may be necessary to refer to RAGS, the risk assessment technical approach, and the EPA risk assessor to complete the table.***
HOW TO COMPLETE/INTERPRET THE TABLE	
Column 1 - Chemical of Potential Concern	
Definition: • Chemicals that are potentially site-related, with data of sufficient quality, that have been retained for quantitative analysis as a result of the screening documented in Table 2.	
Instructions: • Enter the names of the chemicals that were selected as COPCs from Table 2.	***Chemicals may be grouped in the order that the risk assessor chooses. Class descriptions (e.g., PAHs, VOCs, inorganics) can be included as a row before a group of chemicals.***
Column 2 - Unit Risk Value	
Definition: • Toxicity values for carcinogenic effects expressed in terms of risk per unit concentration of the substance in the medium where human contact occurs. Cancer slope factors can be calculated from unit risk values.	
Instructions: • Enter the inhalation unit risk value	***Refer to IRIS and HEAST; if toxicity information is not available, contact EPA's National Center for Environmental Assessment (NCEA) office.***

INSTRUCTIONS FOR TABLE 6.2

CANCER TOXICITY DATA - INHALATION (continued)

Column 3 - Unit Risk Units	
Definition: • The units used for the unit risk for each chemical detected.	
Instructions: • Enter the units for the unit risk values.	***Consult the EPA risk assessor to determine if there is a preference regarding the units to be used.***
Column 4 - Inhalation Cancer Slope Factor Value	
Definition: • A plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime.	***Usually the cancer slope factor is the upper 95th % confidence limit of the dose-response curve for inhalation.***
Instructions: • Enter the Inhalation Cancer Slope Factor if Cancer Slope Factors were used to calculate risk instead of Inhalation Unit Risks.	
Column 5 - Inhalation Cancer Slope Factor Units	
Definition: • The units used for the Inhalation Cancer Slope Factor for each chemical detected.	
Instructions: • Enter the units for the Inhalation Cancer Slope Factors.	***Consult EPA risk assessor to determine if there is a preference regarding the units to be used.***
Column 6 - Weight of Evidence/Cancer Guideline Description	
Definition: • An EPA classification system for characterizing the extent to which the available data indicate that an agent is a human carcinogen.	

INSTRUCTIONS FOR TABLE 6.2

CANCER TOXICITY DATA - INHALATION (continued)

Instructions: • Provide the weight of evidence or cancer guideline description. • Choose from the categories to the right.	***Weight of Evidence:*** ***A - Human carcinogen*** ***B1 - Probable human carcinogen - indicates that limited human data are available.*** ***B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans.*** ***C - Possible human carcinogen*** ***D - Not classifiable as a human carcinogen*** ***E - Evidence of noncarcinogenicity*** ***Cancer Guideline Description:*** ***Known/Likely*** ***Cannot be Determined*** ***Not Likely***

INSTRUCTIONS FOR TABLE 6.2

CANCER TOXICITY DATA - INHALATION (continued)

Column 7 - Unit Risk: Inhalation Cancer Slope Factor Source(s)	
Definition: • A reference for the Unit Risk and Inhalation Cancer Slope Factor values.	
Instructions: • Enter the reference(s) for Unit Risk and Inhalation Cancer Slope Factor values. Use a colon to delineate multiple sources.	***IRIS*** ***HEAST*** ***NCEA***
Column 8 - Unit Risk: Inhalation Cancer Slope Factor Date(s) (MM/DD/YYYY)	
Definition: • The date of the document that was consulted for the cancer toxicity data in MM/DD/YYYY format.	***The MM/DD/YYYY format refers to month/day/year.***
Instructions: • Enter the date in MM/DD/YYYY format. Use a colon to delineate between multiple dates, if multiple sources of information were used. • ***For IRIS references, provide the date IRIS was searched.*** • ***For HEAST references, provide the date of the HEAST reference.*** • ***For NCEA references, provide the date of the information provided by NCEA.***	***For example, the MM/DD/YYYY version of the date March 30, 1995 is 03/30/1995.***

INSTRUCTIONS FOR TABLE 6.3

CANCER TOXICITY DATA - SPECIAL CASE CHEMICALS

PURPOSE OF THE TABLE: • To provide cancer toxicity information for unusual chemicals, surrogate chemicals or circumstances that are not covered by Tables 6.1 or 6.2. Table 6.3 (or non-standard tables) can also be used to accommodate threshold carcinogens, if applicable. Table 6.3 is not required if there are no such chemicals or circumstances.	***For example, a toxicity factor derived specifically for an individual risk assessment should be documented in Table 6.3.***
INFORMATION DOCUMENTED: • Cancer toxicity information (values and units) for special case chemicals • The date and source of the toxicity information.	
TABLE NUMBERING INSTRUCTIONS: • Complete one copy of this table only. • Number it 6.3. • The table should contain a row for each COPC considered.	
GENERAL NOTES/INSTRUCTIONS FOR THIS TABLE: • Table 6.3 does not replace toxicological profiles for the individual chemicals that will be presented in the risk assessment.	***It may be necessary to refer to RAGS, the risk assessment technical approach, and consult the EPA risk assessor to complete the table.***
HOW TO COMPLETE/INTERPRET THE TABLE	
Column 1 - Chemical of Potential Concern	
Definition: • Chemicals that are potentially site-related, with data of sufficient quality, that have been retained for quantitative analysis as a result of the screening documented in Table 2.	
Instructions: • Enter the names of the chemicals that were selected as COPCs from Table 2.	***Chemicals may be grouped in the order that the risk assessor chooses. Class descriptions can be included as a row before a group of chemicals.***
Column 2 - Parameter Name	
Definition: • The name of the toxicity parameter being recorded.	
Instructions: • Enter the names of the toxicity parameter being recorded.	

INSTRUCTIONS FOR TABLE 6.3

CANCER TOXICITY DATA - SPECIAL CASE CHEMICALS (continued)

Column 3 - Parameter Value	
Definition: • The toxicity value for each listed parameter for each chemical of potential concern.	
Instructions: • Enter the toxicity value for each chemical of potential concern.	***Refer to IRIS, HEAST, or other source for these valued.***
Column 4 - Parameter Units	
Definition: • The units associated with the toxicity value.	
Instructions: • Enter the toxicity units.	***Typically (mg/kg-day)$^{-1}$*** ***Consult the EPA risk assessor to determine if there is a preference regarding the units to be used.***
Column 5 -Source(s)	
Definition: • A reference for the cancer toxicity information.	
Instructions: • Enter the reference for toxicity information. Use a colon to delineate multiple sources.	***IRIS*** ***HEAST*** ***NCEA*** *OTHER*
Column 6 - Date(s) (MM/DD/YYYY)	
Definition: • The date of the document that was consulted for the cancer toxicity data in the MM/DD/YYYY format.	***The MM/DD/YYYY format refers to month/day/year.***
Instructions: • Enter the date in MM/DD/YYYY format. Use a comma to delineate between multiple dates, if multiple sources of information were used. • ***For IRIS references, provide the date IRIS was searched.*** • ***For HEAST references, provide the date of the HEAST reference.*** • ***For NCEA references, provide the date of the information provided by NCEA.***	***For example, the MM/DD/YYYY version of the date March 30, 1995 is 03/30/1995.***

INSTRUCTIONS FOR TABLE 6.4

CANCER TOXICITY DATA - EXTERNAL (RADIATION)

PURPOSE OF THE TABLE: • To provide cancer toxicity information for radionuclides.	
INFORMATION DOCUMENTED: • Cancer toxicity information (values and units) for radionuclides. • The source and date of the toxicity information.	
GENERAL NOTES/INSTRUCTIONS FOR THIS TABLE: • Table 6.4 does not replace toxicological profiles for the individual radionuclides that will be presented in the risk assessment.	***It may be necessary to refer to RAGS, the risk assessment technical approach, and the EPA risk assessor to complete the table.***
HOW TO COMPLETE/INTERPRET THE TABLE	
Column 1 - Chemical of Potential Concern	
Definition: • Radionuclides that are potentially site-related, with data of sufficient quality, that have been retained for quantitative analysis as a result of the screening documented in Table 2.	
Instructions: • Enter the names of the radionuclides that were selected as COPCs from Table 2.	***Radionuclides may be grouped in the order that the risk assessor chooses.***
Column 2 - Cancer Slope Factor Value	
Definition: • A Cancer Slope Factor is an age-averaged lifetime excess cancer incidence rate per unit intake (or unit exposure for external exposure pathways) and is used to convert the intake to a cancer risk. Ingestion and inhalation slope factors are central estimates in a linear model of the age-averaged, lifetime attributable radiation cancer incidence (fatal and nonfatal cancer) risk per unity of activity inhaled or ingested, expressed as risk/picocurie (pCi). External exposure slope factors are central estimates of the lifetime attributable radiation cancer incidence risk for each year of exposure to external radiation from photon-emitting radionuclides distributed uniformly in a thick layer of soil, and are expressed as risk/yr per pCi/gram of soil.	
Instructions: • Enter the value of the cancer slope factor for each COPC.	
Column 3 - Cancer Slope Factor Units	
Definition: • The units associated with the Cancer Slope Factor value.	

INSTRUCTIONS FOR TABLE 6.4

CANCER TOXICITY DATA - EXTERNAL (RADIATION) (continued)

Instructions: • Enter the units for the Cancer Slope Factor value.	***Consult the EPA risk assessor to determine if there is a preference regarding the units to be used.***
Column 4 -Source(s)	
Definition: • A reference for the cancer slope or conversion factor value.	
Instructions: • Enter the reference(s) for the cancer slope or conversion factor value. Use a colon to delineate multiple sources.	***For example:*** ***IRIS*** ***HEAST*** ***NCEA*** ***OTHER***
Column 5 - Date(s) (MM/DD/YYYY)	
Definition: • The date of the document that was consulted for the cancer slope or conversion factor value in the MM/DD/YYYY format.	***The MM/DD/YYYY format refers to month/day/year.***
Instructions: • Enter the date in MM/DD/YYYY format. Use a colon to delineate between multiple dates, if multiple sources of information were used. ***For IRIS references, provide the date IRIS was searched.*** ***For HEAST references, provide the date of the HEAST reference.*** ***For NCEA references, provide the date of the information provided by NCEA.***	***For example, the MM/DD/YYYY version of the date March 30, 1995 is 03/30/1995.***

INSTRUCTIONS FOR TABLE 7

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

PURPOSE OF THE TABLE: • To provide a summary of the variables used to calculate chemical cancer risks and non-cancer hazards • To show the EPC and intake used in the non-cancer hazard and cancer risk calculations • To present the result of the calculation for each Exposure Route/Pathway for each COPC • To provide the total hazard index and cancer risk for all Exposure Routes/Pathways for the Scenario Timeframe and Receptor presented in this table.	
INFORMATION DOCUMENTED: • The non-cancer hazard quotient and unit risk for each COPC for each Exposure Route/Pathway • The values used for EPC, cancer and non-cancer intakes, reference doses, and reference concentrations.	***An alternate presentation is also available with cancer information shown on Table 7a and non-cancer information shown on Table 7b.***
TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS: • Complete one copy of Table 7 for each unique combination of the following three fields that will be quantitatively evaluated (Scenario Timeframe, Receptor Population, and Receptor Age). • Enter each combination of these three fields in the Summary Box in the upper left corner of the table. ***Note: Each combination of the three key fields and the first four columns should be found as a row in Table 1.*** • Number each table uniquely, beginning with 7.1 and ending with 7.n where "n" represents the total number of combinations of the six key fields. • Different tables should be prepared to address RME and CT non-cancer hazard calculations when appropriate. • Tables 7.1.RME through 7.n.RME should be completed for RME non-cancer and cancer hazard calculations when appropriate. • Tables 7.1.CT through 7.n.CT should be completed for CT non-cancer and cancer hazard calculations.	***It is possible that some tables may contain some of the same data associated with different descriptions in the Summary Box in the upper left corner.*** ***Separate tables may be necessary to ensure transparency in data presentation for each Exposure Pathway. Replication of information is readily accomplished using spreadsheet software.*** ***Consult the EPA rise assessor for alternatives (e.g., footnotes) to preparing multiple tables with the same data.***

INSTRUCTIONS FOR TABLE 7

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS (continued)

TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS (continued): • An optional approach is to report cancer and non-cancer values on separate tables as follows: - Number non-cancer tables 7.1A.RME - 7.nA.RME or 7.1A.CT - 7.nA.CT, where "n" represents the total number of combinations of the three key fields. - Number cancer tables 7.1B.RME-7.nB RME or 7.1B.CT-7.nB.CT, where "n" represents the total number of combinations of the three key fields. - The first seven columns remain the same for both non-cancer or cancer tables. Columns 8-12 contain either the Cancer Risk Calculations data or the Non-Cancer Hazard Calculations data. - See the blank Planning Tables for an illustration of how Table 7 data can be separated as described above.	***When reporting cancer and non-cancer values on separate tables, use the column names to identify instructions for completing each column, as the column number will differ after Column 7.***
GENERAL NOTES/INSTRUCTIONS FOR THIS TABLE:	
• All table entries, with the exception of Intake, Non-Cancer Hazard and Cancer Risk are presented on tables preceding Table 7. • With the exception of modeled intakes, the intake value is the result of calculations performed using parameters and equations presented in Table 4 and concentrations presented in Table 3. • The Total Non-Cancer Hazard is to be summed for each Exposure Route and Exposure Point in the Exposure Route Total and Exposure Point Total rows. The total Non-Cancer Hazard for all Exposure Pathways for a given Receptor is to be presented as the Total of Receptor Hazards Across All Media at the bottom of the table. This value represents the non-cancer hazard of the various exposure routes/pathways combined. • The total Cancer Risk is to be summed for each Exposure Route and Exposure Point in the Exposure Route Total and Exposure Point Total rows. The Total Cancer Risk for all Exposure Pathways for a given Receptor is to be presented as the Total of Receptor Risks Across All Media at the end of the table. This value represents the cancer risk of the various Exposure Routes/Pathways combined to a given receptor.	

INSTRUCTIONS FOR TABLE 7

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS (continued)

HOW TO COMPLETE/INTERPRET THE TABLE	
SUMMARY BOX IN UPPER LEFT CORNER	
Row 1 - Scenario Timeframe	
Definition: • The time period (current and/or future) being considered for the Exposure Pathway.	
Instructions: • Choose from the picklist to the right.	***Current*** ***Future*** ***Current/Future*** ***Not Documented***
Row 2 - Receptor Population	
Definition: • The exposed individual relative to the Exposure Pathway considered.	***For example, a resident (Receptor Population) who drinks contaminated groundwater.***
Instructions: • Choose from the picklist to the right.	***Resident*** ***Industrial Worker*** ***Commercial Worker*** ***Construction Worker*** ***Other Worker*** ***Golfer*** ***Jogger*** ***Fisher*** ***Hunter*** ***Fisher/Hunter*** ***Swimmer*** ***Other Recreational Person*** ***Child at School/Daycare/ Playground*** ***Trespasser/Visitor*** ***Farmer*** ***Gardener*** ***Gatherer*** ***Other***
Row 3 - Receptor Age	
Definition: • The description of the exposed individual, as defined by the EPA Region or dictated by the site.	***For example, an adult (Receptor Age) resident (Receptor Population) who drinks contaminated groundwater.***

INSTRUCTIONS FOR TABLE 7

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS (continued)

Instructions: • Choose from the picklist to the right.	***Child*** ***Adult*** ***Adolescents (teens)*** ***Pre-Adolescents*** ***Not Documented*** ***Child/Adult*** ***Geriatric*** ***Sensitive*** ***Other*** ***Infant*** ***Toddler*** ***Pregnant***
BODY OF THE TABLE	
Column 1 - Medium	
Definition: • The substance (e.g., air, water, soil) that is a potential source of contaminants in the Exposure Medium. (The Medium will sometimes equal the Exposure Medium.) Usually, the Medium is that targeted for possible remediation.	
Instructions: • Choose from the picklist to the right.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Surface Soil*** ***Subsurface Soil*** ***Other***
Column 2 - Exposure Medium	
Definition: • The contaminated environmental medium to which an individual may be exposed. Includes the transfer of contaminants from one medium to another. ***For example:*** ***1) Contaminants in Groundwater (the Medium) remain in Groundwater (the Exposure Medium) and are available for exposure to receptors.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and are available for exposure to receptors.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and are available for exposure to receptors.***	

Instructions: • Choose from the picklist to the right.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Plant Tissue*** ***Animal Tissue*** ***Fish Tissue*** ***Spring Water*** ***Surface Soil*** ***Subsurface Soil*** ***Particulates*** ***Vapors*** ***Other***
Column 3 - Exposure Point	
Definition: • An exact location of potential contact between a person and a chemical or radionuclide within an Exposure Medium. ***For example:*** ***1) Contaminants are in Groundwater (the Medium and the Exposure Medium) and exposure to Aquifer 1 - Tap Water (the Exposure Point) is evaluated.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and exposure to Aquifer 1 - Water Vapors at Showerhead (the Exposure Point) is evaluated.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and Trout from Dean's Creek (the Exposure Point) is evaluated.***	
Instructions: • Provide the information as text in the Table.	***Exposure Point should be defined in the same way as was done in Planning Table 1.***
Column 4 - Exposure Route	
Definition: • The way a chemical or radionuclide comes in contact with a person (e.g., by ingestion, inhalation, dermal contact).	

INSTRUCTIONS FOR TABLE 7

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS (continued)

Instructions: • Enter the Exposure Route considered from the picklist to the right.	***Inhalation*** ***Ingestion*** ***Combined*** (i.e., Inhalation and Ingestion) ***Dermal*** ***Not Documented*** ***External (Radiation)***

INSTRUCTIONS FOR TABLE 7

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS (continued)

Column 5 - Chemical of Potential Concern	
Definition: • Chemicals that are potentially site-related, with data of sufficient quality, that have been retained for quantitative analysis as a result of the screening documented in Table 2.	
Instructions: • Enter the COPCs selected from the COPC screening.	***Table 2 documents COPC screening.***
Column 6 - EPC Value	
Definition: • The EPC, based on either a statistical derivation of measured data or modeled data, that represents an estimate of the chemical or radionuclide concentration. ***The EPC value may be statistically derived by calculating the 95% UCL of measured groundwater contaminant concentrations from multiple residential wells. Alternatively, the EPC value may be selected as a single measured value, if one data point is used to calculate the risk for each residential well individually. In some cases, the EPC value may be a modeled value (e.g., if upgradient groundwater contaminant concentrations are used to model groundwater concentration at a downgradient exposure point, or if sediment concentrations are used to model fish tissue concentrations).***	***The EPC Value may be calculated, measured, or modeled.***
Instructions: • Enter the EPC value for each COPC. This value should be in Table 3. • If an EPC other than the one found in Table 3 is used, indicate it with a footnote and include a reference to supporting information that will show how the data were modeled in the risk assessment.	***Table 3 documents EPC calculations for RME and CT.***
Column 7 - EPC Units	
Definition: • The units associated with the EPC value.	
Instructions: • Enter the units for EPC values.	***Consult the EPA risk assessor for unit preferences.***
Column 8 - Cancer Risk Calculations - Intake/Exposure Concentration Value (Also Column 8 on Table 7a)	

INSTRUCTIONS FOR TABLE 7

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS (continued)

Definition: • Intake is a measure of exposure expressed as the mass of a substance in contact with the exchange boundary per unit body weight per unit time (e.g. mg chemical/kg body weight/day).	***Refers to the intake/exposure concentration results using the parameters and equations, calculations and/or models presented in Table 4.***
Instructions: • Enter the result of the intake calculations/modeling or the exposure concentration performed for each COPC and Exposure Route.	***The intake equations, calculations, and/or models are documented in Table 4.***
Column 9 - Cancer Risk Calculations - Intake/Exposure Concentration Units (Also Column 9 on Table 7a)	
Definition: • The units for intake or exposure concentration for each COPC and Exposure Route.	
Instructions: • Enter the units from the intake calculation or exposure concentration for each COPC which corresponds to each Exposure Route.	
Column 10 - Cancer Risk Calculations - CSF/Unit Risk Value (Also Column 10 on Table 7a)	
Definition: • The slope factor is used to estimate an upper-bound probability of an individual developing cancer as a result of a lifetime of exposure to a particular level of potential carcinogen. • Unit Risk is a toxicity value for carcinogenic effects expressed in terms of risk per unit concentration of the substance in the medium where human contact occurs. These measures can be calculated from cancer slope factors.	
Instructions: • Enter the cancer slope factor or unit risk for each COPC which corresponds to each exposure route.	***The slope factors and unit risk values for each COPC are presented in Tables 6.1, 6.2, and 6.3.***
Column 11 - Cancer Risk Calculations - CSF/Unit Risk Units (Also Column 11 on Table 7a)	
Definition: • The units for the cancer slope factor or unit risk.	
Instructions: • Enter the cancer slope factor or unit risk units for each COPC for each Exposure Route.	
Column 12 - Cancer Risk Calculations - Cancer Risk (Also Column 12 on Table 7a)	

INSTRUCTIONS FOR TABLE 7

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS (continued)

Definition: • The result of the cancer risk calculation for each COPC for each Exposure Route and Exposure Pathway.	
Instructions: • Enter the cancer risk calculation for each COPC. • Sum the cancer risk results for each Exposure Route in the Exposure Route Total row. • Sum the cancer risk calculation results for each Exposure Point in the Exposure Route Total row. • Sum the total cancer risk results for all Exposure Pathways in the Total of Receptor Risks Across all Media row.	***The sum of all Exposure Routes represents the total cancer risk for all Exposure Routes/ Pathways.***
Column 13 - Non-Cancer Hazard Calculations - Intake/Exposure Concentration Value (Also Column 8 on Table 7b)	
Definition: • Intake is a measure of exposure expressed as the mass of a substance in contact with the exchange boundary per unit body weight per unit time.	***Refers to the intake/exposure concentration results using the parameters and equations/calculations and/or models presented in Table 4.***
Instructions: • Enter the result of the intake calculations/modeling performed for each COPC and Exposure Route.	***The intake equations, calculations, and/or models are documented in Table 4.***
Column 14 - Non-Cancer Hazard Calculations - Intake/Exposure Concentration Units (Also Column 9 on Table 7b)	
Definition: • The units for intake for each COPC and Exposure Route.	
Instructions: • Enter the units from the intake calculation for each COPC which corresponds to each Exposure Route.	
Column 15 - Non-Cancer Hazard Calculations - RfD/RfC Value (Also Column 10 on Table 7b)	
Definition: • RfD is the toxicity value for evaluating non-cancer effects resulting from exposures. • RfC is the toxicity value for inhalation.	

INSTRUCTIONS FOR TABLE 7

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS (continued)

Instructions: • Enter the RfD or RfC value. • For RfD, enter the reference dose for each COPC which corresponds to each exposure route. • Enter Oral RfD values for ingestion. • Enter Adjusted Dermal RfD values for dermal. • Enter Adjusted Inhalation RfD/RfC values for inhalation.	***The reference doses (RfD/RfC) for each COPC are presented in Table 5.***

INSTRUCTIONS FOR TABLE 7

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS (continued)

Column 16 - Non-Cancer Hazard Calculations - RfD/RfC Units (Also Column 11 on Table 7b)	
Definition: • The units associated with the reference dose or reference concentration.	***RfDs are typically reported in mg/kg-day, a dose term, RfCs in mg/m^3.***
Instructions: • Enter the units for reference dose or reference concentration for each COPC for each exposure route. • RfC is typically reported as a concentration in air (mg/m^3) which can be converted to an inhaled dose (mg/kg-day).	
Column 17 - Non-Cancer Hazard Calculations - Hazard Quotient (Also Column 12 on Table 7b)	
Definition: • The ratio of a single substance exposure level, over a specified time period, to a reference dose for that substance, derived from a similar exposure period.	
Instructions: • Enter the result of the hazard quotient calculation for each COPC. • Sum the hazard quotient for each Exposure Route in the Exposure Route Total row. • Sum the hazard quotient for each Exposure Point in the Exposure Route Total row. • Sum the hazard quotients for all Exposure Pathways in the Total of Receptor Hazards across all Media row.	***The Hazard Index represents the total non-cancer hazard for all exposure routes/pathways presented in this table.***

INSTRUCTIONS FOR TABLE 8

CALCULATION OF RADIATION CANCER RISKS

PURPOSE OF THE TABLE: • To provide a summary of the variables and approaches used to calculate radiation cancer risks • To show the EPC used in the radiation cancer risk calculations • To document the radiation risk calculation approach used to calculate radiation cancer risks • To show, based on the documented risk calculation approach, the intake and cancer slope factors • To present the result of the calculation for each Exposure Route/Pathway for each COPC • To provide the total radiation cancer risks for each Exposure Route/Pathway for the Scenario Timeframe, and Receptor presented in this table • To provide the total radiation cancer risks for each Exposure Point for the Scenario Timeframe and Receptor in this table • To provide the total radiation cancer risks across all media for the Scenario Timeframe and Receptor in this table	***Radiation can be evaluated two ways: 1) Calculate cancer risks. The evaluation method used needs to be documented in the Planning Tables 2) Compare radiation doses to standards (i.e., EPA NESHAPS or MCLs or DOE/NRC cleanup standards).*** ***Table 8 is used to show the variables and results when using the first method. The Dose Assessment Worksheet can be used to calculate doses which can be compared to radiological dose standards.***
INFORMATION DOCUMENTED: • The approach for calculating the radiation cancer risk for each COPC for each Exposure Route/Pathway • The values used for EPC, intake and cancer slope factor for each COPC for each Exposure Route • The cancer risk value for each COPC for each Exposure Route/Pathway • Total cancer risk values by Exposure Route, Exposure Point, and across all media for the Scenario Timeframe and Receptor presented in this table	
TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS: • Complete one copy of Table 8 for each unique combination of the following three fields that will be quantitatively evaluated (Scenario Timeframe, Receptor Population, and Receptor Age). • Enter each combination of these three fields in the Summary Box in the upper left corner of the table. • Number each table uniquely, beginning with 8.1 and ending with 8.n where "n" represents the total number of combinations of the three key fields. • Table 8.1.RME through 8.n.RME should be completed for RME cancer risk calculations.	***It is possible that some tables may contain the same data associated with different descriptions in the Summary Box in the upper left corner.*** ***Separate tables may be necessary to ensure transparency in data presentation. Replication of information is readily accomplished using spreadsheet software.*** ***Consult the EPA risk assessor for alternatives (e.g., footnotes) to preparing multiple tables with the same data.***

INSTRUCTIONS FOR TABLE 8

CALCULATION OF RADIATION CANCER RISKS (continued)

GENERAL NOTES/INSTRUCTIONS FOR THIS TABLE: • All table entries, with the exception of risk calculation approach, intake, and cancer risk are presented on tables preceding Table 8. • With the exception of modeled intakes, the intake value is the result of calculations performed using parameters and equations presented in Table 4 and concentrations presented in Table 3. • The total cancer risk for each Exposure Route is to be summed and indicated in the Exposure Route Total row. This value represents the cancer risk of the various Exposure Routes across each Exposure Pathway designated in the table. • The total cancer risk for Each Exposure Point is to be summed and presented in the row labeled Exposure Point Total. • The total cancer risk for all media is to be summed and presented in the box labeled "Total of Receptor Risks Across All Media". This value represents the total radiation cancer risk to the receptor for the timeframe designated in the table.	
HOW TO COMPLETE/INTERPRET THE TABLE	
SUMMARY BOX IN UPPER LEFT CORNER	
Row 1 - Scenario Timeframe	
Definition: • The time period (current and/or future) being considered for the exposure pathway.	
Instructions: • Choose from the picklist to the right.	***Current*** ***Future*** ***Current/Future*** ***Not Documented***
Row 2 - Receptor Population	
Definition: • The exposed individual relative to the Exposure Pathway considered.	***For example, a resident (receptor population) who drinks contaminated groundwater.***

INSTRUCTIONS FOR TABLE 8

CALCULATION OF RADIATION CANCER RISKS (continued)

Instructions: • Choose from the picklist to the right.	***Resident*** ***Industrial Worker*** ***Commercial Worker*** ***Construction Worker*** ***Other Worker*** ***Golfer*** ***Jogger*** ***Fisher*** ***Hunter*** ***Fisher/Hunter*** ***Swimmer*** ***Other Recreational Person*** ***Child at School/Daycare/ Playground*** ***Trespasser/Visitor*** ***Farmer*** ***Gardener*** ***Gatherer*** ***Other***
Row 3 - Receptor Age	
Definition: • The description of the exposed individual, as defined by the EPA Region or dictated by the site.	***For example, an adult (Receptor Age) resident (Receptor Population) who drinks contaminated groundwater.***
Instructions: • Choose from the picklist to the right.	***Child*** ***Adult*** ***Adolescents (teens)*** ***Pre-Adolescents*** ***Not Documented*** ***Child/Adult*** ***Geriatric*** ***Sensitive*** ***Infant*** ***Toddler*** ***Pregnant*** ***Other***
BODY OF THE TABLE	
Column 1 - Medium	
Definition: • The substance (e.g., air, water, soil) that is a potential source of contaminants in the Exposure Medium. (The Medium will sometimes equal the Exposure Medium.) Usually, the Medium is that targeted for possible remediation.	

INSTRUCTIONS FOR TABLE 8

CALCULATION OF RADIATION CANCER RISKS (continued)

Instructions: • Choose from the picklist to the right.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Surface Soil*** ***Subsurface Soil*** ***Other***
Column 2 - Exposure Medium	
Definition: • The contaminated environmental medium to which an individual may be exposed. Includes the transfer of contaminants from one Medium to another. ***For example:*** ***1) Contaminants in Groundwater (the Medium) remain in Groundwater (the Exposure Medium) and are available for exposure to receptors.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and are available for exposure to receptors.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and are available for exposure to receptors.***	
Instructions: • Choose from the picklist to the right.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Plant Tissue*** ***Animal Tissue*** ***Fish Tissue*** ***Spring Water*** ***Surface Soil*** ***Subsurface Soil*** ***Particulates*** ***Vapors*** ***Other***

INSTRUCTIONS FOR TABLE 8

CALCULATION OF RADIATION CANCER RISKS (continued)

Column 3 - Exposure Point	
Definition: • An exact location of potential contact between a person and a chemical or radionuclide within an Exposure Medium. ***For example:*** ***1) Contaminants are in Groundwater (the Medium and the Exposure Medium) and exposure to Aquifer 1 - Tap Water (the Exposure Point) is evaluated.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and exposure to Aquifer 1 - Water Vapors at Showerhead (the Exposure Point) is evaluated.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and Trout from Dean's Creek (the Exposure Point) is evaluated.***	
Instructions: • Provide the information as text in the Table.	***Exposure Point should be defined in the same way as was done in Planning Table 1.***
Column 4 - Exposure Route	
Definition: • The way a chemical or radionuclide comes in contact with a person (e.g., by ingestion, inhalation, dermal contact).	
Instructions: • Enter the Exposure Route considered from the picklist to the right.	***Inhalation*** ***Ingestion*** ***Combined (i.e., Inhalation and Ingestion)*** ***Dermal*** ***Not Documented*** ***External (Radiation)***
Column 5 - Radionuclide of Potential Concern	
Definition: • Radionuclides that are potentially site-related, with data of sufficient quality, that have been retained for quantitative analysis as a result of the screening documented in Table 2.	
Instructions: • Enter the radionuclides of potential concern selected from the COPC screening.	***Table 2 documents COPC screening.***
Column 6 - EPC Value	

INSTRUCTIONS FOR TABLE 8

CALCULATION OF RADIATION CANCER RISKS (continued)

Definition: • The EPC, based on either a statistical derivation of measured data or modeled data, that represents an estimate of the chemical or radionuclide concentration available from a particular Medium or route of exposure.	***The EPC value may be developed from a statistical derivation of measured data or from modeled data. Typically, the EPC units are expressed as activity per mass such as pCi/gram.***
Instructions: • Enter the EPC value for each COPC. • If an EPC other than from Table 3 is used, indicate it with a footnote that includes a reference to supporting information that will show how the data were modeled in the risk assessment.	***Table 3 documents EPC calculations.***
Column 7 - EPC Units	
Definition: • The units associated with the EPC value.	
Instructions: • Enter the units for the EPC values.	***The units may vary depending on the medium.***
Column 8 - Risk Calculation Approach	
Definition: • The approach used for calculating radiation cancer risks.	***Consult the EPA risk assessor or National guidance for the appropriate risk calculation approach. US EPA RAGS Part A and RESRAD are examples of risk calculation approaches.***
Instructions: • Enter the radiation risk calculation approach used for each COPC.	
Column 9 - Cancer Risk Calculations - Intake/Activity Value	
Definition: • Intake is a measure of exposure expressed in units of activity such as pCi.	***Refers to the intake using the parameters and equations/calculations, and/or models presented in Table 4.***
Instructions: • Enter the result of the intake calculations/modeling performed.	***The intake calculations and/or models are documented in Table 4.***
Column 10 - Cancer Risk Calculations - Intake/Activity Units	
Definition: • The units for intake/activity for each COPC and Exposure Route.	

INSTRUCTIONS FOR TABLE 8

CALCULATION OF RADIATION CANCER RISKS (continued)

Instructions: • Enter the units for the intake/activity for each COPC which corresponds to each Exposure Route.	

INSTRUCTIONS FOR TABLE 8

CALCULATION OF RADIATION CANCER RISKS (continued)

Column 11 - Cancer Risk Calculations - CSF Value	
Definitions: • A cancer slope factor (CSF) is an age-averaged lifetime excess cancer incidence rate per unit intake (or unit exposure for external exposure pathways). Ingestion and inhalation slope factors are central estimates in a linear model of the age-averaged, lifetime attributable radiation cancer incidence (fatal and nonfatal cancer) risk per unity of activity inhaled or ingested, expressed as risk/picocurie (pCi). External exposure slope factors are central estimates of the lifetime attributable radiation cancer incidence risk for each year of exposure to external radiation from photon-emitting radio nuclides distributed uniformly in a thick layer of soil, and are expressed as risk/yr per pCi/gram of soil.	***Slope factors presented in Table 6.4 for each radionuclide are the same as those presented here.***
Instructions: • Enter the CSF for each COPC which corresponds to each Exposure Route.	***The cancer slope factors for each COPC are presented in Table 6.4.***
Column 12 - Cancer Risk Calculations - CSF Units	
Definition: • The units associated with the cancer slope factor value.	
Instructions: • Enter the cancer slope factor units for each COPC for each Exposure Route.	***Consult the EPA risk assessor to determine if there is a preference regarding the units to be used.***
Column 13 - Cancer Risk Calculations - Cancer Risk	
Definition: • The result of the cancer risk calculation for each COPC for each exposure route and pathway. Cancer risk is the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to a potential carcinogen.	
Instructions: • Enter the cancer risk calculation for each COPC. • Sum the cancer risk results for each Exposure Route in the Exposure Route Total row. • Sum the cancer risk results for each Exposure Point in the Exposure Point Total row. • Sum the total radiation cancer risk results for all media in the bottom right-hand corner box labeled "Total of Receptor Risks Across All Media".	***The sum of all Exposure Routes represents the total cancer risk for an Exposure Pathway.*** ***The sum of all Exposure Pathways represent the total cancer risk for a medium.*** ***The sum of all media represents the "Total of Receptor Risks Across All Media".***

INSTRUCTIONS FOR TABLE 9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

PURPOSE OF THE TABLE: • To provide a summary of cancer risks and non-cancer hazards for each Receptor by Medium, Exposure Medium, Exposure Route, and Exposure Point	***Table 9 presents cancer risk and non-cancer hazard information for all COPCs and media/exposure points quantitatively evaluated.***
INFORMATION DOCUMENTED: • The cancer risk and non-cancer hazard to each Receptor for each COPC by Exposure Route and Exposure Point • The total cancer risk and non-cancer hazard for each Exposure Point, Exposure Medium, and Medium • The total cancer risks and non-cancer hazards for a Receptor across all media • The primary target organs for non-carcinogenic hazard effects.	
TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS: • Complete one copy of Table 9 for each unique combination of the following three fields that will be quantitatively evaluated (Scenario Timeframe, Receptor Population, and Receptor Age). • Enter each combination of these three fields in the Summary Box in the upper left corner of the table. • Number each table uniquely beginning with 9.1 and ending with 9.n where "n" represents the total number of combinations of the three key fields. • Different tables should be prepared to address RME and CT Risk and Hazard summaries. • Tables 9.1. RME through 9.n. RME should be completed for RME Risk and Hazard summaries. • Table 9.1.CT through 9.n.CT should be completed for CT Risk and Hazard Summaries.	***It is possible that some tables may contain the same data associated with different descriptions in the Summary Box in the upper left corner.*** ***Separate tables may be necessary to ensure transparency in data presentation. Replication of information is readily accomplished using spreadsheet software.*** ***Consult the EPA risk assessor for alternatives (e.g., footnotes) to preparing multiple tables with the same data.***
GENERAL NOTES/INSTRUCTIONS FOR THIS TABLE:	
• Cancer risk and non-cancer hazard information for all COPCs and media/Exposure Points quantitatively evaluated is to be presented in Table 9. • All table entries are presented on Tables preceding Table 9. • Documentation of the non-cancer hazard and carcinogenic risk values for chemicals was presented on Table 7. • Documentation of the carcinogenic risk values for radionuclides was presented on Table 8. • Total cancer risks and non-cancer hazards associated with each Receptor are to be presented for each Exposure Point, Exposure Medium, and Medium and across all media and all Exposure Routes.	

INSTRUCTIONS FOR TABLE 9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs (continued)

HOW TO COMPLETE/INTERPRET THE TABLE	
SUMMARY BOX IN UPPER LEFT CORNER	
Row 1 - Scenario Timeframe	
Definition: • The time period (current and/or future) being considered for the exposure pathway.	
Instructions: • Choose from the picklist to the right.	***Current*** ***Future*** ***Current/Future*** ***Not Documented***
Row 2 - Receptor Population	
Definition: • The exposed individual relative to the Exposure Pathway considered.	***For example, a resident (receptor population) who drinks contaminated groundwater.***
Instructions: • Choose from the picklist to the right.	***Resident*** ***Industrial Worker*** ***Commercial Worker*** ***Construction Worker*** ***Other Worker*** ***Golfer*** ***Jogger*** ***Fisher*** ***Hunter*** ***Fisher/Hunter*** ***Swimmer*** ***Other Recreational Person*** ***Child at School/Daycare/ Playground*** ***Trespasser/Visitor*** ***Gatherer*** ***Farmer*** ***Gardener*** ***Other***
Row 3 - Receptor Age	
Definition: • The description of the exposed individual, as defined by the Region or dictated by the site.	***For example, an adult (Receptor Age) resident (Receptor Population) who drinks contaminated groundwater.***

INSTRUCTIONS FOR TABLE 9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs (continued)

Instructions: • Choose from the picklist to the right.	***Child*** ***Adult*** ***Adolescents (teens)*** ***Pre-Adolescents*** ***Not Documented*** ***Child/Adult*** ***Geriatric*** ***Sensitive*** ***Other*** ***Infant*** ***Toddler*** ***Pregnant***
BODY OF THE TABLE	
Column 1 - Medium	
Definition: • The substance (e.g., air, water, soil) that is a potential source of contaminants in the Exposure Medium. (The Medium will sometimes equal the Exposure Medium.) Usually, the Medium is that targeted for possible remediation.	
Instructions: • Choose from the picklist to the right. For each Medium, • The last entry in this column should be "Medium Total." In this row, the total risk/HI from each Medium (for all chemicals, Exposure Routes, Exposure Points, and Exposure Media) for the current Receptor is entered in the Exposure Routes Total Column.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Other*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Surface Soil*** ***Subsurface Soil***
Column 2 - Exposure Medium	
Definition: • The contaminated environmental medium to which an individual may be exposed. Includes the transfer of contaminants from one medium to another. ***For example:*** ***1) Contaminants in Groundwater (the Medium) remain in Groundwater (the Exposure Medium) and are available for exposure to receptors.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and are available for exposure to receptors.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and are available for exposure to receptors.***	

INSTRUCTIONS FOR TABLE 9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs (continued)

Instructions: • Choose from the picklist to the right. • For each Exposure Medium, the last entry in this column should be "Exposure Medium Total." This refers to the total risk/HI from each Exposure Medium (for all chemicals, Exposure Routes and Exposure Points) for the current Receptor. These totals are recorded in the Carcinogenic and Non-Carcinogenic Exposure Routes Total Columns.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Other*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Plant Tissue*** ***Animal Tissue*** ***Fish Tissue*** ***Spring Water*** ***Surface Soil*** ***Subsurface Soil*** ***Particulates*** ***Vapors***

INSTRUCTIONS FOR TABLE 9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs (continued)

Column 3 - Exposure Point	
Definition: • An exact location of potential contact between a person and a chemical within an Exposure Medium. ***For example:*** ***1) Contaminants are in Groundwater (the Medium and the Exposure Medium) and exposure to Aquifer 1 - Tap Water (the Exposure Point) is evaluated.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and exposure to Aquifer 1 - Water Vapors at Showerhead (the Exposure Point) is evaluated.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and Trout from Dean's Creek (the Exposure Point) is evaluated.***	
Instructions: • Provide the information as text in the Table. • For each Exposure Point, the last entry in this column should be "Exposure Point Total." This refers to the total risk/HI (for all chemicals and Exposure Routes) for the current Receptor. These totals are recorded in the Carcinogenic and Non-Carcinogenic Exposure Routes Total columns.	***Exposure Point should be defined in the same way as was done in Planning Table 1.***
Column 4 - Chemical of Potential Concern	
Definition: • The COPCs quantitatively considered in the risk characterization.	
Instructions: • Enter the COPCs from previous tables. • Enter the term "Chemical Total" at the end of the list of chemicals for each Exposure Point. Use this row to record total risk/HI values from all chemicals at each Exposure Point. • Enter the term "Radionuclide Total" at the end of the list of radionuclides for each Exposure Point. Use this row to record total risk/HI values from all radionucides for each Exposure Point.	
Columns 5, 6, 7, and 8 - Carcinogenic Risk - Ingestion, Inhalation, Dermal and External (Radiation)	
Definition: • The cancer risk value calculated by Receptor for each COPC for each Exposure Route for each Exposure Point.	***The value at the bottom of each column presents the total cancer risk by Exposure Route for each Exposure Point.***

INSTRUCTIONS FOR TABLE 9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs (continued)

Instructions: • Enter the cancer risk value calculated by Receptor for each Exposure Route for each Exposure Point. • Enter the cancer risk totals for each Exposure Route in the rows labeled "Chemical Total" and "Radionuclide Total."	
Column 9 - Carcinogenic Risk - Exposure Routes Total	
Definition: • The total cancer risk for each COPC across all Exposure Routes at each Exposure Point.	
Instructions: • Enter the sum of the cancer risks across Exposure Routes for each COPC. • Enter the sum of the cancer risks in this column for each Exposure Point in the "Exposure Point Total" row. • Enter the total cancer risk for each Exposure Medium and individual Medium in the "Exposure Medium Total"and "Medium Total" rows. • For each Receptor, enter the total cancer risks across all Media and all Exposure Routes as "Receptor Risk Total."	***Consult the EPA risk assessor to determine the appropriate summing of risks.***
Column 10 - Non-Carcinogenic Hazard Quotient - Primary Target Organ	
Definition: • The primary effect reported as a primary target organ effect in IRIS, HEAST, or other source.	
Instructions: • Enter the primary target organ effect as reported in IRIS, HEAST, or other source.	***Consult the EPA risk assessor to determine if multiple effects should be provided.***
Columns 11, 12, and 13 - Non-Carcinogenic Hazard Quotient - Ingestion, Inhalation, Dermal	
Definition: • The non-cancer hazard calculated by Receptor for each COPC for each Exposure Route for each Exposure Point.	***The value at the bottom of each column presents the non-cancer hazard by exposure route for each exposure point, for all effects considered together.***
Instructions: • Enter the non-cancer hazard value calculated by Receptor for each COPC for each Exposure Route for each Exposure Point. • Enter the non-cancer hazard totals for each Exposure Route in the rows labeled "Chemical Total" and "Radionuclide Total."	***Consult the EPA risk assessor for summing hazard quotients.***

INSTRUCTIONS FOR TABLE 9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs (continued)

Column 14 - Non-Carcinogenic Hazard Quotient - Exposure Routes Total	
Definition: • The total non-cancer hazard calculated for each COPC across all Exposure Routes at each Exposure Point.	***The Totals in each column present the total non-cancer hazards by Exposure Routes for each Exposure Point. The values beneath the table under this column present hazard quotients for target organs.***
Instructions: • Enter the sum of non-cancer hazards across the three Exposure Routes in each Exposure Route column. • Enter the sum of the non-cancer hazards across Exposure Routes for each COPC and primary target organ. • Enter the sum of the non-cancer hazards in this column for each Exposure Point in the "Exposure Point Total" row. • Enter the total hazard index for each Exposure Medium and Medium in the "Exposure Medium Total" and "Medium Total" rows. • Enter the total hazard index across all media and all Exposure Routes as "Receptor HI Total." • Enter the total hazard index for primary target organs. • Sum the hazard quotient target organ effects by target organ and enter into the appropriate boxes.	***Consult the EPA risk assessor for specific instructions in summing hazard quotients.***

INSTRUCTIONS FOR TABLE 10

RISK SUMMARY

PURPOSE OF THE TABLE: • To provide a summary for each Receptor by Medium, Exposure Route, and Exposure Point of cancer risks and non-cancer hazards that trigger the need for remedial action. • The Risk Assessor may consult the Remedial Project Manager and other members of the project team to determine what levels of risk may be actionable at the site and what should be included in Table 10. The risks shown on Table 10 should be based upon the Remedial Project Manager's recommendation. If all risks are below actionable levels, determine with the Remedial Project Manager which chemicals should be shown to document the suitability of a No Action decision.	***Table 10 presents cancer risk and non-cancer hazard information for those COPCs and media/exposure points that the Remedial Project Manager determines trigger the need for remedial action (the risk drivers).***
INFORMATION DOCUMENTED: • The cancer risk and non-cancer hazard to each Receptor for each chemical by Exposure Route and Exposure Point for risk drivers • The cancer risk and non-cancer hazard for each Exposure Point, Exposure Medium, and Medium across all Exposure Routes for risk drivers • The total cancer risks and non-cancer hazards for a Receptor across all media for risk drivers • The primary target organs for non-carcinogenic hazard effects for risk drivers.	***For the purpose of these instructions, those COPCs determined to trigger the need for cleanup are simply referred to as "Chemicals."***
TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS: • Complete one copy of Table 10 for each unique combination of the following three fields that will be quantitatively evaluated (Scenario Timeframe, Receptor Population, and Receptor Age). • Enter each combination of these three fields in the Summary Box in the upper left corner of the table. • Number each table uniquely beginning with 10.1 and ending with 10.n where "n" represents the total number of combinations of the three key fields. • Different tables should be prepared to address RME and CT Risk and Hazard summaries. • Tables 10.1. RME through 10.n. RME should be completed for RME Risk and Hazard summaries. • Table 10.1 CT through 10.n.CT should be completed for CT Risk and Hazard Summaries.	***It is possible that some tables may contain the same data associated with different descriptions in the Summary Box in the upper left corner.*** ***Separate tables may be necessary to ensure transparency in data presentation. Replication of information is readily accomplished using spreadsheet software.*** ***Consult the EPA risk assessor for alternatives (e.g., footnotes) to preparing multiple tables with the same information.***

INSTRUCTIONS FOR TABLE 10

RISK SUMMARY (continued)

GENERAL NOTES/INSTRUCTIONS FOR THIS TABLE	
• Cancer risk and non-cancer hazard information for only those COPCs and media/exposure points that trigger the need for remedial action (the risk drivers) is to be presented in Table 10. • All table entries are presented on Tables preceding Table 10. • Documentation of the non-cancer hazard and cancer risk values for chemicals was presented on Table 7. • Documentation of the carcinogenic risk values for radionuclides was presented on Table 8. • Total cancer risks and non-cancer hazards associated with each Receptor are to be presented for each Exposure Point, Exposure Medium, Medium across all media and all Exposure Routes.	
HOW TO COMPLETE/INTERPRET THE TABLE	
SUMMARY BOX IN UPPER LEFT CORNER	
Row 1 - Scenario Timeframe	
Definition: • The time period (current and/or future) being considered for the Exposure Pathway.	
Instructions: • Choose from the picklist to the right.	***Current*** ***Future*** ***Current/Future*** ***Not Documented***
Row 2 - Receptor Population	
Definition: • The exposed individual relative to the Exposure Pathway considered.	***For example, a resident (receptor population) who drinks contaminated groundwater.***

INSTRUCTIONS FOR TABLE 10

RISK SUMMARY (continued)

Instructions: • Choose from the picklist to the right.	***Resident*** ***Industrial Worker*** ***Commercial Worker*** ***Construction Worker*** ***Other Worker*** ***Golfer*** ***Jogger*** ***Fisher*** ***Hunter*** ***Fisher/Hunter*** ***Swimmer*** ***Other Recreational Person*** ***Child at School/Daycare/Playground*** ***Trespasser/Visitor*** ***Farmer*** ***Gatherer*** ***Gardener*** ***Other***

INSTRUCTIONS FOR TABLE 10

RISK SUMMARY (continued)

Row 3 - Receptor Age	
Definition: • The description of the exposed individual, as defined by the Region or dictated by the site.	***For example, an adult (Receptor Age) resident (Receptor Population) who drinks contaminated groundwater.***
Instructions: • Choose from the picklist to the right.	***Child*** ***Adult*** ***Adolescents (teens)*** ***Pre-Adolescents*** ***Not Documented*** ***Child/Adult*** ***Geriatric*** ***Sensitive*** ***Other*** ***Infant*** ***Toddler*** ***Pregnant***
BODY OF THE TABLE	
Column 1 - Medium	
Definition: • The substance (e.g., air, water, soil) that is a potential source of contaminants in the Exposure Medium. (The Medium will sometimes equal the Exposure Medium.) Usually, the Medium is that targeted for possible remediation.	***Enter only the Media that have risks or hazards exceeding target levels.***
Instructions: • Choose from the picklist to the right. • For each Medium, the last entry in this column should be "Medium Total." This refers to the total risk/HI for each Medium (for all chemicals, Exposure Routes, Exposure Points, and Exposure Media) for the current Receptor. These totals are recorded in th Carcinogenic and Non-Carcinogenic Exposure Routes Total columns.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Other*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Surface Soil*** ***Subsurface Soil***
Column 2 - Exposure Medium	

INSTRUCTIONS FOR TABLE 10

RISK SUMMARY (continued)

Definition: • The contaminated environmental medium to which an individual may be exposed. Includes the transfer of contaminants from one medium to another. ***For example:*** ***1) Contaminants in Groundwater (the Medium) remain in Groundwater (the Exposure Medium) and are available for exposure to receptors.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and are available for exposure to receptors.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and are available for exposure to receptors.***	***Enter only the Exposure Media that have risks or hazards exceeding target levels.***
Instructions: • Choose from the picklist to the right. • For each Exposure Medium, the last entry in this coluymn should be "Exposure Medium Total." This refers to the total risk/HI from each Exposure Medium (for all chemicals, Exposure Routes, and Exposure Points) for the current Receptor. These totals are recorded in the Carcinogenic and Non-Carcinogenic Exposure Routes Total columns.	***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge, Soil*** ***Surface Water*** ***Debris*** ***Other*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Vapors*** ***Plant Tissue*** ***Animal Tissue*** ***Fish Tissue*** ***Surface Soil*** ***Subsurface Soil*** ***Particulates*** ***Spring Water***
Column 3 - Exposure Point	
Definition: • An exact location of potential contact between a person and a chemical within an Exposure Medium. ***For example:*** ***1) Contaminants are in Groundwater (the Medium and the Exposure Medium) and exposure to Aquifer 1 - Tap Water (the Exposure Point) is evaluated.*** ***2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and exposure to Aquifer 1 - Water Vapors at Showerhead (the Exposure Point) is evaluated.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Fish Tissue (the Exposure Medium) and Trout in Dean's Creek (the Exposure Point) is evaluated.***	***Enter only the Exposure Points that have risks or hazards exceeding target levels.***

INSTRUCTIONS FOR TABLE 10

RISK SUMMARY (continued)

Instructions: • Provide the information as text in the Table. • For each Exposure Point, the last entry in this column should be "Exposure Point Total." This refers to the total risk/HI from each Exposure Point (for all chemicals, Exposure Routes, and Exposure Points) for the current Receptor. These totals are recorded in the Carcinogenic and Non-Carcinogenic Exposure Routes Total Columns.	***Exposure Point should be defined in the same way as was done in the Planning Table 1.***
Column 4 - Chemical	
Definition: • The COPCs quantitatively considered in the risk characterization.	***Enter only the chemicals that have risks exceeding target levels.***
Instructions: • Enter the COPCs from previous tables that exceed target levels. • Enter the term "Chemical Total" at the end of the list of chemicals for each Exposure Point. • Enter the term "Radionuclide Total" at the end of the list of radionuclides.	
Columns 5, 6, 7 and 8 - Carcinogenic Risk - Ingestion, Inhalation, Dermal, and External (Radiation)	
Definition: • The cancer risk value calculated by Receptor for each chemical for each Exposure Route for each Exposure Point.	***Enter only the risks that exceed target levels.*** ***The value at the bottom of each column presents the cancer risk from all chemicals by Exposure Route for each Exposure Point.***
Instructions: • Enter the cancer risk value calculated by Receptor for each chemical for each Exposure Route for each Exposure Point that exceeds target levels. • Enter the cancer risk totals for each Exposure Route in the last row.	
Column 9 - Carcinogenic Risk - Exposure Routes Total	
Definition: • The total cancer risk for each chemical across all Exposure Routes at each Exposure Point.	

INSTRUCTIONS FOR TABLE 10

RISK SUMMARY (continued)

Instructions: • Enter the sum of the cancer risks across Exposure Routes for each chemical. • Enter the sum of the cancer risks in this column for each Exposure Point in the "Exposure Point Total" row. • Enter the total cancer risk for each Exposure Medium and Medium in the "Exposure Medium Total" and "Medium Total" rows. • Enter the total cancer risk across all Media and all Exposure Routes as "Receptor Risk Total".	
Column 10 - Non-Carcinogenic Hazard Quotient - Primary Target Organ	
Definition: • The primary effect reported as a primary target organ effect in IRIS, HEAST, or other source.	
Instructions: • Enter the primary target organ effect as reported in IRIS, HEAST, or other source. This target organ should also appear in Table 5.	***Consult the EPA risk assessor to determine if multiple effects should be provided.***

INSTRUCTIONS FOR TABLE 10

RISK SUMMARY (continued)

Columns 11, 12, and 13 - Non-Carcinogenic Hazard Quotient - Ingestion, Inhalation, Dermal	
Definition: • The non-cancer hazard calculated by Receptor for each Chemical for each Exposure Route for each Exposure Point.	***Enter only the hazards that exceed target levels.*** ***The value at the bottom of each column presents the non-cancer hazard by Exposure Route for each Exposure Point, for all effects considered together.***
Instructions: • Enter the non-cancer hazard value calculated by Receptor for each chemical for each Exposure Route for each Exposure Point that exceeds target levels. • Enter the non-cancer hazard totals for each Exposure Route in the last row, corresponding to the term "Chemical Total" in Column 9.	***Consult the EPA risk assessor for summing hazard quotients.***
Column 14 - Non-Carcinogenic Hazard Quotient - Exposure Routes Total	
Definition: • The total non-cancer hazard calculated for each chemical across all Exposure Routes at each Exposure Point.	***The totals in each column present the total non-cancer hazards across all Exposure Routes for each Exposure Point.*** ***The values at the bottom of this column present hazard quotients for target organs.***
Instructions: • Enter the sum of non-cancer hazards across the three Exposure Routes in Columns 11, 12, and 13. • Enter the sum of the non-cancer hazards across Exposure Routes for each chemical and primary target organ. • Enter the sum of the non-cancer hazards in this column for each Exposure Point, Exposure Medium, and Medium in the “Exposure Point Total,” “Exposure Medium Total,” and “Medium Total” rows, respectively. • Enter the total hazard index across all Media and all Exposure Routes as “Receptor HI Total.” • Enter the total hazard index for primary target organs. • Sum the hazard quotient target organ effects across all media by target organ and enter into the appropriate boxes below the table.	***Consult the EPA risk assessor for specific instructions in summing hazard quotients.***

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
Adjusted Dermal RfD (5.1)	The adjusted reference dose (RfD) for each cehmical of potential concern detected which is derived from the oral RfD.	***Derivations of the adjusted dermal RfD should be performed in accordance with Regional guidance.***
Adjusted Dermal Cancer Slope Factor (6.1)	The dermal cancer slope factor for each chemical of potential concern, which typically is derived from the oral cancer slope factor.	***Derivation of the dermal cancer slope factor should be performed in accordance with Regional guidance.***
Adjusted Inhalation RfD (5.2)	The inhalation RfD for each chemical of potential concern which is derived from the reference concentration (RfC) value.	***The derivation of the RfD from RfC should be performed in accordance with Regional guidance.***
Adjustment (6.2)	The value used to derive the inhalation cancer slope factor from the unit risk value.	***Toxicity values for carcinogenic effects also can be expressed in terms of risk per unit concentration of the substance in the medium where human contact occurs. These measures are called unit risks and can be calculated from cancer slope factors.***
Arithmetic Mean (3)	The arithmetic average of detected concentrations.	
Background Value (2)	The background value for the chemical in that medium as defined by Regional guidance.	***Refer to Regional guidance for how background values are determined and how background values are considered for COPC screening. If Regional guidance requires a "t-test" or other test which requires backup information, this information should be presented. A footnote should be added to this column to clarify the Regional method used for background. (e.g., literature value, data from a nearby site, statistical tool).***
Cancer Risk (8)	The result of the cancer risk calculation for each COPC for each exposure route and pathway.	

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
Cancer Slope Factor (8)	A plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime. Usually, the cancer slope factor is the upper 95th % confidence limit of the dose-response curve.	***Slope factors presented in Table 6 for each COPC are the same as cancer slope factors presented in Table 8.***
Cancer Slope Factor Units (8)	Usually, the cancer slope factor is the upper 95th % confidence limit of the dose-response curve and is expressed as $(mg/kg\text{-}day)^{-1}$.	
Carcinogenic Risk (Ingestion, Inhalation, Dermal) (9,10)	The cancer risk value calculated by receptor for each COPC for each exposure route for each exposure point.	***The value at the bottom of each column presents the cancer risk by exposure route for each exposure point.***
Carcinogenic Risk (Exposure Routes Total) (9)	The total cancer risk for each COPC across all exposure routes at each exposure point.	
CAS Number (2)	The Chemical Abstract Registry Number, a unique standardized number which is assigned to chemicals.	***Provide CAS Number for chemicals detected in the samples for the medium.***
Central Tendency (CT) (3)	Risk calculations which result from using less conservative methodologies, instead of reasonable maximum methodologies.	***Refer to Regional guidance.***

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
CT Rationale/ Reference (4)	The reason and reference for the parameter value used. If the parameter used is inconsistent with guidance values, provide a detailed explanation of the rationale and a complete reference for the value used.	***Refer to Regional or National guidance for intake parameter values appropriate for each exposure pathway.***
CT Value (4)	The parameter value used for the central tendency exposure intake calculation.	
Chemical (2)	The name of the compound detected in samples for the medium.	***Chemicals can be arranged in the order that the risk assessor prefers.***
Chemicals of Potential Concern (COPC) (3,5.1,5.2,5.3,6.1,6.2, 6.3,7,8)	Chemicals that are potentially site-related, with data of sufficient quality, that have been retained for quantitative analysis as a result of the screening documented in Table 2.	***Provide the chemical name of the COPC based on the results of the screening documented in Table 2. Chemicals can be arranged in the order that the risk assessor prefers.***
COPC Flag (2)	A code which identifies whether the chemical has been selected as a COPC, based on Regional screening guidance.	***Yes*** ***No***
Chronic/Subchronic (5.1,5.2,5.3)	Identifies whether the RfD for a particular chemical is for chronic (long-term) and/or subchronic (short-term) exposure.	***The risk assessor should use professional judgement when extrapolating to time-frames shorter or longer than those employed in any crticial study referenced. As a Superfund program guide-line, chronic is seven years to a lifetime; subchronic is two weeks to seven years (RAGS Part A, Sections 6 and 8).***

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
Combined Uncertainty/ Modifying Factors (5.1,5.2,5.3)	The factors applied to the critical effect level to account for areas of uncertainty inherent in extrapolation from available data.	***Refer to IRIS/HEAST for these values. Examples of uncertainty to be addressed include:*** ***- variations in the general population*** ***- interspecies variability between humans and animals*** ***- use of subchronic data for chronic evaluation*** ***- extrapolation from LOAELs to NOAELs.***
Concentrations Used For Screening (2)	The detected concentration which was used to compare to the screening value.	***Refer to Regional guidance in determining this value. For example, maximum or average values.***
Date (MM/DD/YY) (5,6)	The date of the document that was consulted for the toxicity and target organ information.	***The MM/DD/YY format refers to month/day/year. For example, the MM/DD/YY version of the date March 30, 1995 is 03/30/95.***
Dermal (9,10)	The predicted route of chemical exposure through the skin.	
Detection Frequency (2)	The number of times the chemical was detected versus the number of times it was analyzed, expressed as the "fraction" X/Y.	***Refer to Regional guidance for an explanation of how detection frequency should be interpreted and applied. For example, 5/9 indicates that a chemical was detected in 5 out of 9 samples.***
Exposure Medium (1,2,3,4,7,8,9,10)	The contaminated environmental medium to which an individual is exposed. Includes the transfer of contaminants from one medium to another. ***For example, 1) Contaminants in Groundwater (the Medium) remain in Groundwater (the Exposure Medium) and are available for exposure to receptors. 2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and are available for exposure to receptors. 3) Contaminants in Sediment (the Medium) may be transferred to Animal Tissue (the Exposure Medium) and are available for exposure to receptors.***	***Choose from the following picklist:*** ***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Plant Tissue*** ***Animal Tissue*** ***Spring Water*** ***Surface Soil*** ***Subsurface Soil*** ***Particulates*** ***Vapors*** ***Other***

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
Exposure Pathway (1)	The course a chemical takes from the source to the exposed individual. An exposure pathway analysis links the sources, locations, and types of environmental releases with population locations and activity patterns to determine the significant pathways of human exposure.	
Exposure Point (1,2,3,4,7,8,9,10)	An exact location of potential contact between a person and a chemical within an exposure medium. ***For example: 1) Contaminants are in Groundwater (the Medium and the Exposure Medium) and exposure to Aquifer 1 - Tap Water (the Exposure Point) is evaluated. 2) Contaminants in Groundwater (the Medium) may be transferred to Air (the Exposure Medium) and exposure to Aquifer 1 - Water Vapors at Showerhead (the Exposure Point) is evaluated.*** ***3) Contaminants in Sediment (the Medium) may be transferred to Animal Tissue (the Exposure Medium) and Trout from Dean's Creek (the Exposure Point) is evaluated.***	***Provide the information as text in the table (not to exceed 80 characters).***
Exposure Point Concentration (EPC) (1,2,3,4,7,8,9,10)	The value that represents a conservative estimate of the chemical concentration available from a particular medium or route of exposure.	***The EPC may be calculated, measured, or modeled.***
EPC Selected for Risk or Hazard Calculation (7,8)	The EPC that will be used to quantify potential cancer risks and non-cancer hazards.	***M (i.e., Medium-Specific EPC)*** ***R (i.e., Route-Specific EPC)*** ***Follow Regional guidance for selection of this value.***
EPC Units (3)	The units of the data being used to calculate the exposure point concentration (EPC).	***Units may vary depending on the environmental medium.***

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
Exposure Route (1,4,7,8,9,10)	The way a chemical comes in contact with a person (e.g., by ingestion, inhalation, dermal contact).	***Choose from the following picklist:*** ***Inhalation*** ***Ingestion*** ***Combined (i.e., Inhalation/Ingestion)*** ***Dermal Absorption*** ***Not Documented*** ***External (Radiation)***
Exposure Routes Total (9,10)	The arithmetic sum of cancer risk and non-cancer hazards for the COPCs for the exposure point.	***For non-cancer totals, follow Regional guidance.***
Hazard Quotient (7)	The ratio of a single substance exposure level, over a specified time period, to a reference dose for that substance, derived from a similar exposure period.	
Ingestion (9,10)	The route of chemical exposure through eating (ingestion).	
Inhalation (9,10)	The route of chemical exposure through breathing (inhalation).	
Inhalation Cancer Slope Factor (6.2)	A plausible upper-bound estimate of the probability of a response per unit intake of a chemical over a lifetime.	***Usually the cancer slope factor is the upper 95th % confidence limit of the dose-response curve for inhalation.***
Inhalation RfC Units (5.2)	The RfC units for each chemical detected.	
Inhalation RfC Value (5.2)	The reference concentration value for each of the COPCs.	
Intake (Cancer) (8)	A measure of exposure expressed as the mass of a substance in contact with the exchange boundary per unit body weight per unit time (e.g., mg chemical/kg body weight/day).	***Refers to the intake result using the parameters and equations/calculations and/or models presented in Table 4.***

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
Intake (Non-Cancer) (7)	A measure of exposure expressed as the mass of a substance in contact with the exchange boundary per unit body weight per unit time (e.g., mg chemical/kg body weight/day.	***Refers to the intake result using the parameters and equations/calculations and/or models presented in Table 4.***
Intake (Cancer) Units (8)	The units for intake for each COPC and exposure route.	
Intake (Non-Cancer) Units (7)	The units for intake for each COPC and exposure route.	
Intake Equation/Model Name (4)	The calculation, equation or model used for intake estimates for each exposure route.	
Location of Maximum Concentration (2)	The sample number which identifies the location where the sample was taken.	
Maximum Concentration (2)	The highest detected concentration of the chemical in the medium.	***Refer to RAGS - Part A (EPA, 1989) page 5-8 for guidance on detection/quantification limits.***
Maximum Detected Concentration (3)	The highest detected concentration of the chemical in the medium which is above the sample quantitation limit.	
Maximum Qualifier (2)	The alpha-numeric code assigned to the concentration value by the analytical chemist during data validation for the maximum concentration value.	

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
Medium (1)	The environmental substance (e.g, air, water, soil) originally contaminated.	***Choose from the following picklist:*** ***Groundwater*** ***Leachate*** ***Sediment*** ***Sludge*** ***Soil*** ***Surface Water*** ***Debris*** ***Liquid Waste*** ***Solid Waste*** ***Air*** ***Surface Soil*** ***Subsurface Soil*** ***Other***
Medium EPC Rationale (for RME or CT) (3)	The reason the cited statistic was used to represent the EPC for RME or CT.	
Medium EPC Statistic (for RME or CT) (3)	The statistic selected to represent the Medium EPC Value (RME or CT), based on Regional guidance, the distribution of the data, number of data points, etc.	***Often, this is the 95% Upper Confidence Level (UCL) of the log-transformed data.***
Medium EPC Units (7,8)	The units associated with the Medium EPC Value.	***Units may vary depending on the Medium.***
Medium EPC Value (for RME) (3,7,8)	The EPC, based on either a statistical derivation of measured data or modeled data, that was selected to represent the medium-specific concentration for the RME exposure calculations. The Medium EPC differs from the Route EPC in that the Medium EPC does not consider the transfer of contaminants from one medium to another.	***The Medium EPC Value may be developed from a statistical derivation of measured data or from modeled data. For example, the Medium EPC value may be statistically derived by calculating the 95% UCL of measured groundwater contaminant concentrations from multiple residential wells. Alternatively, the Medium EPC value may be selected as a single measured value if one data point is used to calculate the risk for each residential well individually. In some cases, the Medium EPC value may be a modeled value (e.g., if upgradient groundwater contaminant concentrations are used to model a downgradient exposure point.) Note that none of these examples consider the transfer of contaminants from one medium to another, as is evaluated by Route EPC.***

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
Medium EPC Value (for CT) (3,7,8)	The EPC, based on either a statistical derivation of measured data or modeled data, that was selected to represent the medium-specific concentration for the CT exposure calculations. The Medium EPC differs from the Route EPC in that the Medium EPC does not consider the transfer of contaminants from one medium to another.	***The Medium EPC Value may be developed from a statistical derivation of measured data or from modeled data. For example, the Medium EPC value may be statistically derived by calculating the 95% UCL of measured groundwater contaminant concentrations from multiple residential wells. Alternatively, the Medium EPC value may be selected as a single measured value, if one data point is used to calculate the risk for each residential well individually. In some cases, the Medium EPC value may be a modeled value (e.g., if upgradient groundwater contaminant concentrations are used to model a downgradient exposure point.) Note that none of these examples consider the transfer of contaminants from one medium to another, as is evaluated by Route EPC.***
Minimum Concentration (2)	The lowest detected concentration of the chemical in the medium.	
Minimum Qualifier (2)	The alpha-numeric code assigned to the concentration value by the analytical chemist during data validation for the minimum concentration value.	
Non-Carcinogenic Hazard Quotient (Primary Target Organ) (9,10)	The primary effect reported as a primary target organ effect in IRIS and HEAST.	
Non-Carcinogenic Hazard Quotient (Ingestion, Inhalation, Dermal) (9,10)	The non-cancer hazard calculated by receptor for each COPC for each exposure route for each exposure point.	***The value at the bottom of each column presents the non-cancer hazard by exposure route for each exposure point, for all effects considered together.***
Non-Carcinogenic Hazard Quotient (Exposure Routes Total) (9,10)	The total non-cancer hazard calculated for each COPC across all exposure routes at each exposure point.	***The totals in each column present the total non-cancer hazards across all exposure routes for each exposure point. The values at the bottom of this column present hazard quotients for specific target organs.***

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
Not Documented (picklist term)	The CERCLIS 3 picklist term used when no information is available.	
On-Site/Off-Site (1)	The location of potential contact between a person and a chemical (contaminant) as it relates to the site boundary.	***Choose from the following picklist:*** ***On-site*** ***Off-site*** ***On-site/Off-site*** ***Not Documented***
Oral Cancer Slope Factor (6.1)	Cancer slope factor for ingestion.	
Oral Reference Dose (RfD) Units (5.1)	The oral reference dose (RfD) units for each COPC.	
Oral RfD Value (5.1)	The oral RfD value for each of the COPCs.	
Oral to Dermal Adjustment Factor (5.1,6.1)	The adjustment factor used to convert the oral RfD values to dermal RfD values.	
Parameter Code (4)	The code used for parameters in the intake equation.	***See the instructions for standard codes. Other codes may be added if appropriate.***
Parameter Definition (4)	The parameters used in the intake equation.	
Potential Applicable or Relevant and Appropriate Requirements and To Be Considered (ARAR/TBC) Source (2)	The type or source of ARAR/TBC value entered into the adjacent column.	***For example,*** ***MCL*** ***SMCL***
Potential ARAR/TBC Value (2)	ARAR/TBC values.	***They could be MCL values, soil cleanup level values, or other values to be considered. Refer to Regional guidance regarding the requirements for this column.***

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
Primary Target Organ (5.1,5.2,5.3,9,10)	The organ that is affected most (i.e., experiences critical effects) by chronic or subchronic exposure to the specific COPC, and upon which the RfD is based.	
Range of Detection Limits (2)	The lowest and highest detection limits.	***Refer to Regional or National guidance for definitions of detection limits.***
Rationale for Contaminant Deletion/Selection (2)	The reason the chemical was selected or not selected for quantitative or qualitative analysis.	***Follow Regional guidance for the rationale codes.***
Rationale for Selection or Exclusion of Exposure Pathway (1)	The reason the exposure pathway was selected or not selected for quantitative or qualitative analysis.	***Follow Regional guidance for the rationale codes. The narrative in the Table can not exceed 200 characters.***
Reasonable Maximum Exposure (RME) (3)	The highest exposure that is reasonably expected to occur.	
RME Rationale/Reference (4)	The reason and reference for the parameter value used. This rationale may be Regional or National guidance.	***If the parameter used is inconsistent with guidance values, provide a detailed explanation of rationale and a complete reference for the value.***
RME Value (4)	The parameter value used for the RME intake calculation.	

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
Receptor Age (1)	The description of the exposed individual as defined by the EPA Region or dictated by the site. ***For example, an adult (Receptor Age) resident (Receptor Population) who drinks contaminated groundwater.***	***Choose from the following picklist:*** ***Child*** ***Adult*** ***Adolescents (teens)*** ***Pre-Adolescents*** ***Not Documented*** ***Child/Adult*** ***Geriatric*** ***Sensitive*** ***Infant*** ***Toddler*** ***Pregnant*** ***Other***
Receptor Population (1)	The exposed individual relative to the exposure pathway considered. ***For example, a resident (Receptor Population) who drinks contaminated groundwater.***	***Choose from the following picklist:*** ***Resident*** ***Industrial Worker*** ***Commercial Worker*** ***Construction Worker*** ***Other Worker*** ***Golfer*** ***Jogger*** ***Fisher*** ***Hunter*** ***Fisher/Hunter*** ***Swimmer*** ***Other Recreational Person*** ***Child at School/Daycare/Playground*** ***Trespasser/Visitor*** ***Farmer*** ***Gardener*** ***Other***
Reference Concentration (7)	The toxicity value for inhalation typically reported as a concentration in air (mg/m^3) which can be converted to an inhaled dose (mg/kg-day).	
Reference Concentration Units (7)	The units associated with the reference concentration.	
Reference Dose (RfD) (7)	The preferred toxicity value for evaluating non-cancer effects resulting from exposures.	

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
RfD or RfC Units (7,8)	The units associated with the RfD or RfC for each COPC.	***Typically reported in mg/kg-day, a dose term.***
Route EPC Units (7,8)	The units associated with the Route EPC Value.	***Units may vary depending on the Route of Exposure.***
Route EPC Value (7,8)	The EPC, based on either a statistical derivation of measured data or based on modeled data, that was selected to represent the route-specific concentration for the exposure calculations. The Route EPC differs from the Medium EPC in that the Route EPC may consider the transfer of contaminants from one medium to another, where applicable for a particular exposure route.	***The Route EPC may be developed from a statistical derivation of measured data or from modeled data. The Route EPC may be identical to the Medium EPC or it may be modeled based on the Medium EPC. For example, for groundwater ingestion, the Medium EPC and the Route EPC will typically be the same value. Alternatively, for groundwater inhalation, the Medium EPC will often be a statistical derivation if measured concentrations in groundwater, while the Route EPC will often be a modeled inhalation concentration that is based on the measured concentrations.***
Scenario Timeframe (1)	The time period (current and/or future) being considered for the exposure pathway.	***Choose from the following picklist:*** ***Current*** ***Future*** ***Current/Future*** ***Not Documented***
Screening Toxicity Value (2)	The screening level used to compare detected concentrations of chemicals.	***Refer to Regional guidance for the source of the screening value and for guidance on comparing the screening value to detected concentrations.***
Source (6.1,6.2,6.3)	A reference for the weight of evidence/cancer guideline description entry.	***For example:*** ***IRIS*** ***HEAST*** ***NCEA***
Source of Toxicity/Primary Target Organ (5.3)	The source of the toxicity value and primary target organ information.	***For example:*** ***IRIS*** ***HEAST*** ***NCEA***
Source of RfD/RfC/Primary Target Organ (5.1,5.2,5.3)	The source of the RfD/RfC and target organ information.	***For example:*** ***IRIS*** ***HEAST*** ***NCEA***

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
Subchronic (5.1,5.2,5.3)	A short-term (two weeks to seven years) designation.	***As a Superfund program guideline, chronic is seven years to a lifetime; subchronic is two weeks to seven years (RAGS Part A, Sections 6 and 8). The risk assessor should use professional judgement when extrapolating to timeframes shorter or longer than those employed in any crticial study referenced.***
Summary Box (2,3,4,7,8,9,10)	A box in the upper left corner of a Table containing the combination of parameters that define a unique exposure pathway.	***The Summary Box typically specifies the unique combination of Scenario Timeframe, Medium, Exposure Medium, and Exposure Point. For selected tables, the Receptor Population and Receptor Age are presented.***
Total Hazard Index (9,10)	A summation of non-cancer hazards across media and exposure routes.	***Refer to Region-specific guidance on summing toxic endpoint effects.***
Total Risk (9,10)	A summation of cancer risk across media and exposure routes.	
Toxicity Units (5.3,6.3)	The units associated with the toxicity value.	
Type of Analysis (1)	The level of evaluation (quantitative or qualitative) to be performed for the exposure pathway based on site-specific analysis.	***Choose from the following picklist:*** ***Quant (i.e., Quantitative)*** ***Qual (i.e., Qualitative)*** ***None***
Units (2,3)	The concentration units for each chemical detected.	***Refer to Regional guidance to determine if there is a preference regarding the units used for different matrices (e.g., mg/kg for soil, ug/L for groundwater). Choices include:*** ***mg/l*** ***µg/l*** ***ng/l*** ***pg/l*** ***%*** ***ppm*** ***ppb*** ***ppt*** ***g/kg*** ***mg/kg*** ***µg/kg*** ***ng/kg*** ***µg/g*** ***mg/m^3*** ***$\mu g/m^3$*** ***fibers/l*** ***$fibers/m^3$*** ***fibers/kg*** ***lbs/day*** ***$\mu g/100cm^2$*** ***mg/cm^2*** ***µRem/hr*** ***Rem/yr*** ***pCi/g*** ***pCi/kg*** ***pCi/m^3*** ***pCi/l*** ***$pCi/m^2/sec$*** ***Other*** ***Not Documented***
Units (for parameter codes) (4)	The units for the parameter code used in the intake equation.	

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
Unit Risk (6.2)	Toxicity values for carcinogenic effects expressed in terms of risk per unit concentration of the substance in the medium where human contact occurs. These measures can be calculated from cancer slope factors.	
Toxicity Value (5.3,6.3)	The toxicity value for each of the COPCs.	
Weight of Evidence/Cancer Guideline Description (6.1,6.2)	An EPA classification system for characterizing the extent to which the available data indicate that an agent is a human carcinogen.	***EPA Group:*** ***A - Human carcinogen*** ***B1 - Probable human carcinogen - indicates that limited human data are available.*** ***B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans.*** ***C - Possible human carcinogen*** ***D - Not classifiable as a human carcinogen*** ***E - Evidence of noncarcinogenicity*** ***Weight of Evidence:*** ***Known/Likely*** ***Cannot be Determined*** ***Not Likely***
95% UCL of Normal Data (3)	The statistic for the 95% Upper Confidence Limit (UCL) on the arithmetic mean of measured data.	***Refer to National guidance (Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive: 9285.7-08l, May 1992) and Regional guidance for calculating this term.*** ***Supplemental information should be provided in the risk assessment.***

APPENDIX C

DATA USEABILITY WORKSHEET

DATA USEABILITY WORKSHEET
Site:
Medium:

Activity	Comment
Field Sampling	
Discuss sampling problems and field conditions that affect data useability.	
Are samples representative of receptor exposure for this medium (e.g. sample depth, grab vs composite, filtered vs unfiltered, low flow, etc.)?	
Assess the effect of field QC results on data useability.	
Summarize the effect of field sampling issues on the risk assessment, if applicable.	
Analytical Techniques	
Were the analytical methods appropriate for quantitative risk assessment?	
Were detection limits adequate?	
Summarize the effect of analytical technique issues on the risk assessment, if applicable.	
Data Quality Objectives	
Precision - How were duplicates handled?	

DATA USEABILITY WORKSHEET (continued)
Site:
Medium:

Activity	Comment
Data Quality Objectives (continued)	
Accuracy - How were split samples handled?	
Representativeness - Indicate any problems associated with data representativeness (e.g., trip blank or rinsate blank contamination, chain of custody problems, etc.).	
Completeness - Indicate any problems associated with data completeness (e.g., incorrect sample analysis, incomplete sample records, problems with field procedures, etc.).	
Comparability - Indicate any problems associated with data comparability.	
Were the DQOs specified in the QAPP satisfied?	
Summarize the effect of DQO issues on the risk assessment, if applicable.	
Data Validation and Interpretation	
What are the data validation requirements?	
What method or guidance was used to validate the data?	

DATA USEABILITY WORKSHEET (continued)
Site:
Medium:

Activity	Comment
Data Validation and Interpretation (continued)	
Was the data validation method consistent with guidance? Discuss any discrepancies.	
Were all data qualifiers defined? Discuss those which were not.	
Which qualifiers represent useable data?	
Which qualifiers represent unuseable data?	
How are tentatively identified compounds handled?	
Summarize the effect of data validation and interpretation issues on the risk assessment, if applicable.	
Additional notes:	

Note: The purpose of this Worksheet is to succinctly summarize the data useability analysis and conclusions. Reference specific pages in the Remedial Investigation and/or the Risk Assessment text to further expand on the information presented here.

TECHNICAL APPROACH TO RISK ASSESSMENT (TARA)
SCHEDULE WORKSHEET

_____ SITE

Activity - *RAGS Part D Reference*[1]	Comments[2]
PROJECT SCOPING	
Preliminary site conceptual model - *Section 2.1*	
Site visit - *Sec 2.1*	
Scoping meeting - *Sec 2.1*	
PRGs and ARARs (initial discussion) - *Sec 2.1*	
Identification of deliverables - *Sec 2.1*	
Planning Table 1 (preliminary version) - *Sec 2.1*	
Probabilistic Analysis (preliminary consideration) - *Sec 2.1*	
RI/FS Workplan (consideration of risk assessment objectives) - *Sec 2.2*	
Baseline Risk Assessment Workplan (consideration of risk assessment objectives) - *Sec 2.2*	
Probabilistic Analysis (additional consideration and Workplan as appropriate) - *Sec 2.2.1*	
REMEDIAL INVESTIGATION	
Planning Table 0 - *Sec. 3.1.1*	
TARA Schedule Worksheet - *Sec. 3.1.1 and Appendix C*	
Planning Table 1 - *Sec 3.1.1*	
Data Useability Worksheet - *Sec 3.1.1 and Appendix C*	
Supporting information for background value for Planning Table 2 - *Sec 3.1.1*	
Planning Table 2 - *Sec 3.1.1*	
Supporting information for EPC for Planning Table 3 - *Sec 3.1.1*	
Planning Table 3 -*Sec 3.1.1*	
REMEDIAL INVESTIGATION (continued)	

Notes:
[1]Add other activities as appropriate for the site.
[2]Use this column to identify the applicability, schedule, and responsibility for each activity. Activities that are not required for a particular site can be noted as NA (not applicable). It is recommended that the responsibility and schedule for both the preparation and review of each activity be noted.

TECHNICAL APPROACH TO RISK ASSESSMENT (TARA)
SCHEDULE WORKSHEET

_____ SITE

Activity - *RAGS Part D Reference*[1]	**Comments[2]**
Supporting information on modeled intake methodology and parameters for Planning Table 4 - *Sec 3.1.1*	
Supporting information on chemical-specific parameters for Planning Table 4 - *Sec 3.1.1*	
Dermal Worksheet - *Sec 3.1.1 and Appendix C*	
Planning Table 4 - *Sec 3.1.1*	
Supporting information on toxicity data for special case chemicals on Planning Tables 5/6 - *Sec 3.1.1*	
Planning Table 5 - *Sec 3.1.1*	
Planning Table 6 - *Sec 3.1.1*	
Supporting information on special chemical risk and hazard calculations for Planning Tables 7/8 - *Sec 3.1.1*	
Planning Table 7 - *Sec 3.1.1*	
Planning Table 8 - *Sec. 3.1.1*	
Radiation Dose Assessment Worksheet - *Sec 3.1.1 and Appendix C*	
Planning Table 9 - *Sec 3.1.1*	
Planning Table 10 - *Sec 3.1.1*	
Lead Worksheets - *Sec 3.1.1 and Appendix C*	
Assessment of Confidence and Uncertainty - *Sec 3.1.2*	
Summary of Probabilistic Analysis - *Sec 3.1.3*	
Draft Baseline Risk Assessment - *Sec 3.2*	
REMEDIAL INVESTIGATION (continued)	
Final Baseline Risk Assessment - *Sec 3.3*	
Draft ROD Risk Worksheets - *Sec 3.3 and Appendix C*	
FEASIBILITY STUDY	

Notes:
[1]Add other activities as appropriate for the site.
[2]Use this column to identify the applicability, schedule, and responsibility for each activity. Activities that are not required for a particular site can be noted as NA (not applicable). It is recommended that the responsibility and schedule for both the preparation and review of each activity be noted.

TECHNICAL APPROACH TO RISK ASSESSMENT (TARA)
SCHEDULE WORKSHEET

_____ SITE

Activity - *RAGS Part D Reference*[1]	Comments[2]
Remedial Action Objectives - *Sec 4.2*	
Remediation Goals - *Sec 4.2*	
Risks and hazards associated with PRGs - *Sec 4.4*	
Risk considerations of remedial technologies and alternatives - *Sec 4.5*	
AFTER THE FEASIBILITY STUDY	
Risk evaluation for the Proposed Plan - *Sec 5.1*	
Documentation of risks in the Record of Decision - *Sec 5.2*	
Revise ROD Risk Worksheets - *Sec 5.2 and Appendix C*	
Risk evaluation during remedial design and remedial action - *Sec 5.3*	
Risk evaluation associated with explanations of significant differences - *Sec 5.4*	
Risk evaluations during five-year review - *Sec 5.5*	
Public meeting participation	

Notes:
[1]Add other activities as appropriate for the site.
[2]Use this column to identify the applicability, schedule, and responsibility for each activity. Activities that are not required for a particular site can be noted as NA (not applicable). It is recommended that the responsibility and schedule for both the preparation and review of each activity be noted.

Dermal Worksheet

Intermediate Variables for Calculating DA(event)

Chemical of Potential Concern	Media	Dermal Absorption Fraction (soil)	FA	Kp		T(event)		Tau		T*		B
			Value	Value	Units	Value	Units	Value	Units	Value	Units	Value

FA = Fraction Absorbed Water

Kp = Dermal Permeability Coefficient of Compound in Water

T(event) = Event Duration

Tau = Lag Time

T* = Time to Reach Steady-State

B = Dimensionless Ratio of the Permeability Coefficient of a Compound Through the Stratum Corneum Relative to its Permeability Coefficient Across the Viable Epidermis

RADIATION DOSE ASSESSMENT WORKSHEET

Site Name

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Dose Approach	Internal/External Dose		Standard for Comparison(1)	Conversion Factor			Risk
					Value	Units		Value	Units		Value	Units	Source	
			Exp. Route Total											
			Exp. Route Total											
		Exposure Point Total												
			Exp. Route Total											
		Exposure Point Total												
			Exp. Route Total											
			Exp. Route Total											
		Exposure Point Total												

Total of Receptor Dose Across All Media

Total of Receptor Risks Across All Media

TABLE X (RAGS D IEUBK LEAD WORKSHEET)
Site Name: <SITE and OU>
Receptor: <Receptor> (Age <X> Months) Exposure to Media as Described

1. Lead Screening Questions

Medium	Lead Concentration Used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Soil	<X>	mg/kg	Average Detected Value	400	mg/kg	Recommended Soil Screening Level
Water	<X>	ug/L	Average Detected Value	15	ug/L	Recommended Drinking Water Action Level

2. Lead Model Questions

Question	Response for Residential Lead Model
What lead model (version and date) was used?	<model> <version and date>
Where are the input values located in the risk assessment report?	Located in Appendix <X> <IEUBKwin OUTPUT>
What range of media concentrations were used for the model?	<Refer to sampling data table>
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	<Statistic used> Data are Located in Appendix <X>
Was soil sample taken from top 2 cm? If not, why?	<Yes/No>
Was soil sample sieved? What size screen was used? If not sieved, provide rationale.	<Yes/No> Mesh size <X> um
What was the point of exposure/location?	<describe>
Where are the output values located in the risk assessment report?	Located in Appendix X <IEUBKwin OUTPUT>
Was the model run using default values only?	<Yes/No>
Was the default soil bioavailability used?	<Yes/No> Default is 30%
Was the default soil ingestion rate used?	<Yes/No> Default values for 7 age groups are 85, 135, 135, 100, 090, and 85 mg/day
If non-default values were used, where are the rationale for the values located in the risk assessment report?	Located in Appendix X <IEUBKwin OUTPUT>

3. Final Result

Medium	Result	Comment/PRG [1]
<MEDIUM>	Input value of <X> (units) in <MEDIUM> results in YYY% of <receptor> above a blood lead level of 10 ug/dL. Geometric mean blood lead = ZZZ ug/dL. This exceeds the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children exceeding 10 ug/dL blood lead.	Based on site conditions, a PRG of X (units) is indicated for <MEDIUM>.

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

TABLE Y (RAGS D ADULT LEAD WORKSHEET)
Site Name: <SITE and OU>
Receptor: Adult Non-Resident, Exposure to Media as Described

1. Lead Screening Questions

Medium	Lead Concentration used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Soil	<X>	mg/kg	Average Detected Value	750	mg/kg	Recommended Soil Screening Level

2. Lead Model Questions

Question	Response
What lead model was used? Provide reference and version	
If the EPA Adult Lead Model (ALM) was not used provide rationale for model selected.	
Where are the input values located in the risk assessment report?	Located in Appendix <Y>
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	<Statistic used> Data are Located in Appendix <X>
What was the point of exposure and location?	
Where are the output values located in the risk assessment report?	Located in Appendix <Y>
What GSD value was used? If this is outside the recommended range of 1.8-2.1), provide rationale in Appendix <Y>.	
What baseline blood lead concentration (PbB_0) value was used? If this is outside the default range of 1.7 to 2.2 provide rationale in Appendix <Y>	
Was the default exposure frequency (EF; 219 days/year) used?	<Yes/No>
Was the default BKSF used (0.4 ug/dL per ug/day) used?	<Yes/No>
Was the default absorption fraction (AF; 0.12) used?	<Yes/No>
Was the default soil ingestion rate (IR; 50 mg/day) used?	<Yes/No>
If non-default values were used for any of the parameters listed above, where are the rationale for the values located in the risk assessment report?	Located in Appendix <Y>

3. Final Result

Medium	Result	Comment/RBRG [1]
Soil	Input value of XXX ppm in soil results in YYY% of receptors above a blood lead level of ZZ ug/d and geometric mean blood lead = ZZZ ug/dL. This exceeds the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children (fetuses of exposed women) exceeding 10 ug/dL blood lead.	<RBRG>

1. Attach the ALM spreadsheet output file upon which the Risk Based Remediation Goal (RBRG) was based and description of rationale for parameters used. For additional information, see www.epa.gov/superfund/programs/lead

Highlight 6-15: Example Table Format

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe:
Medium:
Exposure Medium:

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Minimum	Maximum					

Key

Example Language Describing Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentratons

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Highlight 6-16A: Example Table Format

Sample Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)

Pathway: Inhalation

Chemical of Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)

Pathway: External (Radiation)

Chemical of Concern	Cancer Slope or Conversion Factor	Exposure Route	Units	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)

Key

Example Language Describing Summary of Toxicity Assessment

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Highlight 6-16B: Example Table Format

Sample Non-Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Dermal RfD	Dermal RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	Dates of Rfd: Target Organ (MM/DD/YYYY)

Pathway: Inhalation

Chemical of Concern	Chronic/ Subchronic	Inhalation RfC	Inhalation RfC Units	Inhalation RfD	Inhalation RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfC: RfD: Target Organ	Dates (MM/DD/YYYY)

Key

Example Language Describing Summary of Toxicity Assessment

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Highlight 6-18A: Example Table Format

Risk Characterization Summary - Carcinogens

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
							Soil Risk Total =	
							Groundwater risk total =	
							Total Risk =	

Key

Example Language Describing Risk Characterization

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Highlight 6-18B: Example Table Format

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe:
Receptor Population:
Receptor Age:

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
							Soil Hazard Index Total =	
						Groundwater Hazard Index Total =		
						Receptor Hazard Index =		
						Organ Hazard Index =		

Key

Example Language Describing Risk Characterization

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Example Worksheets

DATA USEABILITY WORKSHEET
The Dean Company
Medium: Groundwater

Activity	Comment
Field Sampling	
Discuss sampling problems and field conditions that affect data useability.	Groundwater samples were collected from 12 monitoring wells located onsite. There were no apparent problems reported from the field collection program that could affect data useability.
Are samples representative of receptor exposure for this medium (e.g. sample depth, grab vs composite, filtered vs unfiltered, low flow, etc.)?	Groundwater samples submitted for organic and inorganic analyses were non-filtered samples collected using low flow purging and sampling techniques. These samples are representative of receptor exposure.
Assess the effect of field QC results on data useability.	A few of the metals in the samples were qualified "B" due to the presence of the metals in blank samples.
Summarize the effect of field sampling issues on the risk assessment, if applicable.	There are no field sampling issues that should affect the risk assessment.
Analytical Techniques	
Were the analytical methods appropriate for quantitative risk assessment?	Yes. Groundwater samples were analyzed for organic compounds according to Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis, Multi-Media, Multi-Concentration, OLM04.2. Inorganic groundwater samples were analyzed according to CLP SOW for Inorganic Analysis, Multi-Media, Multi-Concentration, ILM04.1.
Were detection limits adequate?	Yes. The method detection and quantitation limit were less than the associated risk-based concentration (RBC) values, except for chloroform and thallium. For these two compounds, no available methods can achieve the RBC as a quantitation limit. For all non-detected chemicals in groundwater, the method detection and quantitation limits were less than the associated RBC values. Recommend no changes to the data set.
Summarize the effect of analytical technique issues on the risk assessment, if applicable.	There are no analytical technique issues that should affect the risk assessment.

DATA USEABILITY WORKSHEET (cont.)
The Dean Company
Medium: Groundwater

Activity	Comment
Data Quality Objectives	
Precision - How were duplicates handled?	Relative percent differences (RPDs) were calculated for one pair of duplicate samples. The RPDs were less than the EPA-approved RPD of 20%. The highest concentration of a compound detected in the samples was used in the risk assessment.
Accuracy - How were split samples handled?	Split samples were not collected.
Representativeness - Indicate any problems associated with data representativeness (e.g., trip blank or rinsate blank contamination, chain of custody problems, etc.).	Analytes qualified with a "B" due to blank contamination will be considered as non-detects during the risk assessment.
Completeness - Indicate any problems associated with data completeness (e.g., incorrect sample analysis, incomplete sample records, problems with field procedures, etc.).	No problems were associated with data completeness.
Comparability - Indicate any problems associated with data comparability.	No problems have been associated with data comparability.
Were the DQOs specified in the QAPP satisfied?	Yes, the DQOs identified in the Sampling and Analysis Plan were satisfied.
Summarize the effect of DQO issues on the risk assessment, if applicable.	There are no DQO issues that should affect the risk assessment.

DATA USEABILITY WORKSHEET (cont.)
The Dean Company
Medium: Groundwater

Activity	Comment
Data Validation and Interpretation	
What are the data validation requirements?	For organic samples, validators were required to check the following items: holding times, instrument performance checks, initial and continuing calibrations, blanks, system monitoring compounds, matrix spike/matrix spike duplicates, regional QA/QC, internal standards, target compound identification, contract required quantitation limits, tentatively identified compounds, system performance, and overall assessment of data. For inorganic samples, validators were required to check holding times, calibration, blanks, interference checks, laboratory control samples, duplicate samples, matrix spike samples, furnace atomic absorption QC, ICP Serial Dilution, sample result verification, field duplicates, and perform an overall assessment of the data.
What method or guidance was used to validate the data?	Region III modifications to "Laboratory Data Validation Functional Guidelines for Validating Organic (and Inorganic) Analyses", USEPA 9/94 (and 4/93).
Was the data validation method consistent with guidance? Discuss any discrepancies.	Yes. The data validation method was consistent with regional guidance.
Were all data qualifiers defined? Discuss those which were not.	Yes. All data qualifiers were defined.
Which qualifiers represent useable data?	B, J, L, U, UJ, and UL
Which qualifiers represent unuseable data?	R
How are tentatively identified compounds handled?	Only TICs that were determined not to be laboratory or field artifacts were reported. All TICs were reported with an "N" and/or a "J" qualifier. "N" qualified data indicates that the analyte is tentatively identified. "J" qualified data indicates that the analyte is present but reported value is estimated. TICs will be evaluated qualitatively in the risk assessment.

DATA USEABILITY WORKSHEET (cont.)
The Dean Company
Medium: Groundwater

Activity	Comment
Summarize the effect of data validation and interpretation issues on the risk assessment, if applicable.	Unusable data qualified with an "R" will not be used in the risk assessment. All other data, both qualified and unqualified, will be used in the risk assessment.
Additional notes:	None.

DATA USEABILITY WORKSHEET
The Dean Company
Medium: Soil

Activity	Comment
Field Sampling	
Discuss sampling problems and field conditions that affect data useability.	There were no apparent problems that could affect data useability.
Are samples representative of receptor exposure for this medium (e.g. sample depth, grab vs composite, filtered vs unfiltered, low flow, etc.)?	Yes. Soil samples are representative of receptor exposure for this medium.
Assess the effect of field QC results on data useability.	Overall, the trip, field, and rinsate blanks were generally non-detect for VOCs and SVOCs with the exception of low levels of commonly reported laboratory contaminants. Several of the metals in the samples were qualified "B" due to the presence of the metals in blank samples.
Summarize the effect of field sampling issues on the risk assessment, if applicable.	There are no field sampling issues that should affect the risk assessment.
Analytical Techniques	
Were the analytical methods appropriate for quantitative risk assessment?	Yes. Samples were analyzed for organic compounds according to Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis, Multi-Media, Multi-Concentration, OLM04.2. Inorganic soil samples were analyzed according to CLP SOW for Inorganic Analysis, Multi-Media, Multi-Concentration, ILM04.1.
Were detection limits adequate?	Yes. The method detection and quantitation limit were less than the associated risk-based concentration (RBC) values.
Summarize the effect of analytical technique issues on the risk assessment, if applicable.	There are no analytical technique issues that should affect the risk assessment.

DATA USEABILITY WORKSHEET (cont.)
The Dean Company
Medium: Soil

Activity	Comment
Data Quality Objectives	
Precision - How were duplicates handled?	Relative percent differences (RPDs) were calculated for one pair of duplicate samples. The RPDs were less than the EPA-approved RPD of 35%. The highest concentration of a compound detected in the samples was used in the risk assessment.
Accuracy - How were split samples handled?	Split samples were not collected.
Representativeness - Indicate any problems associated with data representativeness (e.g., trip blank or rinsate blank contamination, chain of custody problems, etc.).	Analytes qualified with a "B" due to blank contamination will be considered as non-detects during the risk assessment.
Completeness - Indicate any problems associated with data completeness (e.g., incorrect sample analysis, incomplete sample records, problems with field procedures, etc.).	No problems were associated with data completeness.
Comparability - Indicate any problems associated with data comparability.	No problems have been associated with data comparability.
Were the DQOs specified in the QAPP satisfied?	Yes, the DQOs identified in the Sampling and Analysis Plan were satisfied.
Summarize the effect of DQO issues on the risk assessment, if applicable.	There are no DQO issues that should affect the risk assessment.

DATA USEABILITY WORKSHEET (cont.)
The Dean Company
Medium: Soil

Activity	Comment
Data Validation and Interpretation	
What are the data validation requirements?	For organic samples, validators were required to check the following items: holding times, instrument performance checks, initial and continuing calibrations, blanks, system monitoring compounds, matrix spike/matrix spike duplicates, regional QA/QC, internal standards, target compound identification, contract required quantitation limits, tentatively identified compounds, system performance, and overall assessment of data. For inorganic samples, validators were required to check holding times, calibration, blanks, interference checks, laboratory control samples, duplicate samples, matrix spike samples, furnace atomic absorption QC, ICP serial dilution, sample result verification, field duplicates, and perform an overall assessment of the data.
What method or guidance was used to validate the data?	Region III modifications to "Laboratory Data Validation Functional Guidelines for Validating Organic (and Inorganic) Analyses", USEPA 9/94 (and 4/93).
Was the data validation method consistent with guidance? Discuss any discrepancies.	Yes. The data validation method was consistent with regional guidance.
Were all data qualifiers defined? Discuss those which were not.	Yes. All data qualifiers were defined.
Which qualifiers represent useable data?	B, J, K, L, U, UJ, and UL
Which qualifiers represent unuseable data?	R
How are tentatively identified compounds handled?	Only TICs that were determined not to be laboratory or field artifacts were reported. All TICs were reported with an "N" and/or a "J" qualifier. "N" qualified data indicates that the analyte is tentatively identified. "J" qualified data indicates that the analyte is present but the reported value is estimated. TICs will be evaluated qualitatively in the risk assessment.

DATA USEABILITY WORKSHEET (cont.)
The Dean Company
Medium: Soil

Activity	Comment
Summarize the effect of data validation and interpretation issues on the risk assessment, if applicable.	Unusable data qualified with an "R" will not be used in the risk assessment. All other data, both qualified and unqualified, will be used in the risk assessment.
Additional notes:	None.

EXAMPLE TECHNICAL APPROACH TO RISK ASSESSMENT (TARA) SCHEDULE WORKSHEET

The Dean Company

Activity - *RAGS Part D Reference*[1]	Comments[2]
PROJECT SCOPING	
Preliminary site conceptual model - *Section 2.1*	November 30, 2000
Site visit - *Sec 2.1*	November 4, 2000
Scoping meeting - *Sec 2.1*	November 2, 2000
PRGs and ARARs (initial discussion) - *Sec 2.1*	November 2, 2000
Identification of deliverables - *Sec 2.1*	November 30, 2000
Planning Table 1 (preliminary version) - *Sec 2.1*	November 30, 2000
Probabilistic Analysis (preliminary consideration) - *Sec 2.1*	November 30, 2000
RI/FS Workplan (consideration of risk assessment objectives) - *Sec 2.2*	November 30, 2000
Baseline Risk Assessment Workplan (consideration of risk assessment objectives) - *Sec 2.2*	November 30, 2000
Probabilistic Analysis (additional consideration and Workplan as appropriate) - *Sec 2.2.1*	November 30, 2000
REMEDIAL INVESTIGATION	
Planning Table 0 - *Sec. 3.1.1*	August 30, 2001
TARA Schedule Worksheet - *Sec. 3.1.1 and Appendix C*	August 30, 2001
Planning Table 1 - *Sec 3.1.1*	August 30, 2001
Data Useability Worksheet - *Sec 3.1.1 and Appendix C*	August 30, 2001
Supporting information for background value for Planning Table 2 - *Sec 3.1.1*	August 30, 2001
Planning Table 2 - *Sec 3.1.1*	August 30, 2001
Supporting information for EPC for Planning Table 3 - *Sec 3.1.1*	August 30, 2001
Planning Table 3 -*Sec 3.1.1*	August 30, 2001

Notes:

[1]Add other activities as appropriate for the site.

[2]Use this column to identify the applicability, schedule, and responsibility for each activity. Activities that are not required for a particular site can be noted as NA (not applicable). It is recommended that the responsibility and schedule for both the preparation and review of each activity be noted.

EXAMPLE TECHNICAL APPROACH TO RISK ASSESSMENT (TARA) SCHEDULE WORKSHEET

The Dean Company

Activity - *RAGS Part D Reference*[1]	Comments[2]
REMEDIAL INVESTIGATION (continued)	
Supporting information on modeled intake methodology and parameters for Planning Table 4 - *Sec 3.1.1*	August 30, 2001
Supporting information on chemical-specific parameters for Planning Table 4 - *Sec 3.1.1*	August 30, 2001
Dermal Worksheet - *Sec 3.1.1 and Appendix C*	August 30, 2001
Planning Table 4 - *Sec 3.1.1*	August 30, 2001
Supporting information on toxicity data for special case chemicals on Planning Tables 5/6 - *Sec 3.1.1*	August 30, 2001
Planning Table 5 - *Sec 3.1.1*	August 30, 2001
Planning Table 6 - *Sec 3.1.1*	August 30, 2001
Supporting information on special chemical risk and hazard calculations for Planning Tables 7/8 - *Sec 3.1.1*	October 21, 2001
Planning Table 7 - *Sec 3.1.1*	October 21, 2001
Planning Table 8 - *Sec. 3.1.1*	October 21, 2001
Radiation Dose Assessment Worksheet - *Sec 3.1.1 and Appendix C*	October 21, 2001
Planning Table 9 - *Sec 3.1.1*	October 21, 2001
Planning Table 10 - *Sec 3.1.1*	October 21, 2001
Lead Worksheets - *Sec 3.1.1 and Appendix C*	October 21, 2001
Assessment of Confidence and Uncertainty - *Sec 3.1.2*	October 21, 2001
Summary of Probabilistic Analysis - *Sec 3.1.3*	October 21, 2001
Draft Baseline Risk Assessment - *Sec 3.2*	October 21, 2001
Final Baseline Risk Assessment - *Sec 3.3*	January 15, 2001

Notes:
[1]Add other activities as appropriate for the site.
[2]Use this column to identify the applicability, schedule, and responsibility for each activity. Activities that are not required for a particular site can be noted as NA (not applicable). It is recommended that the responsibility and schedule for both the preparation and review of each activity be noted.

EXAMPLE TECHNICAL APPROACH TO RISK ASSESSMENT (TARA) SCHEDULE WORKSHEET

The Dean Company

Activity - *RAGS Part D Reference*[1]	Comments[2]
REMEDIAL INVESTIGATION (continued)	
Draft ROD Risk Worksheets - *Sec 3.3 and Appendix C*	January 15, 2001
FEASIBILITY STUDY	
Remedial Action Objectives - *Sec 4.2*	January 15, 2001
Remediation Goals - *Sec 4.2*	January 15, 2001
Risks and hazards associated with PRGs - *Sec 4.4*	January 15, 2001
Risk considerations of remedial technologies and alternatives - *Sec 4.5*	January 15, 2001
AFTER THE FEASIBILITY STUDY	
Risk evaluation for the Proposed Plan - *Sec 5.1*	To be determined
Documentation of risks in the Record of Decision - *Sec 5.2*	To be determined
Revise ROD Risk Worksheets - *Sec 5.2 and Appendix C*	To be determined
Risk evaluation during remedial design and remedial action - *Sec 5.3*	To be determined
Risk evaluation associated with explanations of significant differences - *Sec 5.4*	To be determined
Risk evaluations during five-year review - *Sec 5.5*	To be determined
Public meeting participation	To be determined

Notes:

[1]Add other activities as appropriate for the site.

[2]Use this column to identify the applicability, schedule, and responsibility for each activity. Activities that are not required for a particular site can be noted as NA (not applicable). It is recommended that the responsibility and schedule for both the preparation and review of each activity be noted.

Dermal Worksheet
Intermediate Variables for Calculating DA(event)
The Dean Company

Chemical of Potential Concern	Medium	Dermal Absorption Fraction (soil)	FA	Kp		T(event)		Tau		T*		B
			Value	Value	Units	Value	Units	Value	Units	Value	Units	Value
phthalate	Groundwater	- -	0.8	2.50E-002	cm/hour	0.58	hour/event	16.27	hour	39.05	hour	0.2
Chloroform	Groundwater	- -	1	1.50E-001	cm/hour	0.58	hour/event	0.49	hour	1.18	hour	0
Heptachlor	Groundwater	- -	0.8	8.70E-003	cm/hour	0.58	hour/event	12.99	hour	31.16	hour	0.1
Barium *	Groundwater	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Manganese *	Groundwater	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Thallium *	Groundwater		- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
4,4'-DDD *	Soil	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
4,4'-DDE *	Soil	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
4,4-DDT	Soil	0.03	No data	No data	No data	No data	No data	No data	No data	No data	No data	No data
Aluminum *	Soil	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Copper *	Soil	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Iron *	Soil	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Manganese *	Soil	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Thallium *	Soil	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -

FA = Fraction Absorbed Water
Kp = Dermal Permeability Coefficient of Compound in Water

T(event) = Event Duration
Tau = Lag Time

T* = Time to Reach Steady-State
B = Dimensionless Ratio of the Permeability Coefficient of a Compound Through the Stratum Corneum Relative to its Permeability Coefficient Across the Viable Epidermis

* = Dermal assessment not recommended based on RAGS Part E, Appendix B-3 screening table.

TABLE X (RAGS D IEUBK LEAD WORKSHEET)
Site Name: <SITE and OU>
Receptor: <Receptor> (Age <X> Months) Exposure to Media as Described

1. Lead Screening Questions

Medium	Lead Concentration Used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Soil	<X>	mg/kg	Average Detected Value	400	mg/kg	Recommended Soil Screening Level
Water	<X>	ug/L	Average Detected Value	15	ug/L	Recommended Drinking Water Action Level

2. Lead Model Questions

Question	Response for Residential Lead Model
What lead model (version and date) was used?	<model> <version and date>
Where are the input values located in the risk assessment report?	Located in Appendix <X> <IEUBKwin OUTPUT>
What range of media concentrations were used for the model?	<Refer to sampling data table>
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	<Statistic used> Data are Located in Appendix <X>
Was soil sample taken from top 2 cm? If not, why?	<Yes/No>
Was soil sample sieved? What size screen was used? If not sieved, provide rationale.	<Yes/No> Mesh size <X> um
What was the point of exposure/location?	<describe>
Where are the output values located in the risk assessment report?	Located in Appendix X <IEUBKwin OUTPUT>
Was the model run using default values only?	<Yes/No>
Was the default soil bioavailability used?	<Yes/No> Default is 30%
Was the default soil ingestion rate used?	<Yes/No> Default values for 7 age groups are 85, 135, 135, 100, 090, and 85 mg/day
If non-default values were used, where are the rationale for the values located in the risk assessment report?	Located in Appendix X <IEUBKwin OUTPUT>

3. Final Result

Medium	Result	Comment/PRG [1]
<MEDIUM>	Input value of <X> (units) in <MEDIUM> results in YYY% of <receptor> above a blood lead level of 10 ug/dL. Geometric mean blood lead = ZZZ ug/dL. This exceeds the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children exceeding 10 ug/dL blood lead.	Based on site conditions, a PRG of X (units) is indicated for <MEDIUM>.

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

TABLE Y (RAGS D ADULT LEAD WORKSHEET)
Site Name: Example Site, Slag Pile 2
Receptor: Adult Worker, Exposure to Media as Described

1. Lead Screening Questions

Medium	Lead Concentration used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Soil	2000	mg/kg	Average Detected Value	750	mg/kg	Recommended Soil Screening Level

2. Lead Model Questions

Question	Response
What lead model was used? Provide reference and version	EPA Interim Adult Lead Model (1996)
If the EPA Adult Lead Model (ALM) was not used provide rationale for model selected.	n/a
Where are the input values located in the risk assessment report?	Located in Appendix 5
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Mean soil concentration. Data are Located in Appendix 2
What was the point of exposure and location?	OU 3 Slag pile area
Where are the output values located in the risk assessment report?	Located in Appendix 5
What GSD value was used? If this is outside the recommended range of 1.8-2.1, provide rationale in Appendix <Y>.	1.8
What baseline blood lead concentration (PbB_0) value was used? If this is outside the default range of 1.7 to 2.2 provide rationale in Appendix <Y>.	2.0
Was the default exposure frequency (EF; 219 days/year) used?	Yes
Was the default BKSF used (0.4 ug/dL per ug/day) used?	Yes
Was the default absorption fraction (AF; 0.12) used?	Yes
Was the default soil ingestion rate (IR; 50 mg/day) used?	Yes
If non-default values were used for any of the parameters listed above, where are the rationale for the values located in the risk assessment report?	Located in Appendix 5

3. Final Result

Medium	Result	Comment/RBRG [1]
Soil	2000 ppm lead in soil results in >5% of receptors above a blood lead level of 10 ug/d and geometric mean blood lead = 11.6 ug/dL. This exceeds the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children (fetuses of exposed women) exceeding 10 ug/dL blood lead.	1500 ppm

1. Attach the ALM spreadsheet output file upon which the Risk Based Remediation Goal (RBRG) was based and description of rationale for parameters used. For additional information, see www.epa.gov/superfund/programs/lead

APPENDIX D

EXAMPLE SCENARIOS

1. **Duplicate Exposure Information for Different Exposure Points**
2. **Modeled Inhalation from Showering**
3. **Measured Data and Subsequent Ingestion**
4. **Modeled Data and Subsequent Ingestion**
5. **Modeled Data**
6. **Multiple Source Exposures**
7. **Possible Summing Options on Planning Tables 9 and 10**
8. **Child/Adult Lifetime Cancer Risk**
9. **Transfer of Contaminants Through Multiple Media**
10. **Lead Data Example**
11. **Radiation Data Example**

Example Scenario No. 1
Duplicate Exposure Information for Different Exposure Points
(with Planning Tables 1 and 4)

Scenario Description: Data are available for several exposure points that are to be evaluated separately in the risk assessment. In this risk assessment, data will be evaluated separately for ingestion and dermal contact from three different slag piles (Slag Piles 1, 2, and 3) for the same scenario timeframe, medium, and exposure medium.

Planning Table Issues Associated with this Scenario:

The primary issue with this scenario is whether or how to show the exposure points on Planning Tables 1 and 4. Note that the exposure parameter values used for daily intake calculations are identical for each individual pathway, i.e. the values presented on Planning Table 4 are the same for all exposure points for each type of exposure route.

1. How will Planning Table 1 show the three separate exposure points?

Planning Table 1 will need to show the three separate exposure points since each data set will be evaluated separately in the risk assessment. Planning Table 1 needs to show:

Medium: Solid Waste
Exposure Medium: Solid Waste
Exposure Point: Slag Pile 1

Medium: Solid Waste
Exposure Medium: Solid Waste
Exposure Point: Slag Pile 2

Medium: Solid Waste
Exposure Medium: Solid Waste
Exposure Point: Slag Pile 3

2. Do the values used for daily intake calculations need to be shown three separate times on Planning Table 4 for each exposure point even though the values and intake equations are identical?

There are two options that can be followed:

Option 1: Complete Planning Table 4 according to the RAGS Part D instructions. For this example, Planning Table 4 would have three sets of identical values and intake equations, one for each exposure point.

Option 2: Complete Planning Table 4 using only one set of values and intake equations and indicate on the table that these values are identical for all three different exposure points. This can be accomplished by including "Slag Piles 1, 2, and 3" in the Exposure

Example Scenario No. 1 (continued)
Duplicate Exposure Information for Different Exposure Points
(with Planning Tables 1 and 4)

Point column and footnoting that these values and intake equations are the same for all three exposure points.

Option 1 is provided in the Example Tables in Appendix A. Option 2, consisting of a revised example Planning Table 4, is illustrated in the accompanying table.

EXAMPLE SCENARIO 11

TABLE 10.2.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Aquifer 1 - Tap Water	Heptachlor	7E-04	--	3E-04	--	1E-03	Liver	4	--	1	5
			Manganese	--	--	--	--	--	Central Nervous System	40	--	--	40
			Uranium	--	--	--	--	--	Kidney	8	--	--	8
			Chemical Total	7E-04	--	3E-04	--	1E-03		52	--	1	53
			Uranium 238	1E-06	--	--	--	1E-06					
			Radium 226	3E-06	--	--	--	3E-06					
			Radionuclide Total	4E-06	--	--	--	4E-06					
		Exposure Point Total						1E-03					53
	Exposure Medium Total							1E-03					53
Groundwater Total								1E-03					53
Soil	Soil	Soil at Site 1	4,4'-DDE	3E-006	--	--	--	3E-06	--	--	--	--	--
			4,4'-DDT	1E-05	--	9E-07	--	1E-05	--	--	--	--	--
			Uranium	--	--	--	--	--	Kidney	3	--	--	3
			Chemical Total	1E-05	--	9E-07	--	1E-05		3	--	--	3
			Radium 226	5E-07	--	--	9E-05	9E-05					
			Radionuclide Total	6E-07	--	--	9E-05	9E-05					
		Exposure Point Total						1E-04					3
	Exposure Medium Total							1E-04					3
Soil Total								1E-04					3
Receptor Total								1E-03					56

Total Risk Across All Media: 1E-03

Total Hazard Across All Media: 56

Total Liver HI Across All Media = 5
Total Kidney HI Across All Media = 11
Total Central Nervous System HI Across All Media = 40

Cancer risks presented are those greater than 1E-06; Non-cancer risks presented are those greater than 1.

EXAMPLE SCENARIO 1

TABLE 1
SELECTION OF EXPOSURE PATHWAYS
The Dean Company

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Solid Waste	Solid Waste	Slag Pile 1	Receptor Population	Age 1	Ingestion	Quant	Rationale
						Dermal	Quant	Rationale
			Slag Pile 2	Receptor Population	Age 1	Ingestion	Quant	Rationale
						Dermal	Quant	Rationale
			Slag Pile 3	Receptor Population	Age 1	Ingestion	Quant	Rationale
						Dermal	Quant	Rationale

EXAMPLE SCENARIO 1
Option 2

TABLE 4.1.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE
The Dean Company

Scenario Timeframe: Future
Medium: Solid Waste
Exposure Medium: Solid Waste

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Receptor Population	Age 1	Slag Piles 1, 2, 3 (1)	CS	Chemical Concentration in Slag	See Table 3.1	mg/kg	See Table 3.1	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR	Ingestion Rate of Slag	100	mg/day	EPA, 1991	CS x IR x FI x EF x ED x CF1 x 1/BW x 1/AT
				FI	Fraction Ingested	1	- -	Professional Judgment	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
				CF1	Conversion Factor	1E-06	kg/mg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 1989	
Dermal	Receptor Population	Age 1	Slag Piles 1, 2, 3 (1)	CS	Chemical Concentration in Slag	See Table 3.1	mg/kg	See Table 3.1	Dermal Absorbed Dose (DAD) (mg/kg-day) =
				CF1	Conversion Factor	1E-06	kg/mg	- -	DA-event x EF x ED x EV x SA X 1/BW x 1/AT
				SA	Skin Surface Area Available for Contact	5,700	cm2	EPA, 2001	where
				AF	Soil to Skin Adherence Factor	0.19	mg/cm2-event	EPA, 2001	Absorbed Dose per Event (DA-event) (mg/cm2-event) =
				ABS-d	Absorption Factor	chemical-specific	unitless	EPA, 2001	CS x CF1 x AF x ABS-d
				EV	Event Frequency	1	events/day	EPA, 2001	
				EF	Exposure Frequency	350	days/year	EPA, 2001	
				ED	Exposure Duration	24	years	EPA, 1991	
				BW	Body Weight	70	kg	EPA, 2001	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 2001	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 2001	

(1) Parameters for Slag Piles 2 and 3 are identical to Slag Pile 1, and are therefore not repeated.

EPA 1989: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual, Part A. OERR EPA/540/1-89/002.

EPA 1991: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER 9285.6-03.

EPA 1995: Assessing Dermal Exposure from Soil, Technical Guidance Manual, Region III, EPA/903-K-95-003.

EPA 1997: Exposure Factors Handbook, Volume 1. EPA/600/P-95/002Fa.

EPA 2001: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim.

NA = Not Available

Example Scenario No. 2
Modeled Inhalation from Showering (with Planning Tables 1, 2, 3, 4, and 7)

Scenario Description: Individuals may be exposed to chemicals of potential concern in air by inhalation of chemicals through showering. The inhalation pathway is modeled using an EPA-accepted inhalation model. For this example scenario, a model accepted by EPA regions, such as the Foster and Chrostowski Shower Model, is used to evaluate *future adult resident inhalation exposure to groundwater*. See Example Scenario 4 for illustrations of how to present modeled data.

Planning Table Issues Associated with this Scenario:

1. How will use of an inhalation model affect Planning Table 1?
   Planning Table 1 can accommodate this easily. Planning Table 1 can be completed to include an exposure medium (e.g., Water Vapors at Showerhead) and include the inhalation exposure route for all applicable scenarios. For this scenario example, Planning Table 1 would include a row that would describe this inhalation exposure pathway.

2. What data will be included in Planning Table 2 -- modeled air concentrations or measured groundwater concentrations?
   In this example, Planning Table 2 will show measured groundwater concentrations. The data will be screened against tap water screening values.

3. What data will be included in Planning Table 3?
   In this example, Planning Table 3 will show measured groundwater statistics.

4. How will the inhalation model parameters be shown on Planning Table 4?
   For this example, the upper left hand corner Summary Box and the exposure route, receptor population, receptor age, and exposure point fields should be completed. However, exposure parameters and intake equations do not need to be entered into the table if there are space limitations. In the exposure route column, enter "Inhalation" with a footnote. Include the footnote explanation beneath the table that describes the model to be used and the section of the risk assessment text where information regarding modeled intake development can be found. Supporting information that summarizes the modeled intake methodology and parameters used to calculate modeled intake values should be included in the Baseline Risk Assessment Report as an attachment. Non-standard tables may also be used to display modeled information. Refer to the Risk Assessment text for details on the modeled intake methodology, the parameters used to calculate modeled intake values, and the modeled air concentrations predicted by the model.

Example Scenario No. 2
Modeled Inhalation from Showering (with Planning Tables 1, 2, 3, 4, and 7)

5. How are the modeled results displayed on Planning Table 7?

   For this example, EPC values are calculated using measured groundwater data. They can be found on Planning Table 3. Intake/Exposure concentration values are values that are generated using the inhalation model. These values need to be included on this table. The risks and hazards will be calculated using the "Intake / Exposure concentration values" based on modeling and appropriate toxicity information.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

The Dean Company

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Groundwater	Groundwater	Aquifer 1 - Tap Water	Resident	Adult	Dermal	Quant	Future onsite residents may rely on domestic wells drawing from Aquifer 1.
						Ingestion	Quant	Future onsite residents may rely on domestic wells drawing from Aquifer 1.
					Child	Dermal	Quant	Future onsite residents may rely on domestic wells drawing from Aquifer 1.
						Ingestion	Quant	Future onsite residents may rely on domestic wells drawing from Aquifer 1.
		Air	Water Vapors at Showerhead	Resident	Adult	Inhalation	Quant	Future onsite residents may rely on domestic wells drawing from Aquifer 1.
					Child	Inhalation	None	Children are assumed not to shower.

EXAMPLE SCENARIO 2

TABLE 2.2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The Dean Company

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Point	CAS Number	Chemical	Minimum (1) Concentration (Qualifier)	Maximum (1) Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (4) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Water Vapors at Showerhead	117817	Bis(2-ethylhexyl)phthalate	2 J	5 J	ug/l	GW3D	4 / 12	7 - 11	5	NA	4.8 C	6	MCL	Y	ASL
	67663	Chloroform	0.6 J	9	ug/l	GW3D	3 / 12	1 - 1	9	NA	0.063 C	100	MCL	Y	ASL
	75150	Carbon Disulfide	0.3 J	4.5	ug/l	GW3D	3 / 12	1 - 1	4.5	NA	100 N	NA	NA	N	BSL
	76448	Heptachlor	2 J	33 J	ug/l	GW4D	6 / 12	0.05 - 0.05	33	NA	0.015 C	0.4	MCL	Y	ASL
	108883	Toluene	0.1 J	0.2 J	ug/l	GW3D	3 / 12	1 - 1	0.2	NA	75 N	1000	MCL	N	BSL

(1) Measured groundwater concentrations.

(2) Maximum concentration used for screening.

(3) To date, no background study has been completed.

(4) All compounds are screened against the Risk-Based Concentration (RBC) Table, U.S. EPA Region III, October 5, 2000 for tap water (cancer benchmark = 1E-06; HQ = 0.1).

(5) Rationale Codes:

Selection Reason: Above Screening Level (ASL)

Deletion Reason: Below Screening Level (BSL)

Definitions: NA = Not Applicable

COPC = Chemical of Potential Concern

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered

MCL = Maximum Contaminant Level

J = Estimated Value

C = Carcinogen

N = Noncarcinogen

EXAMPLE SCENARIO 2

TABLE 3.2.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Groundwater

Exposure Medium: Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (N/T)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Water Vapors at Showerhead	Bis(2-ethylhexyl)phthalate	ug/l	4	5.5 T	5 J	5	ug/l	Max	W-Test (1)
	Chloroform	ug/l	1.9	14.9 T	9	9	ug/l	Max	W-Test (1)
	Heptachlor	ug/l	27	30 T	33 J	30	ug/l	95% UCL - T	W - Test (2)

Note: Measured groundwater concentrations used to calculate EPC values.

Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T)

(1) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

(2) Shapiro-Wilk W Test indicates data are lognormally transformed.

N = Normal

T = Transformed

J = Estimated Value

EXAMPLE SCENARIO 2

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Groundwater

Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation (1)	Resident	Adult	Water Vapors at Showerhead	(1)	(1)	(1)	(1)	(1)	Foster and Chrostowski Model

(1) Refer to the Risk Assessment text for details on the modeled intake methodology, the parameters used to calculate modeled intake values, and the modeled air concentrations predicted by the Foster and Chrostowski Shower Model.

EXAMPLE SCENARIO 2

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Aquifer 1 - Tap Water	Ingestion	Bis(2-ethylhexyl)phthalate	0.005	mg/l	4.7E-005	mg/kg/day	1.4E-002	1/mg/kg/day	7E-007	1.4E-004	mg/kg/day	2.0E-002	mg/kg/day	0.007
				Chloroform	0.009	mg/l	8.5E-005	mg/kg/day	6.1E-003	1/mg/kg/day	5E-007	2.5E-004	mg/kg/day	1.0E-002	mg/kg/day	0.03
				Heptachlor	0.03	mg/l	2.8E-004	mg/kg/day	4.5E+000	1/mg/kg/day	1E-003	8.1E-004	mg/kg/day	5.0E-004	mg/kg/day	2
			Exp. Route Total								1E-003					2
			Dermal	Bis(2-ethylhexyl)phthalate	0.005	mg/l	3.9E-006	mg/kg/day	2.5E-002	1/mg/kg/day	1E-007	1.1E-005	mg/kg/day	1.1E-002	mg/kg/day	0.001
				Chloroform	0.009	mg/l	1.9E-006	mg/kg/day	6.1E-003	1/mg/kg/day	1E-008	5.5E-006	mg/kg/day	1.0E-002	mg/kg/day	0.0006
				Heptachlor	0.03	mg/l	7.6E-006	mg/kg/day	9.0E+000	1/mg/kg/day	7E-005	2.2E-005	mg/kg/day	2.5E-004	mg/kg/day	0.09
			Exp. Route Total								7E-005					0.09
		Exposure Point Total									1E-003					2
	Air	Water Vapors at Showerhead	Inhalation	Bis(2-ethylhexyl)phthalate	0.005	mg/l (1)	2.3E-006	mg/kg/day	NA	NA	NA	3.6E-006	mg/kg/day	NA	NA	NA
				Chloroform	0.009	mg/l (1)	1.3E-004	mg/kg/day	8.1E-002	1/mg/kg/day	1E-005	3.9E-004	mg/kg/day	8.6E-005	mg/kg/day	5
				Heptachlor	0.03	mg/l (1)	2.6E-004	mg/kg/day	4.5E+000	1/mg/kg/day	1E-003	7.7E-004	mg/kg/day	NA	NA	NA
			Exp. Route Total								1E-003					5
		Exposure Point Total									1E-003					5
											Total of Receptor Risks Across All Media					Total of Receptor Hazards Across All Media
											2E-003					7

(1) EPC values are shown as measured groundwater values and are found on Table 3.2.RME.

Example Scenario No. 3
Measured Data and Subsequent Ingestion (Planning Tables 1, 2 and 3)

Scenario Description: Measured fish tissue data are available for evaluation in the risk assessment. The data are available for a specific species: trout. The measured data will be used in the risk assessment to determine the potential for adverse effects from ingestion of fish. This scenario is based upon fish tissue to show how to include measured data in the tables, but it can be applied to other exposure media.

Planning Table Issues Associated with this Scenario:

1. How will Planning Table 1 show fish tissue exposure?
   In this situation, it is assumed that the source of exposure for the fish was the sediment, Planning Table 1 will need to show a specific exposure point for the trout as follows:

   Medium: Sediment
   Exposure Medium: Fish Tissue
   Exposure Point: Trout

2. What data will be included in Planning Table 2 - measured fish tissue data or sediment data?
   Planning Table 2 will show measured trout analytical data. The data will be screened against fish tissue screening values.

3. What data will be included in Planning Table 3?
   Planning Table 3 will show measured fish tissue statistics for the trout.

EXAMPLE SCENARIO 3

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

The Dean Company

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Sediment	Sediment	Pond 1	Receptor Population	Age 1	Route 1	Quant	Rationale
						Route 2	Quant	Rationale
					Age 2	Route 1	Quant	Rationale
						Route 2	Quant	Rationale
		Fish Tissue	Trout	Receptor Population	Age 1	Route 1	Quant	Rationale
					Age 2	Route 1	Quant	Rationale

EXAMPLE SCENARIO 3

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The Dean Company

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Fish Tissue

Exposure Point	CAS Number	Chemical	Minimum (1) Concentration (Qualifier)	Maximum (1) Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
Trout	11096825	Arochlor 1260	0.0002 J	0.005 J	mg/kg	Trout - 1	3 / 10	0.0001 - 0.0001	0.005	NA	0.0016 C	NA	NA	Y	ASL
	7439921	Lead	0.004 J	0.007 J	mg/kg	Trout - 3	5 / 10	0.001 - 0.001	0.007	NA	NA	NA	NA	Y	NTX
	1746016	2,3,7,8-Tetrachlorodibenzodioxin	0.00000001 J	0.00000005 J	mg/kg	Trout - 1	4 / 10	0.00000001 - 0.00000001	0.00000005	NA	0.000000021 C	NA	NA	Y	ASL

(1) Measured fish tissue concentrations. Maximum measured fish tissue concentrations used for screening.

(2) Background values are not available.

(3) All compounds were screened against the Risk-Based Concentration (RBC) Table, U.S. EPA Region III, May 8, 2001 for fish tissue (cancer benchmark = 1E-06; HQ = 0.1).

(4) Rationale Codes:

Selection Reason: Above Screening Level (ASL)
No Toxicity Infomation (NTX)

Definitions:

NA = Not Applicable
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
J = Estimated Value
C = Carcinogen
N = Noncarcinogen

EXAMPLE SCENARIO 3

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Sediment

Exposure Medium: Fish Tissue

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (N/T)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Trout	Arochlor 1260	mg/kg	0.003	0.0035 (T)	0.005 J	0.0035	mg/kg	95% UCL - T	W - Test (1)
	Lead	mg/kg	0.005	0.0063 (T)	0.007 J	0.0063	mg/kg	95% UCL - T	W - Test (1)
	2,3,7,8-Tetrachlorodibenzodioxin	mg/kg	0.00000002	0.000000047 (T)	0.00000005 J	0.000000047	mg/kg	95% UCL -T	W - Test (1)

Statistics: 95% UCL of Transformed Data (95% UCL - T)

(1) Shapiro-Wilk W Test indicates data are log-normally distributed.

Note: Measured fish tissue concentrations used to calculate EPC values.

N = Normal

T = Transformed

J = Estimated Value

Example Scenario No. 4
Modeled Data and Subsequent Ingestion (Planning Tables 1 and 2)

Scenario Description: Modeled fish tissue data are available for evaluation in the risk assessment based on concentrations of contaminants in the sediment. The modeled data will be used in the risk assessment to determine the potential for adverse effects from ingestion of the fish. This scenario is based upon fish tissue to show how to include modeled data in the tables, but it can be applied to other exposure media.

Planning Table Issues Associated with this Scenario:

The primary issue with this scenario is what data to show on Planning Table 2 and subsequent tables (modeled fish tissue or measured sediment data). There are two options for data presentation.

> Option 1 (Modeled Fish Tissue Concentrations): The modeled fish tissue concentrations could appear on Planning Table 2 in the Concentration Used for Screening column. These modeled concentrations would be screened against fish tissue screening values. The methodology used to develop the modeled concentrations should be referenced on the tables. This option should be used when screening on fish tissue concentrations.
>
> Option 2 (Measured Sediment Concentrations): Measured sediment concentrations could be presented on Planning Table 2. The measured concentrations are the values used as input in the model to determine predicted fish tissue concentrations. The modeling methodology could be discussed in the text and referenced on Planning Table 4. The model results would be used for intake calculations in Planning Table 7. This option should be used when screening on sediment concentrations.

1. How will Planning Table 1 show fish tissue exposure?
   Assuming the source of exposure for the fish is sediment, Planning Table 1 will need to show a specific exposure point for the fish as follows:

   Medium: Sediment
   Exposure Medium: Fish Tissue
   Exposure Point: Trout

2. What data will be included in Planning Table 2 - measured sediment data or modeled fish tissue data?
   See discussion of options, above, and footnotes on Planning Table 2.

EXAMPLE SCENARIO 4

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

The Dean Company

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Timeframe	Sediment	Fish Tissue	Trout	Population 1	Age 1	Route 1	Quant	Rationale
					Age 2	Route 1	Quant	Rationale
				Population 2	Age 1	Route 1	Quant	Rationale
					Age 2	Route 1	Quant	Rationale

EXAMPLE SCENARIO 4
Option 1

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The Dean Company

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Fish Tissue

Exposure Point	CAS Number	Chemical	Minimum Concentration (1) (Qualifier)	Maximum Concentration (1) (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (4) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)
Trout	11096825	Arochlor 1260	0.6 J	5.5 J	mg/kg	SD01	3 / 10	0.1 - 0.2	0.005	NA	0.0016 (C)	NA	NA	Y	ASL
	7439921	Lead	210 J	500 J	mg/kg	SD03	5 / 10	10 - 16	0.007	NA	NA	NA	NA	Y	NTX
	1746016	2,3,7,8-Tetrachlorodibenzodioxin	0.000001 J	0.00005 J	mg/kg	SD01	4 / 10	0.000001 - 0.000001	0.00000005	NA	0.000000021 (C)	NA	NA	Y	ASL

(1) Measured sediment concentrations.

(2) Concentrations used for screening are fish tissue values derived from the X model. Refer to the risk assessment text for details on the model methodology.

(3) To date, no background study has been completed.

(4) All compounds were screened against the Risk-Based Concentration (RBC) Table, U.S. EPA Region III, May 8, 2001 for fish tissue (cancer benchmark = 1E-06; HQ = 0.1).

(5) Rationale Codes:

Selection Reason: Above Screening Level (ASL)
No Toxicity Infomation (NTX)

EXAMPLE SCENARIO 4
Option 2

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The Dean Company

Scenario Timeframe: Future
Medium: Sediment
Exposure Medium: Fish Tissue

Exposure Point	CAS Number	Chemical	Minimum Concentration (1) (Qualifier)	Maximum Concentration (1) (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
Trout	11096825	Arochlor 1260	0.6 J	5.5 J	mg/kg	SD01	3 / 10	0.1 - 0.2	5.5	NA	3.2 (C)	NA	NA	Y	ASL
	7439921	Lead	210 J	500 J	mg/kg	SD03	5 / 10	10 - 16	500	NA	400	NA	NA	Y	ASL
	1746016	2,3,7,8-Tetrachlorodibenzodioxin	0.000001 J	0.00005 J	mg/kg	SD01	4 / 10	0.000001 - 0.000001	0.00005	NA	0.000043 (C)	NA	NA	Y	ASL

(1) Measured sediment concentrations are shown and maximum concentrations are used for screening. These data will be used as input in the X model to predict fish tissue concentrations. Refer to the risk assessment text for details on the model methodology.

(2) To date, no background study has been completed.

(3) All compounds were screened against the Risk-Based Concentration (RBC) Table, U.S. EPA Region III, May 8, 2001 for 10 times the residential soil value (cancer benchmark = 10 x 1E-06; HQ = 10 x 0.1). Lead was screened against the U.S. EPA screening value of 400 mg/kg.

(4) Rationale Codes:

Selection Reason: Above Screening Level (ASL)

Definitions:

NA = Not Applicable
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
J = Estimated Value
C = Carcinogen
N = Noncarcinogen

Example Scenario No. 5
Modeled Data (Planning Table 1)

Scenario Description: The risk assessment uses data that have been modeled to evaluate potential risks. The modeling results are for spatial changes, temporal changes, and transfer between media.

Planning Table Issues Associated with this Scenario:

The issue associated with this scenario is how to identify and evaluate each different modeled data set. In this temporal change example, groundwater data have been modeled to represent concentrations in future years (1 year, 2 years, and 5 years in the future). This evaluation can be accommodated by assigning a separate exposure point to each future year.

1. How will Planning Table 1 be completed?

   Planning Table 1 could show temporal changes using the exposure point column, as shown on the accompanying table.

EXAMPLE SCENARIO 5

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

Site Name

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Groundwater	Groundwater	Groundwater - Modeled 1 year into the future	Resident	Adult	Ingestion	Quant	Rationale
						Dermal	Quant	Rationale
			Groundwater - Modeled 2 Years into the Future	Resident	Adult	Ingestion	Quant	Rationale
						Dermal	Quant	Rationale
			Groundwater - Modeled 5 Years into the Future	Resident	Adult	Ingestion	Quant	Rationale
						Dermal	Quant	Rationale

Example Scenario No. 6
Multiple Source Exposures (Planning Table 1)

Scenario Description: The risk assessment is evaluating the ingestion of fish tissue affected by both contaminated surface water and sediment.

Planning Table Issues Associated with this Scenario:

1. How will the medium, exposure medium, and exposure point be represented in Planning Table 1 for fish tissue?

The exposure point for fish tissue ingestion can be presented in two different ways, as described in the options below:

Option 1

Medium: Surface Water/Sediment
Exposure Medium: Fish Tissue
Exposure Point: Trout - contaminant uptake from surface water and sediment

This option should be used if screening will be performed against measured or modeled fish tissue data.

Option 2

Medium: Surface Water
Exposure Medium: Fish Tissue
Exposure Point: Trout - contaminant uptake from surface water

AND

Medium: Sediment
Exposure Medium: Fish Tissue
Exposure Point: Trout - contaminant uptake from sediment

This option should be used if screening will be performed against measured surface water or sediment data.

EXAMPLE SCENARIO 6
OPTION 1

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

The Dean Company

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Surface Water/Sediment	Fish Tissue	Trout--Contaminant Uptake from Surface Water and Sediment	Receptor Population	Age 1	Ingestion	Quant	Rationale
					Age 2	Ingestion	Quant	Rationale

EXAMPLE SCENARIO 6
OPTION 2

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

The Dean Company

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Surface Water	Fish Tissue	Trout--Contaminant Uptake from Surface Water	Receptor Population	Age 1	Ingestion	Quant	Rationale
					Age 2	Ingestion	Quant	Rationale
	Sediment	Fish Tissue	Trout--Contaminant Uptake from Sediment	Receptor Population	Age 1	Ingestion	Quant	Rationale
					Age 2	Ingestion	Quant	Rationale

Example Scenario No. 7
Possible Summing Options (Planning Tables 9 and 10)

Scenario Description: The risk assessment is evaluating several different exposure points for a particular set of media and exposure media. The EPA risk assessor for the site may allow the risk assessor to use abridged versions of Planning Tables 9 and 10 which do not require the same level of summation as the version of Planning Tables 9 and 10 shown in Appendix A.

Planning Table Issues Associated with this Scenario:

1. How will the risk data be summed on Planning Tables 9 and 10 for medium, exposure medium, exposure point, and receptor (combination of scenario timeframe, receptor population, and receptor age)?

The summing of risk for these exposure pathway elements can be presented in two different ways, as described in the options below. The EPA risk assessor will determine the type of summing that is appropriate for a particular site.

Option 1

Summing will occur in the standard fashion at four levels: medium, exposure medium, exposure point, and receptor.

Option 1 is shown in the accompanying tables and in Appendix A

Option 2

Summing will occur at fewer levels only: e.g., for exposure point and receptor only. Consult the EPA risk assessor to determine the appropriate procedure to follow.

Option 2 is shown in the accompanying tables.

EXAMPLE SCENARIO 7

Option 1

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Aquifer 1 - Tap Water	Bis(2-ethylhexyl)phthalate	7E-07	- -	1E-07	- -	8E-07	Liver	0.007	- -	0.001	0.008
			Chloroform	5E-07	- -	1E-08	- -	5E-07	Liver	0.03	- -	0.0006	0.03
			Chemical Total	1E-06	- -	1E-07	- -	1E-06		0.03	- -	0.002	0.04
			Radionuclide Total										
		Exposure Point Total						1E-06					0.04
	Exposure Medium Total							1E-06					0.04
	Air	Water Vapors from Showerhead	Bis(2-ethylhexyl)phthalate	- -	3E-08	- -	- -	3E-08	- -	- -	- -	- -	- -
			Chloroform	- -	1E-05	- -	- -	1E-05	Liver	- -	5	- -	5
			Chemical Total	- -	1E-05	- -	- -	1E-05		- -	5	- -	5
			Radionuclide Total										
		Exposure Point Total						1E-05					5
	Exposure Medium Total							1E-05					5
Groundwater Total								1E-05					5

EXAMPLE SCENARIO 7

Option 1

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Soil at Site 1	4,4'-DDE	1E-06	- -	1E-06	- -	2E-06	- -	- -	- -	- -	- -
			4,4'-DDT	5E-06	- -	5E-006	- -	1E-005	Liver	0.08	- -	0.08	0.2
			Chemical Total	6E-06	- -	6E-06	- -	1E-05		0.08		0.08	0.2
			Radionuclide Total										
		Exposure Point Total						1E-05					0.2
		Soil at Site 2	4,4'-DDE	8E-08	- -	8E-08	- -	2E-07	- -	- -	- -	- -	- -
			4,4'-DDT	5E-08	- -	5E-08	- -	1E-07	Liver	0.0009	- -	0.0009	0.002
			Chemical Total	1E-07	- -	1E-07	- -	3E-07		0.0009		0.0009	0.002
			Radionuclide Total										
		Exposure Point Total						3E-07					0.002
	Exposure Medium Total							1E-05					0.002
Soil Total								1E-05					0.002
Receptor Total								2E-05					5

Total Risk Across All Media: 2E-05

Total Hazard Across All Media: 5

Total Liver HI Across All Media = 5

EXAMPLE SCENARIO 7
Option 2

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Aquifer 1 - Tap Water	Bis(2-ethylhexyl)phthalate	7E-07	--	1E-07	--	8E-07	Liver	0.007	--	0.001	0.008
			Chloroform	5E-07	--	1E-08	--	5E-07	Liver	0.03	--	0.0006	0.03
			Chemical Total	1E-06	--	1E-07	--	1E-06		0.03	--	0.002	0.04
			Radionuclide Total										
		Exposure Point Total						1E-06					0.04
	Air	Water Vapors from Showerhead	Bis(2-ethylhexyl)phthalate	--	3E-08	--	--	3E-08	--	--	--	--	--
			Chloroform	--	1E-05	--	--	1E-05	Liver	--	5	--	5
			Chemical Total	--	1E-05	--	--	1E-05		--	5	--	5
			Radionuclide Total										
		Exposure Point Total						1E-05					5
Soil	Soil	Soil at Site 1	4,4'-DDE	1E-06	--	1E-06	--	2E-06	--	--	--	--	--
			4,4'-DDT	5E-06	--	5E-006	--	1E-005	Liver	0.08	--	0.08	0.2
			Chemical Total	6E-06	--	6E-06	--	1E-05		0.08		0.08	0.2
			Radionuclide Total										
		Exposure Point Total						1E-05					0.2
		Soil at Site 2	4,4'-DDE	8E-08	--	8E-08	--	2E-07	--	--	--	--	--
			4,4'-DDT	5E-08	--	5E-08	--	1E-07	Liver	0.0009	--	0.0009	0.002
			Chemical Total	1E-07	--	1E-07	--	3E-07		0.0009		0.0009	0.002
			Radionuclide Total										
		Exposure Point Total						3E-07					0.002

Total Risk Across All Media: 2E-05

Total Hazard Across All Media = 5

Total Liver HI Across All Media = 5

EXAMPLE SCENARIO 7

Option 1

TABLE 10.1.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Water Vapors from Showerhead	Chloroform	- -	1E-05	- -	- -	1E-05	Liver	- -	5	- -	5
			Chemical Total	- -	1E-05	- -	- -	1E-05		- -	5	- -	5
			Radionuclide Total										
		Exposure Point Total						1E-05					5
	Exposure Medium Total							1E-05					5
Groundwater Total								1E-05					5
Soil	Soil	Soil at Site 1	4,4'-DDE	1E-06	- -	1E-06	- -	2E-06	- -	- -	- -	- -	- -
			4,4'-DDT	5E-06	- -	5E-06	- -	1E-05	- -	- -	- -	- -	- -
			Chemical Total	6E-06	- -	6E-06	- -	1E-05		- -		- -	- -
			Radionuclide Total										
		Exposure Point Total						1E-05					- -
	Exposure Medium Total							1E-05					- -
Soil Total								1E-05					- -
Receptor Total								2E-05					5

Total Risk Across All Media: 2E-05

Total Hazard Across All Media: 5

Cancer risks presented are those greater than 1E-06; Non-cancer risks presented are those greater than 1.

Total Liver HI Across All Media = 5

EXAMPLE SCENARIO 7

Option 2

TABLE 10.1.RME

RISK SUMMARY

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Air	Water Vapors from Showerhead	Chloroform	- -	1E-05	- -	- -	1E-05	Liver	- -	5	- -	5
			Chemical Total	- -	1E-05	- -	- -	1E-05		- -	5	- -	5
			Radionuclide Total										
		Exposure Point Total						1E-05					5
Soil	Soil	Soil at Site 1	4,4'-DDE	1E-06	- -	1E-06	- -	2E-06	- -	- -	- -	- -	- -
			4,4'-DDT	5E-06	- -	5E-006	- -	1E-005	- -	- -	- -	- -	- -
			Chemical Total	6E-06	- -	6E-06	- -	1E-05		- -		- -	- -
			Radionuclide Total										
		Exposure Point Total						1E-05					- -

Total Risk Across All Media: 2E-05

Total Hazard Across All Media = 5

Cancer risks presented are those greater than 1E-06; Non-cancer risks presented are those greater than 1.

Total Liver HI Across All Media = 5

Example Scenario No. 8
Child/Adult Lifetime Cancer Risk (Planning Tables 1, 4, 7, 9)

Scenario Description: For this risk assessment the lifetime risk will be evaluated. Lifetime risk evaluates the combined risk from childhood through adulthood.

Planning Table Issues Associated with this Scenario:
In some regions, lifetime cancer risks are calculated by adding child and adult risk estimates together. In other regions, age-adjusted exposure factors are used to calculate lifetime cancer risk.

1. How should lifetime cancer risk be presented on Planning Table 1?
   For the "receptor age" column, choose from the picklist and enter "Adult", "Child", and "Child/Adult"

2. How should the other Planning Tables be completed?
   Two options are presented:

   Option 1–Child/Adult calculated through summing cancer risks for separate Child and Adult receptors

   Planning Tables 1, 4, and 7 would have separate Child and Adult receptor ages. Planning Table 1 would also show a Child/Adult receptor to indicate that the Child/Adult analyses will be performed. Planning Table 4s would be developed for Child and Adult receptors with appropriate exposure factor values. A Planning Table 4 would also be shown for the Child/Adult receptor with no exposure factor values provided. Instead, a note would indicate that Child/Adult cancer risks will be calculated based upon the sum of Child cancer risk and Adult cancer risk.

   Planning Table 7s and 9s would then be developed for three receptor ages: Child, Adult, and Child/Adult (a version of Planning Tables 7 and 9 combining the Child and the Adult cancer risk data into a single Child/Adult table with a note that the data on the table was derived from summing the Child and Adult data).

   Option 2–Child/Adult calculated using age-adjusted exposure factors

   As in Option 1, Planning Tables 1, 4, and 7 in Option 2 would show separate Child and Adult receptor ages as well as the Child/Adult receptor age. For the Option 2 Planning Table 4, the Child/Adult receptor age would be shown with age-adjusted exposure factor values. For the Option 2 Planning Tables 7 and 9, the Child/Adult cancer risks would be calculated using age-adjusted exposure factor values.

EXAMPLE SCENARIO 8

Option 1

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

The Dean Company

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Soil	Soil	Soil at Site 1	Resident	Adult	Dermal	Quant	Future onsite residents may come into contact with soil.
						Ingestion	Quant	Future onsite residents may ingest soil.
					Child	Dermal	Quant	Future onsite residents may come into contact with soil.
						Ingestion	Quant	Future onsite residents may ingest soil.
					Child/Adult	Dermal	Quant	Future onsite residents may come into contact with soil.
						Ingestion	Quant	Future onsite residents may ingest soil.

EXAMPLE SCENARIO 8

Option 2

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

The Dean Company

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Soil	Soil	Soil at Site 1	Resident	Adult	Dermal	Quant	Future onsite residents may come into contact with soil.
						Ingestion	Quant	Future onsite residents may ingest soil.
					Child	Dermal	Quant	Future onsite residents may come into contact with soil.
						Ingestion	Quant	Future onsite residents may ingest soil.
					Child/Adult	Dermal	Quant	Future onsite residents may come into contact with soil.
						Ingestion	Quant	Future onsite residents may ingest soil.

EXAMPLE SCENARIO 8
Option 1

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR	Ingestion Rate of Soil	100	mg/day	EPA, 1991	CS x IR x FI x EF x ED x CF1 x 1/BW x 1/AT
				FI	Fraction Ingested	1	- -	Professional Judgment	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
				CF1	Conversion Factor	1E-06	kg/mg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 1989	
		Child	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	CDI (mg/kg-day) =
				IR	Ingestion Rate of Soil	200	mg/day	EPA, 1991	CS x IR x FI x EF x ED x CF1 x 1/BW x 1/AT
				FI	Fraction Ingested	1	- -	Professional Judgment	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	
				CF1	Conversion Factor	1E-06	kg/mg	- -	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	
				AT-N	Averaging Time - Non-Cancer	2,190	days	EPA, 1989	
		Child/Adult	Soil at Site 1	- -	- -	- -	- -	- -	Child/Adult cancer risks will be calculated as the sum of the Child cancer risk and the Adult cancer risk.

EXAMPLE SCENARIO 8
Option 1

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Resident	Adult	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	CDI (mg/kg-day) =
				CF1	Conversion Factor	1E-06	kg/mg	- -	CS x CF1 x SA x AF x AB x EF x ED x 1/BW x 1/AT
				SA	Skin Surface Area Available for Contact	5,000	cm2	EPA, 1997	
				AF	Soil to Skin Adherence Factor	0.19	mg/cm2	EPA, 1997	
				AB	Absorption Factor	chemical-specific	unitless	EPA, 1995	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 1989	
		Child	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	CDI (mg/kg-day) =
				CF1	Conversion Factor	1E-06	kg/mg	- -	CS x CF1 x SA x AF x AB x EF x ED x 1/BW x 1/AT
				SA	Skin Surface Area Available for Contact	3,600	cm2	EPA, 1997	
				AF	Soil to Skin Adherence Factor	0.11	mg/cm2	EPA, 1997	
				AB	Absorption Factor	chemical-specific	unitless	EPA, 1995	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	
				AT-N	Averaging Time - Non-Cancer	2,190	days	EPA, 1989	
		Child/Adult	Soil at Site 1	- -	- -	- -	- -	- -	Child/Adult cancer risks will be calculated as the sum of the Child cancer risk and the Adult cancer risk.

EPA 1989: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual, Part A. OERR EPA/540/1-89/002.

EPA 1991: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER 9285.6-03.

EPA 1995: Assessing Dermal Exposure from Soil, Technical Guidance Manual, Region III, EPA/903-K-95-003.

EPA 1997: Exposure Factors Handbook, Volume 1. EPA/600/P-95/002Fa.

EXAMPLE SCENARIO 8
Option 2

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR	Ingestion Rate of Soil	100	mg/day	EPA, 1991	CS x IR x FI x EF x ED x CF1 x 1/BW x 1/AT
				FI	Fraction Ingested	1	- -	Professional Judgment	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
				CF1	Conversion Factor	1.0E-06	kg/mg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 1989	
		Child	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	CDI (mg/kg-day) =
				IR	Ingestion Rate of Soil	200	mg/day	EPA, 1991	CS x IR x FI x EF x ED x CF1 x 1/BW x 1/AT
				FI	Fraction Ingested	1	- -	Professional Judgment	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	
				CF1	Conversion Factor	1.0E-06	kg/mg	- -	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	
				AT-N	Averaging Time - Non-Cancer	2,190	days	EPA, 1989	
		Child/Adult	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	CDI (mg/kg/day) =
				IF	Ingestion Factor	114	mg-year/kg-day	EPA 1991b	CS x IF x CF x FI x EF x 1/AT
				BW-C	Body Weight, Child	15	kg	EPA, 1991a	where
				BW-A	Body Weight, Adult	70	kg	EPA, 1991a	IF = (ED-C x IR-C / BW-C) + (ED-TOT - ED-C) x
				IR-C	Ingestion Rate, Child	200	mg/day	EPA, 1991a	(IR-A / BW-A)
				IR-A	Ingestion Rate, Adult	100	mg/day	EPA, 1991a	
				ED-C	Exposure Duration, Child	6	years	EPA, 1991a	
				ED-TOT	Exposure Duration, Total	30	years	EPA, 1991a	
				CF	Conversion Factor	1.0E-06	kg/mg	- -	
				FI	Fraction Ingested	1	unitless	Professional Judgment	
				EF	Exposure Frequency	350	days/year	EPA, 1991a	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	

EXAMPLE SCENARIO 8
Option 2

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Soil

Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Resident	Adult	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	CDI (mg/kg-day) =
				CF1	Conversion Factor	1.0E-06	kg/mg	- -	CS x CF1 x SA x AF x AB x EF x ED x 1/BW x 1/AT
				SA	Skin Surface Area Available for Contact	5,000	cm2	EPA, 1997	
				AF	Soil to Skin Adherence Factor	0.19	mg/cm2	EPA, 1997	
				AB	Absorption Factor	chemical-specific	unitless	EPA, 1995	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 1989	
		Child	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	CDI (mg/kg-day) =
				CF1	Conversion Factor	1.0E-06	kg/mg	- -	CS x CF1 x SA x AF x AB x EF x ED x 1/BW x 1/AT
				SA	Skin Surface Area Available for Contact	3,600	cm2	EPA, 1997	
				AF	Soil to Skin Adherence Factor	0.11	mg/cm2	EPA, 1997	
				AB	Absorption Factor	chemical-specific	unitless	EPA, 1995	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	
				AT-N	Averaging Time - Non-Cancer	2,190	days	EPA, 1989	

EXAMPLE SCENARIO 8
Option 2

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Soil

Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal (continued)	Resident (continued)	Child/Adult	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	CDI (mg/kg-day) =
				DF	Dermal Factor	3,154	cm2-year/kg-day	EPA 1991b	CS x CF1 x DF x AF x AB x EF x 1/AT
				BW-C	Body Weight, Child	15	kg	EPA, 1991a	where
				BW-A	Body Weight, Adult	70	kg	EPA, 1991a	DF = (ED-C x SA-C / BW-C) + (ED-TOT - ED-C) x
				SA-C	Surface Area, Child	3,600	cm2	EPA, 1997	(SA-A / BW-A)
				SA-A	Surface Area, Adult	5,000	cm2	EPA, 1997	
				ED-C	Exposure Duration, Child	6	years	EPA, 1991a	
				ED-TOT	Exposure Duration, Total	30	years	EPA, 1991a	
				AF	Soil to Skin Adherence Factor	0.15	mg/cm2	Professional Judgment	
				EF	Exposure Frequency	350	days/year	EPA 1991a	
				AB	Absorption Factor	chemical-specific	unitless	EPA, 1995	
				CF1	Conversion Factor	1.0E-06	kg/mg	- -	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	

EPA 1989: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual, Part A. OERR EPA/540/1-89/002.

EPA 1991a: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER 9285.6-03.

EPA 1991b: Human Health Evaluation Manual, Part B: Development of Risk-Based Preliminary Remediation Goals. OSWER Directive 9285.7-01B

EPA 1997: Exposure Factors Handbook, Volume 1. EPA/600/P-95/002Fa.

EPA 1995: Assessing Dermal Exposure from Soil, Technical Guidance Manual, Region III, EPA/903-K-95-003.

EXAMPLE SCENARIO 8
Option 1

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Soil	Soil at Site 1	Ingestion	4,4'-DDD	0.452	mg/kg	2.1E-07	mg/kg/day	2.4E-01	1/mg/kg/day	5E-08	6.2E-07	mg/kg/day	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	3.2E-06	mg/kg/day	3.4E-01	1/mg/kg/day	1E-06	9.3E-06	mg/kg/day	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	1.3E-005	mg/kg/day	3.4E-01	1/mg/kg/day	5E-06	3.9E-05	mg/kg/day	5.0E-04	mg/kg/day	0.08
				Aluminum	9964	mg/kg	4.7E-003	mg/kg/day	NA	NA	NA	1.4E-02	mg/kg/day	1.0E+00	mg/kg/day	0.01
				Manganese	201	mg/kg	9.5E-005	mg/kg/day	NA	NA	NA	2.8E-04	mg/kg/day	1.4E-01	mg/kg/day	0.002
				Thallium	1.2	mg/kg	5.6E-007	mg/kg/day	NA	NA	NA	1.6E-06	mg/kg/day	NA	NA	NA
			Exp. Route Total								6E-06					0.09
			Dermal	4,4'-DDD	0.452	mg/kg	2.0E-007	mg/kg/day	2.7E-01	1/mg/kg/day	5E-08	5.9E-07	mg/kg/day	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	3.0E-06	mg/kg/day	3.8E-01	1/mg/kg/day	1E-06	8.8E-06	mg/kg/day	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	1.3E-005	mg/kg/day	3.8E-01	1/mg/kg/day	5E-06	3.7E-005	mg/kg/day	4.5E-004	mg/kg/day	0.08
				Aluminum	9964	mg/kg	4.5E-004	mg/kg/day	NA	NA	NA	1.3E-003	mg/kg/day	2.7E-001	mg/kg/day	0.005
				Manganese	201	mg/kg	9.0E-006	mg/kg/day	NA	NA	NA	2.6E-005	mg/kg/day	7.0E-03	mg/kg/day	0.004
				Thallium	1.2	mg/kg	5.3E-008	mg/kg/day	NA	NA	NA	1.5E-007	mg/kg/day	NA	NA	NA
			Exp. Route Total								6E-06					0.09
		Exposure Point Total									1E-05					0.2
	Expsoure Medium Total										1E-05					0.2
Soil Total											1E-05					0.2
									Total of Receptor Risks Across All Media		1E-05			Total of Receptor Hazards Across All Media		0.2

EXAMPLE SCENARIO 8
Option 1

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Soil	Soil at Site 1	Ingestion	4,4'-DDD	0.452	mg/kg	5.0E-07	mg/kg/day	2.4E-01	1/mg/kg/day	1E-07	5.8E-06	mg/kg/day	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	7.4E-06	mg/kg/day	3.4E-01	1/mg/kg/day	3E-06	8.7E-05	mg/kg/day	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	3.1E-005	mg/kg/day	3.4E-01	1/mg/kg/day	1E-05	3.7E-004	mg/kg/day	5.0E-04	mg/kg/day	0.7
				Aluminum	9964	mg/kg	1.1E-002	mg/kg/day	NA	NA	NA	1.3E-001	mg/kg/day	1.0E+00	mg/kg/day	0.1
				Manganese	201	mg/kg	2.2E-004	mg/kg/day	NA	NA	NA	2.6E-003	mg/kg/day	1.4E-01	mg/kg/day	0.02
				Thallium	1.2	mg/kg	1.3E-006	mg/kg/day	NA	NA	NA	1.5E-005	mg/kg/day	NA	NA	NA
			Exp. Route Total								1E-05					0.8
			Dermal	4,4'-DDD	0.452	mg/kg	9.8E-08	mg/kg/day	2.7E-01	1/mg/kg/day	3E-08	1.1E-06	mg/kg/day	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	1.5E-06	mg/kg/day	3.8E-01	1/mg/kg/day	6E-07	1.7E-05	mg/kg/day	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	6.2E-006	mg/kg/day	3.8E-01	1/mg/kg/day	2E-06	7.2E-005	mg/kg/day	4.5E-004	mg/kg/day	0.2
				Aluminum	9964	mg/kg	2.2E-004	mg/kg/day	NA	NA	NA	2.5E-003	mg/kg/day	2.7E-001	mg/kg/day	0.009
				Manganese	201	mg/kg	4.4E-006	mg/kg/day	NA	NA	NA	5.1E-005	mg/kg/day	7.0E-003	mg/kg/day	0.007
				Thallium	1.2	mg/kg	2.6E-008	mg/kg/day	NA	NA	NA	3.0E-007	mg/kg/day	NA	NA	NA
			Exp. Route Total								3E-06					0.2
		Exposure Point Total									1E-05					1
	Exposure Medium Total										1E-05					1
Medium											1E-05					1
										Total of Receptor Risks Across All Media	1E-05				Total of Receptor Hazards Across All Media	1

EXAMPLE SCENARIO 8
Option 1

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Receptor Population: Resident

Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Soil	Soil at Site 1	Ingestion	4,4'-DDD	0.452	mg/kg	7.1E-07	mg/kg/day	2.4E-01	1/mg/kg/day	2E-07	- -	- -	- -	- -	- -
				4,4'-DDE	6.8	mg/kg	1.1E-05	mg/kg/day	3.4E-01	1/mg/kg/day	4E-06	- -	- -	- -	- -	- -
				4,4'-DDT	28.6	mg/kg	4.4E-05	mg/kg/day	3.4E-01	1/mg/kg/day	2E-05	- -	- -	- -	- -	- -
				Aluminum	9964	mg/kg	1.6E-02	mg/kg/day	NA	NA	NA	- -	- -	- -	- -	- -
				Manganese	201	mg/kg	3.2E-05	mg/kg/day	NA	NA	NA	- -	- -	- -	- -	- -
				Thallium	1.2	mg/kg	1.9E-06	mg/kg/day	NA	NA	NA	- -	- -	- -	- -	- -
			Exp. Route Total								2E-05					- -
			Dermal	4,4'-DDD	0.452	mg/kg	3.0E-07	mg/kg/day	2.7E-01	1/mg/kg/day	8E-08	- -	- -	- -	- -	- -
				4,4'-DDE	6.8	mg/kg	4.5E-06	mg/kg/day	3.8E-01	1/mg/kg/day	2E-06	- -	- -	- -	- -	- -
				4,4'-DDT	28.6	mg/kg	1.9E-05	mg/kg/day	3.8E-01	1/mg/kg/day	7E-06	- -	- -	- -	- -	- -
				Aluminum	9964	mg/kg	6.7E-04	mg/kg/day	NA	NA	NA	- -	- -	- -	- -	- -
				Manganese	201	mg/kg	1.3E-05	mg/kg/day	NA	NA	NA	- -	- -	- -	- -	- -
				Thallium	1.2	mg/kg	7.9E-08	mg/kg/day	NA	NA	NA	- -	- -	- -	- -	- -
			Exp. Route Total								9E-06	- -	- -	- -	- -	- -
		Exposure Point Total									3E-05					- -
	Exposure Medium Total										3E-05					- -
Medium											3E-05					- -
											Total of Receptor Risks Across All Media					Total of Receptor Hazards Across All Media

Note: Child/Adult cancer risk was calculated as the sum of the Child cancer risk (Table 7.2.RME) and the Adult cancer risk (Table 7.1.RME).

EXAMPLE SCENARIO 8
Option 2

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Receptor Population: Resident

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Soil	Soil at Site 1	Ingestion	4,4'-DDD	0.452	mg/kg	2.1E-07	mg/kg/day	2.4E-01	1/mg/kg/day	5E-08	6.2E-07	mg/kg/day	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	3.2E-06	mg/kg/day	3.4E-01	1/mg/kg/day	1E-06	9.3E-06	mg/kg/day	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	1.3E-005	mg/kg/day	3.4E-01	1/mg/kg/day	5E-06	3.9E-05	mg/kg/day	5.0E-04	mg/kg/day	0.08
				Aluminum	9964	mg/kg	4.7E-003	mg/kg/day	NA	NA	NA	1.4E-02	mg/kg/day	1.0E+00	mg/kg/day	0.01
				Manganese	201	mg/kg	9.5E-005	mg/kg/day	NA	NA	NA	2.8E-04	mg/kg/day	1.4E-01	mg/kg/day	0.002
				Thallium	1.2	mg/kg	5.6E-007	mg/kg/day	NA	NA	NA	1.6E-06	mg/kg/day	NA	NA	NA
			Exp. Route Total								6E-06					0.09
			Dermal	4,4'-DDD	0.452	mg/kg	2.0E-007	mg/kg/day	2.7E-01	1/mg/kg/day	5E-08	5.9E-07	mg/kg/day	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	3.0E-06	mg/kg/day	3.8E-01	1/mg/kg/day	1E-06	8.8E-06	mg/kg/day	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	1.3E-005	mg/kg/day	3.8E-01	1/mg/kg/day	5E-06	3.7E-005	mg/kg/day	4.5E-004	mg/kg/day	0.08
				Aluminum	9964	mg/kg	4.5E-004	mg/kg/day	NA	NA	NA	1.3E-003	mg/kg/day	2.7E-001	mg/kg/day	0.005
				Manganese	201	mg/kg	9.0E-006	mg/kg/day	NA	NA	NA	2.6E-005	mg/kg/day	7.0E-03	mg/kg/day	0.004
				Thallium	1.2	mg/kg	5.3E-008	mg/kg/day	NA	NA	NA	1.5E-007	mg/kg/day	NA	NA	NA
			Exp. Route Total								6E-06					0.09
		Exposure Point Total									1E-05					0.2
	Exposure Medium Total										1E-05					0.2
Soil Total											1E-05					0.2
											Total of Receptor Risks Across All Media					Total of Receptor Hazards Across All Media
											1E-05					0.2

EXAMPLE SCENARIO 8
Option 2

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Receptor Population: Resident

Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Soil	Soil at Site 1	Ingestion	4,4'-DDD	0.452	mg/kg	5.0E-07	mg/kg/day	2.4E-01	1/mg/kg/day	1E-07	5.8E-06	mg/kg/day	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	7.4E-06	mg/kg/day	3.4E-01	1/mg/kg/day	3E-06	8.7E-05	mg/kg/day	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	3.1E-005	mg/kg/day	3.4E-01	1/mg/kg/day	1E-05	3.7E-004	mg/kg/day	5.0E-04	mg/kg/day	0.7
				Aluminum	9964	mg/kg	1.1E-002	mg/kg/day	NA	NA	NA	1.3E-001	mg/kg/day	1.0E+00	mg/kg/day	0.1
				Manganese	201	mg/kg	2.2E-004	mg/kg/day	NA	NA	NA	2.6E-003	mg/kg/day	1.4E-01	mg/kg/day	0.02
				Thallium	1.2	mg/kg	1.3E-006	mg/kg/day	NA	NA	NA	1.5E-005	mg/kg/day	NA	NA	NA
			Exp. Route Total								1E-05					0.8
			Dermal	4,4'-DDD	0.452	mg/kg	9.8E-08	mg/kg/day	2.7E-01	1/mg/kg/day	3E-08	1.1E-06	mg/kg/day	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	1.5E-06	mg/kg/day	3.8E-01	1/mg/kg/day	6E-07	1.7E-05	mg/kg/day	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	6.2E-006	mg/kg/day	3.8E-01	1/mg/kg/day	2E-06	7.2E-005	mg/kg/day	4.5E-004	mg/kg/day	0.2
				Aluminum	9964	mg/kg	2.2E-004	mg/kg/day	NA	NA	NA	2.5E-003	mg/kg/day	2.7E-001	mg/kg/day	0.009
				Manganese	201	mg/kg	4.4E-006	mg/kg/day	NA	NA	NA	5.1E-005	mg/kg/day	7.0E-003	mg/kg/day	0.007
				Thallium	1.2	mg/kg	2.6E-008	mg/kg/day	NA	NA	NA	3.0E-007	mg/kg/day	NA	NA	NA
			Exp. Route Total								3E-06					0.2
		Exposure Point Total									1E-05					1
	Exposure Medium Total										1E-05					1
Soil Total											1E-05					1
										Total of Receptor Risks Across All Media	1E-05				Total of Receptor Hazards Across All Media		1

EXAMPLE SCENARIO 8
Option 2

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Soil	Soil at Site 1	Ingestion	4,4'-DDD	0.452	mg/kg	7.1E-07	mg/kg/day	2.4E-01	1/mg/kg/day	2E-07	- -	- -	- -	- -	- -
				4,4'-DDE	6.8	mg/kg	1.1E-05	mg/kg/day	3.4E-01	1/mg/kg/day	4E-06	- -	- -	- -	- -	- -
				4,4'-DDT	28.6	mg/kg	4.5E-05	mg/kg/day	3.4E-01	1/mg/kg/day	2E-05	- -	- -	- -	- -	- -
				Aluminum	9964	mg/kg	1.6E-02	mg/kg/day	NA	NA	NA	- -	- -	- -	- -	- -
				Manganese	201	mg/kg	3.1E-04	mg/kg/day	NA	NA	NA	- -	- -	- -	- -	- -
				Thallium	1.2	mg/kg	1.8E-06	mg/kg/day	NA	NA	NA	- -	- -	- -	- -	- -
			Exp. Route Total								2E-05					- -
			Dermal	4,4'-DDD	0.452	mg/kg	2.9E-07	mg/kg/day	2.7E-01	1/mg/kg/day	8E-08	- -	- -	- -	- -	- -
				4,4'-DDE	6.8	mg/kg	4.4E-06	mg/kg/day	3.8E-01	1/mg/kg/day	2E-06	- -	- -	- -	- -	- -
				4,4'-DDT	28.6	mg/kg	1.9E-05	mg/kg/day	3.8E-01	1/mg/kg/day	7E-06	- -	- -	- -	- -	- -
				Aluminum	9964	mg/kg	6.5E-04	mg/kg/day	NA	NA	NA	- -	- -	- -	- -	- -
				Manganese	201	mg/kg	1.3E-05	mg/kg/day	NA	NA	NA	- -	- -	- -	- -	- -
				Thallium	1.2	mg/kg	7.8E-08	mg/kg/day	NA	NA	NA	- -	- -	- -	- -	- -
			Exp. Route Total								9E-06					- -
		Exposure Point Total									3E-05					- -
	Exposure Medium Total										3E-05					- -
Soil Total											3E-05					- -
										Total of Receptor Risks Across All Media	3E-05				Total of Receptor Hazards Across All Media		- -

Note: Child/Adult cancer risk was calculated using age-adjusted exposure factor values.

EXAMPLE SCENARIO 8
Option 1

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Soil at Site 1	4,4'-DDD	5E-08	- -	5E-08	- -	1E-07	- -	- -	- -	- -	- -
			4,4'-DDE	1E-06	- -	1E-06	- -	2E-06	- -	- -	- -	- -	- -
			4,4'-DDT	5E-06	- -	5E-06	- -	1E-05	Liver	0.08	- -	0.08	0.2
			Aluminum	- -	- -	- -	- -	- -	Central Nervous System	0.01	- -	0.005	0.02
			Manganese	- -	- -	- -	- -	- -	Central Nervous System	0.002	- -	0.004	0.006
			Thallium	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Chemical Total	6E-06	- -	6E-06	- -	1E-05		0.09	- -	0.09	0.2
			Radionuclide Total										
		Exposure Point Total						1E-05					0.2
	Exposure Medium Total							1E-05					0.2
Soil Total								1E-05					0.2
Receptor Total								1E-05					0.2

Total Risk Across All Media 1E-05

Total Hazard Across All Media 0.2

EXAMPLE SCENARIO 8
Option 2

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Soil at Site 1	4,4'-DDD	5E-08	- -	5E-08	- -	1E-07	- -	- -	- -	- -	- -
			4,4'-DDE	1E-06	- -	1E-06	- -	2E-06	- -	- -	- -	- -	- -
			4,4'-DDT	5E-06	- -	5E-06	- -	1E-05	Liver	0.08	- -	0.08	0.2
			Aluminum	- -	- -	- -	- -	- -	Central Nervous System	0.01	- -	0.005	0.02
			Manganese	- -	- -	- -	- -	- -	Central Nervous System	0.002	- -	0.004	0.006
			Thallium	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Chemical Total	6E-06	- -	6E-06	- -	1E-05		0.09	- -	0.09	0.2
			Radionuclide Total										
		Exposure Point Total						1E-05					0.2
	Exposure Medium Total							1E-05					0.2
Soil Total								1E-05					0.2
Receptor Total								1E-05					0.2

Total Risk Across All Media 1E-05

Total Hazard Across All Media 0.2

EXAMPLE SCENARIO 8
Option 1

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Soil at Site 1	4,4'-DDD	1E-07	- -	3E-08	- -	1E-07	- -	- -	- -	- -	- -
			4,4'-DDE	3E-06	- -	6E-07	- -	3E-06	- -	- -	- -	- -	- -
			4,4'-DDT	1E-05	- -	2E-06	- -	1E-05	Liver	0.7	- -	0.2	0.9
			Aluminum	- -	- -	- -	- -	- -	Central Nervous System	0.1	- -	0.009	0.1
			Manganese	- -	- -	- -	- -	- -	Central Nervous System	0.02	- -	0.007	0.03
			Thallium	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Chemical Total	1E-05	- -	3E-06	- -	1E-05		0.8	- -	0.2	1
			Radionuclide Total										
		Exposure Point Total						1E-05					1
	Exposure Medium Total							1E-05					1
Soil Total								1E-05					1
Receptor Total								1E-05					1

Total Risk Across All Media: 1E-05

Total Hazard Across All Media: 1

EXAMPLE SCENARIO 8
Option 2

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Soil at Site 1	4,4'-DDD	1E-07	- -	3E-08	- -	1E-07	- -	- -	- -	- -	- -
			4,4'-DDE	3E-06	- -	6E-07	- -	3E-06	- -	- -	- -	- -	- -
			4,4'-DDT	1E-05	- -	2E-06	- -	1E-05	Liver	0.7	- -	0.2	0.9
			Aluminum	- -	- -	- -	- -	- -	Central Nervous System	0.1	- -	0.009	0.1
			Manganese	- -	- -	- -	- -	- -	Central Nervous System	0.02	- -	0.007	0.03
			Thallium	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Chemical Total	1E-05	- -	3E-06	- -	1E-05		0.8	- -	0.2	1
			Radionuclide Total										
		Exposure Point Total						1E-05					1
	Exposure Medium Total							1E-05					1
Soil Total								1E-05					1
Receptor Total								1E-05					1

Total Risk Across All Media: 1E-05

Total Hazard Across All Media: 1

EXAMPLE SCENARIO 8
Option 1

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Soil at Site 1	4,4'-DDD	2E-07	- -	8E-08	- -	3E-07	- -	- -	- -	- -	- -
			4,4'-DDE	4E-06	- -	2E-06	- -	6E-06	- -	- -	- -	- -	- -
			4,4'-DDT	2E-05	- -	7E-06	- -	3E-05	- -	- -	- -	- -	- -
			Aluminum	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Manganese	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Thallium	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Chemical Total	2E-05	- -	9E-06	- -	3E-05		- -	- -	- -	- -
			Radionuclide Total										
		Exposure Point Total						3E-05					- -
	Exposure Medium Total							3E-05					- -
Soil Total								3E-05					- -
Receptor Total								3E-05					- -

Total Risk Across All Media: 3E-05

Total Hazard Across All Media: - -

Note: This table represents the residential lifetime cancer risk and was derived by combining the adult residential risks and the child residential risks.

EXAMPLE SCENARIO 8
Option 2

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Soil at Site 1	4,4'-DDD	2E-07	- -	8E-08	- -	3E-07	- -	- -	- -	- -	- -
			4,4'-DDE	4E-06	- -	2E-06	- -	6E-06	- -	- -	- -	- -	- -
			4,4'-DDT	2E-05	- -	7E-06	- -	3E-05	- -	- -	- -	- -	- -
			Aluminum	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Manganese	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Thallium	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Chemical Total	2E-05	- -	9E-06	- -	3E-05		- -	- -	- -	- -
			Radionuclide Total										
		Exposure Point Total						3E-05					- -
	Exposure Medium Total							3E-05					- -
Soil Total								3E-05					- -
Receptor Total								3E-05					- -

Total Risk Across All Media: 3E-05

Total Hazard Across All Media: - -

Note: Child/Adult cancer risk was calculated using age-adjusted exposure factor values.

Example Scenario No. 9
Transfer of Contaminants Through Multiple Media (Planning Table 1)

Scenario Description: The risk assessment evaluates the potential adverse effects from contaminants in soil that is taken up by plants and then taken up by an animal that is then ingested by human receptors.

Planning Table Issues Associated with this Scenario:

1. How can Planning Table 1 accommodate this three-way transfer?
   Planning Table 1 can accommodate this scenario as follows:

   Medium: Soil
   Exposure Medium: Animal Tissue
   Exposure Point: Beef from cattle grazing in field

This example scenario assumes that only the first and last media are of interest and no evaluation is needed for intermediate media. Consult with the EPA Risk Assessor to determine if screening is to be conducted on intermediate media (e.g., in an exposure scenario in which a contaminant moves from soil to plant tissue to animal tissue, whether an evaluation should be conducted for the intermediate plant tissue step).

EXAMPLE SCENARIO 9

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

The Dean Company

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Timeframe	Soil	Animal Tissue (1)	Beef from cattle grazing in field	Population 1	Age 1	Route 1	Quant	Rationale
					Age 2	Route 1	Quant	Rationale
				Population 2	Age 1	Route 1	Quant	Rationale
					Age 2	Route 1	Quant	Rationale

(1) Modeled via plant uptake from soil and beef cattle ingestion of plants. See Appendix x for full details of modeling.

Example Scenario No. 10
Lead Data Example (Lead Worksheets)

Scenario Description: Lead is present in site soil and the child and adult lead models were used to evaluate blood lead levels. The standard tables do not accommodate lead model results.

Planning Table Issues Associated with this Scenario:

1. Since there are no standard tables that accommodate lead, how should lead results be presented?
   The Lead Worksheets should be completed to demonstrate the evaluation performed and the results of analysis.

Examples of completed Lead Worksheets follow.

TABLE Y (RAGS D ADULT LEAD WORKSHEET)
Site Name: Example Site, Slag Pile 2
Receptor: Adult Worker, Exposure to Media as Described

1. Lead Screening Questions

Medium	Lead Concentration used in Model Run		Basis for Lead Concentration Used For Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Soil	2000	mg/kg	Average Detected Value	750	mg/kg	Recommended Soil Screening Level

2. Lead Model Questions

Question	Response
What lead model was used? Provide reference and version	EPA Interim Adult Lead Model (1996)
If the EPA Adult Lead Model (ALM) was not used provide rationale for model selected.	n/a
Where are the input values located in the risk assessment report?	Located in Appendix 5
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Mean soil concentration. Data are Located in Appendix 2
What was the point of exposure and location?	OU 3 Slag pile area
Where are the output values located in the risk assessment report?	Located in Appendix 5
What GSD value was used? If this is outside the recommended range of 1.8-2.1, provide rationale in Appendix <Y>.	1.8
What baseline blood lead concentration (PbB_0) value was used? If this is outside the default range of 1.7 to 2.2 provide rationale in Appendix <Y>.	2.0
Was the default exposure frequency (EF; 219 days/year) used?	Yes
Was the default BKSF used (0.4 ug/dL per ug/day) used?	Yes
Was the default absorption fraction (AF; 0.12) used?	Yes
Was the default soil ingestion rate (IR; 50 mg/day) used?	Yes
If non-default values were used for any of the parameters listed above, where are the rationale for the values located in the risk assessment report?	Located in Appendix 5

3. Final Result

Medium	Result	Comment/RBRG [1]
Soil	2000 ppm lead in soil results in >5% of receptors above a blood lead level of 10 ug/d and geometric mean blood lead = 11.6 ug/dL. This exceeds the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children (fetuses of exposed women) exceeding 10 ug/dL blood lead.	1500 ppm

1. Attach the ALM spreadsheet output file upon which the Risk Based Remediation Goal (RBRG) was based and description of rationale for parameters used. For additional information, see www.epa.gov/superfund/programs/lead

TABLE X (RAGS D IEUBK LEAD WORKSHEET)
Site Name: Example Site, Neighborhood 2
Receptor: Future Residential Child (Age 0 to 84 Months) Exposure to Media as Described

1. Lead Screening Questions

Medium	Lead Concentration used in Model Run		Basis for Lead Concentration Used for Model Run	Lead Screening Concentration		Basis for Lead Screening Level
	Value	Units		Value	Units	
Soil	1000	mg/kg	Average Detected Value	400	mg/kg	Recommended Soil Screening Level
Water	4	ug/L	Average Detected Value	15	ug/L	Recommended Drinking Water Action Level

2. Lead Model Questions

Question	**Response for Residential Lead Model**
What lead model (version and date) was used?	IEUBK version 0.99d, 1994
Where are the input values located in the risk assessment report?	Located in Appendix 3
What range of media concentrations were used for the model?	Refer to sampling data table 2
What statistics were used to represent the exposure concentration terms and where are the data on concentrations in the risk assessment that support use of these statistics?	Mean value of backyard and side yard. Data presented in Appendix 3.
Was soil sample taken from top 2 cm? If not, why?	Yes
Was soil sample sieved? What size screen was used? If not sieved, provide rationale.	Yes, 250 um
What was the point of exposure/location?	Residential yard in Neighborhood 2: back yard and side yard composite.
Where are the output values located in the risk assessment report?	Located in Appendix 3
Was the model run using default values only?	Yes, except for soil and dust concentration data.
Was the default soil bioavailability used?	Yes. Default is 30%
Was the default soil ingestion rate used?	Yes. Default values for 7 age groups are 85, 135, 135, 100, 090, and 85 mg/day
If non-default values were used, where are the rationale for the values located in the risk assessment report?	Located in Appendix 3

3. Final Result

Medium	**Result**	**Comment/PRG [1]**
Soil	Input value of 1000 ppm in soil (and MSA derived dust of 710 ppm) results in 42.7% of children 0-84 months above a blood lead level of 10 ug/dL. Geometric mean blood lead = 9.5 ug/dL. This exceeds the blood lead goal as described in the 1994 OSWER Directive of no more than 5% of children exceeding 10 ug/dL blood lead.	Based on site conditions, a PRG of 354 ppm in soil is indicated. This PRG is typically rounded to 400 ppm.

1. Attach the IEUBK text output file and graph upon which the PRG was based as an appendix. For additional information, see www.epa.gov/superfund/programs/lead

Example Scenario No. 11
Radiation Data Example

Scenario Description: The site has radiological and chemical waste associated with it and radiological and chemical analyses were performed as part of the investigation. Potential adverse health effects will be evaluated in the risk assessment.

Planning Table Issues Associated with this Scenario:

Since radiological risk assessment uses different methodologies and terminologies than chemical risk assessment, how can the radiological risk assessment data be shown in the Planning Tables?

Planning Table 6.4 (Cancer Toxicity Data - External (Radiation)) and Planning Table 8 (Calculation of Radiation Cancer Risks) were developed by the Workgroup. The carcinogenic risk sections of Planning Tables 9 and 10 were expanded to include an External (Radiation) column. The following radiological risk example includes these Planning Tables.

Note: Many of the Example Planning Tables (i.e., those Example Planning Tables that do not specifically address radionuclides) provided for this Example Scenario are identical to those from Appendix A.

EXAMPLE SCENARIO 11

TABLE 0

SITE RISK ASSESSMENT IDENTIFICATION INFORMATION

The Dean Company

Site Name/OU: The Dean Company
Region: III
EPA ID Number: PAD999999999
State: PA
Status: Fund Lead Remedial Investigation
Federal Facility (Y/N): N
EPA Project Manager: John Smith
EPA Risk Assessor: Jane Doe
Document Author: Mary Smith-Johnson
Document Title: Human Health Risk Assessment for the Dean Company Site
Document Date: August 8, 2001
Comments: This site is contaminated with both chemical and radioactive compounds.

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

The Dean Company

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future	Groundwater	Groundwater	Aquifer 1--Tap Water	Resident	Adult	Dermal	Quant	Future onsite residents may rely on domestic wells drawing from Aquifer 1.
						Ingestion	Quant	Future onsite residents may rely on domestic wells drawing from Aquifer 1.
					Child	Dermal	Quant	Future onsite residents may rely on domestic wells drawing from Aquifer 1.
						Ingestion	Quant	Future onsite residents may rely on domestic wells drawing from Aquifer 1.
		Air	Water Vapors from Showerhead	Resident	Adult	Inhalation	Quant	Future onsite residents may rely on domestic wells drawing from Aquifer 1.
					Child	Inhalation	None	Children are assumed not to shower.
	Soil	Soil	Soil at Site 1	Resident	Adult	Dermal	Quant	Future onsite residents may come into contact with soil.
						Ingestion	Quant	Future onsite residents may ingest soil.
						External (Radiation)	Quant	Future onsite residents may come into contact with soil.
					Child	Dermal	Quant	Future onsite residents may come into contact with soil.
						Ingestion	Quant	Future onsite residents may ingest soil.
						External (Radiation)	Quant	Future onsite residents may come into contact with soil.

EXAMPLE SCENARIO 11

TABLE 2.1

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The Dean Company

Scenario Timeframe: Future

Medium: Groundwater

Exposure Medium: Groundwater

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
Aquifer 1 - Tap Water	117817	Bis(2-ethylhexyl)phthalate	2 J	5 J	ug/l	GW3D	4 / 12	3 - 4	5	NA	4.8 C	6	MCL	Y	ASL
	67663	Chloroform	0.6 J	9	ug/l	GW3D	3 / 12	1 - 1	9	NA	0.063 C	100	MCL	Y	ASL
	75150	Carbon Disulfide	0.3 J	4.5	ug/l	GW3D	3 / 12	1 - 1	4.5	NA	100 N	NA	NA	N	BSL
	76448	Heptachlor	2 J	33 J	ug/l	GW4D	6 / 12	0.01 - 0.01	33	NA	0.015 C	0.4	MCL	Y	ASL
	108883	Toluene	0.1 J	0.2 J	ug/l	GW3D	3 / 12	1 - 1	0.2	NA	75 N	1000	MCL	N	BSL
	7429905	Aluminum	134 J	1340	ug/l	GW3D	2 / 12	29 - 38.2	1340	NA	3700 N	50 - 200	SMCL	N	BSL
	7440393	Barium	65 J	489	ug/l	GW1D	6 / 12	0.2 - 1	489	NA	260 N	2000	MCL	Y	ASL
	7440417	Beryllium	0.2 K	1.5 K	ug/l	GW2D	3 / 12	0.1 - 1	1.5	NA	7.3 N	4	MCL	N	BSL
	7439921	Lead	6 J	35 J	ug/l	GW3D	4 / 12	0.1 - 1	35	NA	15	15	MCL	Y	ASL
	7439965	Manganese	1900	12500	ug/l	GW1D	6 / 12	0.3 - 1	12500	NA	73 N	50	SMCL	Y	ASL
	7440020	Nickel	0.9 J	1.5 J	ug/l	GW4D	3 / 12	0.9 - 7	1.5	NA	73 N	NA	NA	N	BSL
	7440611	Uranium	50	500	ug/l	GW1D	12 / 12	1 - 2	500	NA	11 N	NA	NA	Y	ASL
	7440611	Uranium 238	0.23	80	pCi/l	GW1D	12 / 12	NA	NA	NA	NA	NA	NA	Y	DET
	13982-63-3	Radium 226	0.2	11	pCi/l	GW1D	12 / 12	NA	NA	NA	NA	5	MCL	Y	DET

(1) Maximum concentration used for screening chemicals. No screening was conducted for radionuclides; all radionuclides detected are selected as COPCs.

(2) To date, no background study has been completed.

(3) All compounds were screened against the Risk-Based Concentration (RBC) Table, U.S. EPA Region III, May 8, 2001 for tap water (cancer benchmark = 1E-06; HQ = 0.1). Lead was screened against the action level of 15 ug/l.

(4) Rationale Codes:

Selection Reason: Above Screening Level (ASL)

Detected at Site (DET)

Deletion Reason: Below Screening Level (BSL)

Definitions: NA = Not Applicable

MCL = Maximum Contaminant Level

SMCL = Secondary Maximum Contaminant Level

J = Estimated Value

K = Estimated Value - Biased High

C = Carcinogen

N = Noncarcinogen

TABLE 2.2

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The Dean Company

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
Water Vapors	117817	Bis(2-ethylhexyl)phthalate	2 J	5 J	ug/l	GW3D	4 / 12	3 - 4	5	NA	4.8 C	6	MCL	Y	ASL
from SHowerhead	67663	Chloroform	0.6 J	9	ug/l	GW3D	3 / 12	1 - 1	9	NA	0.063 C	100	MCL	Y	ASL
	75150	Carbon Disulfide	0.3 J	4.5	ug/l	GW3D	3 / 12	1 - 1	4.5	NA	100 N	NA	NA	N	BSL
	76448	Heptachlor	2 J	33 J	ug/l	GW4D	6 / 12	0.01 - 0.01	33	NA	0.015 C	0.4	MCL	Y	ASL
	108883	Toluene	0.1 J	0.2 J	ug/l	GW3D	3 / 12	1 - 1	0.2	NA	75 N	1000	MCL	N	BSL
	7429905	Aluminum	134 J	1340	ug/l	GW3D	2 / 12	29 - 38.2	1340	NA	3700 N	50 - 200	SMCL	N	BSL
	7440393	Barium	65 J	489	ug/l	GW1D	6 / 12	0.2 - 1	489	NA	260 N	2000	MCL	Y	ASL
	7440417	Beryllium	0.2 K	1.5 K	ug/l	GW2D	3 / 12	0.1 - 1	1.5	NA	7.3 N	4	MCL	N	BSL
	7439921	Lead	6 J	35 J	ug/l	GW3D	4 / 12	0.1 - 1	35	NA	15	15	MCL	Y	ASL
	7439965	Manganese	1900	12500	ug/l	GW1D	6 / 12	0.3 - 1	12500	NA	73 N	50	SMCL	Y	ASL
	7440020	Nickel	0.9 J	1.5 J	ug/l	GW4D	3 / 12	0.9 - 7	1.5	NA	73 N	NA	NA	N	BSL
	7440611	Uranium	50	500	ug/l	GW1D	12 / 12	1 - 2	500	NA	11 N	NA	NA	Y	ASL
	7440611	Uranium 238	0.23	80	pCi/l	GW1D	12 / 12	NA	NA	NA	NA	NA	NA	Y	DET
	13982-63-3	Radium 226	0.2	11	pCi/l	GW1D	12 / 12	NA	NA	NA	NA	5	MCL	Y	DET

(1) Maximum concentration used for screening chemicals. No screening was conducted for radionuclides; all radionuclides detected are selected as COPCs.

(2) To date, no background study has been completed.

(3) All compounds were screened against the Risk-Based Concentration (RBC) Table, U.S. EPA Region III, May 8, 2001 for tap water (cancer benchmark = 1E-06; HQ = 0.1). Lead was screened against the action level of 15 ug/l.

(4) Rationale Codes:

Selection Reason: Above Screening Level (ASL)
Detected at Site (DET)

Deletion Reason: Below Screening Level (BSL)

Definitions: NA = Not Applicable
MCL = Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
J = Estimated Value
K = Estimated Value - Biased High
C = Carcinogen
N = Noncarcinogen

TABLE 2.3

OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

The Dean Company

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (1)	Background Value (2)	Screening Toxicity Value (3) (N/C)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
Soil at Site 1	11096825	Aroclor-1260	15 J	110 J	ug/kg	SS03	6 / 29	33 - 300	110	NA	320 C	NA	NA	N	BSL
	56553	Benzo(a)anthracene	120 J	230 J	ug/kg	SS03	16 / 29	330 - 700	230	NA	870 C	NA	NA	N	BSL
	50328	Benzo(a)pyrene	48 J	70 J	ug/kg	SS03	17 / 29	30 - 70	70	NA	87 C	NA	NA	N	BSL
	75150	Carbon Disulfide	2 J	33	ug/kg	SB07	4 / 29	10 - 16	33	NA	780000 N	NA	NA	N	BSL
	72548	4,4'-DDD	1 J	4200	ug/kg	SS09	22 / 29	3.3 - 1900	4200	NA	2700 C	NA	NA	Y	ASL
	72559	4,4'-DDE	0.44 J	7200 J	ug/kg	SS09	28 / 29	2.2 - 700	7200	NA	1900 C	NA	NA	Y	ASL
	50293	4,4'-DDT	0.69 J	290000 J	ug/kg	SB08	29 / 29	3.3 - 700	290000	NA	1900 C	NA	NA	Y	ASL
	108883	Toluene	1 J	2 J	ug/kg	SS08	2 / 29	10 - 16	2	NA	1600000 N	NA	NA	N	BSL
	7429905	Aluminum	1960	21700	mg/kg	SB07	29 / 29	6.3 - 11	21700	NA	7800 N	NA	NA	Y	ASL
	7440417	Beryllium	0.1 J	13.4	mg/kg	SS06	23 / 29	0.02 - 0.21	13.4	NA	16 N	NA	NA	N	BSL
	7439921	Lead	56 J	750 J	mg/kg	SS03	16 / 29	10 - 16	750	NA	400	NA	NA	Y	ASL
	7439965	Manganese	5.9	688	mg/kg	SS03	29 / 29	0.05 - 0.5	688	NA	160 N	NA	NA	Y	ASL
	7782492	Selenium	0.53 J	1	mg/kg	SS02	9 / 29	0.43 - 0.75	1	NA	39 N	NA	NA	N	BSL
	7440611	Uranium	50	700	mg/kg	SS03	17 / 29	1 - 2	700	NA	610 N	NA	NA	Y	ASL
	7440611	Uranium 238	0.3	110	pCi/g	SS03	29 / 29	0.2 - 0.3	NA	NA	NA	NA	NA	Y	DET
	13982-63-3	Radium 226	0.36	41	pCi/g	SS02	29 / 29	0.2 - 0.3	NA	NA	NA	NA	NA	Y	DET

(1) Maximum concentration used for screening chemicals. No screening was conducted for radionuclides; all radionuclides detected are selected as COPCs.

(2) To date, no background study has been completed.

(3) All compounds were screened against the Risk-Based Concentration (RBC) Table, U.S. EPA Region III, May 8, 2001 for residential soil (cancer benchmark = 1E-06; HQ = 0.1). Lead was screened against the U.S. EPA screening value of 400 mg/kg.

(4) Rationale Codes:

Selection Reason: Above Screening Level (ASL)
Detected at Site (DET)

Deletion Reason: Below Screening Level (BSL)

Definitions: NA = Not Applicable
J = Estimated Value
C = Carcinogen
N = Noncarcinogen

EXAMPLE SCENARIO 11

TABLE 3.1.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Groundwater

Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (N/T)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Aquifer 1 - Tap Water	Bis(2-ethylhexyl)phthalate	ug/l	4	5.5 (T)	5 J	5	ug/l	Max	W-Test (1)
	Chloroform	ug/l	1.9	14.9 (T)	9	9	ug/l	Max	W-Test (1)
	Heptachlor	ug/l	27	30 (T)	33 J	30	ug/l	95% UCL - T	W - Test (2)
	Barium	ug/l	224	2835 (T)	489	489	ug/l	Max	W-Test (1)
	Lead	ug/l	21	32 (T)	35 J	32	ug/l	95% UCL - T	W - Test (2)
	Manganese	ug/l	6052	33449 (T)	12500	12500	ug/l	Max	W-Test (1)
	Uranium	ug/l	62	375 (T)	500	375	ug/l	95% UCL - T	W - Test (2)
	Uranium 238	pCi/l	3.2	8.3 (T)	80	8.3	pCi/l	95% UCL - T	W - Test (2)
	Radium 226	pCi/l	3.5	4 (T)	11	4	pCi/l	95% UCL - T	W - Test (2)

Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T)

(1) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

(2) Shapiro-Wilk W Test indicates data are lognormally transformed.

T = Transformed

J = Estimated Value

EXAMPLE SCENARIO 11

TABLE 3.2.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Water Vapors from Showerhead	Bis(2-ethylhexyl)phthalate	ug/l	4	5.5 (T)	5 J	5	ug/l	Max	W-Test (1)
	Chloroform	ug/l	1.9	14.9 (T)	9	9	ug/l	Max	W-Test (1)
	Heptachlor	ug/l	27	30 (T)	33 J	30	ug/l	95% UCL - T	W - Test (2)

Statistics: Maximum Detected Value (Max); 95% UCL of Transformed Data (95% UCL - T)

(1) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.

(2) Shapiro-Wilk W Test indicates data are log-normally distributed.

T = Transformed

J = Estimated Value

TABLE 3.3.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Soil

Exposure Medium: Soil

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (N/T)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Soil at Site 1	4,4'-DDD	ug/kg	239	452 (T)	4200	452	ug/kg	95 % UCL -T	W - Test (2)
	4,4'-DDE	ug/kg	596	6793 (T)	7200 J	6793	ug/kg	95% UCL - T	W - Test (2)
	4,4'-DDT	ug/kg	11007	28619 (N)	290000 J	28619	ug/kg	95% UCL - N	W - Test (1)
	Aluminum	mg/kg	7450	9964 (T)	21700	9964	mg/kg	95% UCL - T	W - Test (2)
	Lead	mg/kg	210	345 (T)	750 J	345	mg/kg	95% UCL - T	W - Test (2)
	Manganese	mg/kg	116	201 (T)	688	201	mg/kg	95% UCL - T	W - Test (2)
	Uranium	mg/kg	125	675 (T)	700	675	mg/kg	95% UCL - T	W - Test (2)
	Uranium 238	pCi/g	2.5	3.4 (T)	110	3.4	pCi/g	95% UCL - T	W - Test (2)
	Radium 226	pCi/g	3.1	3.9 (T)	41	3.9	pCi/g	95 % UCL - T	W- Test (2)

Statistics: 95% UCL of Normal Data (95% UCL - N); 95% UCL of Transformed Data (95% UCL - T)

(1) Shapiro-Wilk W Test indicates data are normally distributed.

(2) Shapiro-Wilk W Test indicates data are lognormally transformed.

N = Normal

T = Transformed

J = Estimated Value

EXAMPLE SCENARIO 11

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	Aquifer 1 - Tap Water	CW	Chemical Concentration in Water	See Table 3.1	mg/l	See Table 3.1	Chronic Daily Intake (CDI) (mg/kg/day) = CW x IR-W x EF x ED x 1/BW x 1/AT
				IR-W	Ingestion Rate of Water	2	l/day	EPA, 1991	
				EF	Exposure frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989a	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 1989a	
				CWR	Radionuclide Concentration in Water	See Table 3.1	pCi/l	See Table 3.1	Intake (pCi) = CWR x IR x EF x ED
				IR-W	Ingestion Rate of Water	2	l/day	EPA, 1991	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
		Child	Aquifer 1 - Tap Water	CW	Chemical Concentration in Water	See Table 3.1	mg/l	See Table 3.1	CDI (mg/kg/day) = CW x IR-W x EF x ED x 1/BW x 1/AT
				IR-W	Ingestion Rate of Water	1	l/day	EPA, 1989b	
				EF	Exposure frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989a	
				AT-N	Averaging Time - Non-Cancer	2,190	days	EPA, 1989a	
				CWR	Radionuclide Concentration in Water	See Table 3.1	pCi/l	See Table 3.1	Intake (pCi) = CWR x IR x EF x ED
				IR-W	Ingestion Rate of Water	1	l/day	EPA, 1991	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	

EXAMPLE SCENARIO 11

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Groundwater

Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal	Resident	Adult	Aquifer 1 - Tap Water	CW	Chemical Concentration in Water	See Table 3.1	mg/l	See Table 3.1	Dermally Absorbed Dose (DAD) (mg/kg-day) =
				FA	Fraction Absorbed Water	Chemical Specific	- -	EPA, 2001	DA-event x EV x ED x EF x SA x 1/BW x 1/AT
				Kp	Permeability Constant	Chemical Specific	cm/hr	EPA, 2001	where for organic compounds,
				SA	Skin Surface Area	18,000	cm2	EPA, 2001	Absorbed Dose per Event (DA-event) (mg/cm2-event) =
				tau-event	Lag time per event	Chemical Specific	hours/event	EPA, 2001	2 FA x Kp x CW x CF x SQRT{(6 x tau-event x t-event)/pi}
				t-event	Event Duration	0.58	hours/event	EPA, 2001	or
				B	Ratio of permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis	Chemical Specific	- -	EPA, 2001	DA-event = FA x Kp x CW x {(t-event/(1 + B)) + 2 x tau-event x ((1 + (3 x B) + (3 x B x B))/(1 + B)2)} and where for inorganic compounds, DA-event = Kp x CW x CF x t-event
				EV	Event Frequency	1	events/day	EPA, 2001	
				EF	Exposure Frequency	350	days/year	EPA, 2001	
				ED	Exposure Duration	24	years	EPA, 1991	
				CF	Volumetric Conversion Factor for Water	0.001	l/cm3	- -	
				BW	Body Weight	70	kg	EPA, 2001	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 2001	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 2001	

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Groundwater

Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Dermal (continued)	Resident (continued)	Child	Aquifer 1 - Tap Water	CW	Chemical Concentration in Water	See Table 3.1	mg/l	See Table 3.1	DAD (mg/kg-day) =
				FA	Fraction Absorbed Water	Chemical Specific	- -	EPA, 2001	DA-event x EV x ED x EF x SA x 1/BW x 1/AT
				Kp	Permeability Constant	Chemical Specific	cm/hr	EPA, 2001	where for organic compounds,
				SA	Skin Surface Area	6,600	cm2	EPA, 2001	DA-event (mg/cm2-event) =
				tau-event	Lag time per event	Chemical Specific	hours/event	EPA, 2001	2 FA x Kp x CW x CF x SQRT{(6 x tau-event x t-event)/pi}
				t-event	Event Duration	1	hours/event	EPA, 2001	or
				B	Ratio of permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis	Chemical Specific	- -	EPA, 2001	DA-event = FA x Kp x CW x {(t-event/(1 + B)) + 2 x tau-event x ((1 + (3 x B) + (3 x B x B))/(1 + B)2)} and where for inorganic compounds, DA-event = Kp x CW x CF x t-event
				EV	Event Frequency	1	events/day	EPA, 2001	
				EF	Exposure Frequency	350	days/year	EPA, 2001	
				ED	Exposure Duration	6	years	EPA, 2001	
				CF	Volumetric Conversion Factor for Water	0.001	l/cm3	- -	
				BW	Body Weight	15	kg	EPA, 2001	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 2001	
				AT-N	Averaging Time - Non-Cancer	2,190	days	EPA, 2001	

EPA 1989a: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual, Part A. OERR EPA/540/1-89/002.

EPA 1989b: Exposure Factors Handbook, July 1989, EPA/600/8-89/043.

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EPA 1992: Dermal Exposure Assessment: Principles and Applications. EPA/600/8-91/011B.

EPA 1997: Exposure Factors Handbook, Volume 1. EPA/600/P-95/002Fa.

EPA 2001: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim.

EXAMPLE SCENARIO 11

TABLE 4.2.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Medium: Groundwater

Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation (1)	Resident	Adult	Water Vapors from Showerhead	(1)	(1)	(1)	(1)	(1)	Foster and Chrostowski Model

(1) Refer to the Risk Assessment text for details on the modeled intake methodology and parameters used to calculate modeled intake values for the Foster and Chrostowski Shower Model.

EXAMPLE SCENARIO 11

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	Chronic Daily Intake (CDI) (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	100	mg/day	EPA, 1991	CS x IR x FI x EF x ED x CF1 x 1/BW x 1/AT
				FI	Fraction Ingested	1	- -	Professional Judgment	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
				CF1	Conversion Factor	1E-06	kg/mg	- -	
				BW	Body Weight	70	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 1989	
				CSR	Radionuclide Concentration in Soil	See Table 3.3	pCi/g	See Table 3.3	Intake (pCi) = CSR x IR x CF x EF X ED
				IR-S	Ingestion Rate of Soil	100	mg/day	EPA, 1991	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	24	years	EPA, 1991	
				CF1	Conversion Factor	1.00E-03	g/mg	- -	
		Child	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	CDI (mg/kg-day) =
				IR-S	Ingestion Rate of Soil	200	mg/day	EPA, 1991	CS x IR x FI x EF x ED x CF1 x 1/BW x 1/AT
				FI	Fraction Ingested	1	- -	Professional Judgment	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	
				CF1	Conversion Factor	1E-06	kg/mg	- -	
				BW	Body Weight	15	kg	EPA, 1991	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 1989	
				AT-N	Averaging Time - Non-Cancer	2,190	days	EPA, 1989	

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion (continued)	Resident (continued)	Child (continued)	Soil at Site 1 (continued)	CSR	Radionuclide Concentration in Soil	See Table 3.3	pCi/g	See Table 3.3	Intake (pCi) = CSR x IR x CF x EF X ED
				IR-S	Ingestion Rate of Soil	200	mg/day	EPA, 1991	
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				ED	Exposure Duration	6	years	EPA, 1991	
				CF1	Conversion Factor	1.00E-03	g/mg	- -	
Dermal	Resident	Adult	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	Dermal Absorbed Dose (DAD) (mg/kg-day) =
				CF	Conversion Factor	1E-06	kg/mg	- -	DA-event x EF x ED x EV x SA X 1/BW x 1/AT
				SA	Skin Surface Area Available for Contact	5,700	cm2	EPA, 2001	where
				AF	Soil to Skin Adherence Factor	0.07	mg/cm2-event	EPA, 2001	Absorbed Dose per Event (DA-event) (mg/cm2-event) =
				ABS-d	Dermal Absorption Factor	chemical-specific	unitless	EPA, 2001	CS x CF x AF x ABS-d
				EV	Event Frequency	1	events/day	EPA, 2001	
				EF	Exposure Frequency	350	days/year	EPA, 2001	
				ED	Exposure Duration	24	years	EPA, 1991	
				BW	Body Weight	70	kg	EPA, 2001	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 2001	
				AT-N	Averaging Time - Non-Cancer	8,760	days	EPA, 2001	
		Child	Soil at Site 1	CS	Chemical Concentration in Soil	See Table 3.3	mg/kg	See Table 3.3	DAD (mg/kg-day) =
				CF	Conversion Factor	1E-06	kg/mg	- -	DA-event x EF x ED x EV x SA X 1/BW x 1/AT
				SA	Skin Surface Area Available for Contact	2,800	cm2	EPA, 2001	where
				AF	Soil to Skin Adherence Factor	0.2	mg/cm2-event	EPA, 2001	DA-event (mg/cm2-event) =
				ABS-d	Dermal Absorption Factor	chemical-specific	unitless	EPA, 2001	CS x CF x AF x ABS-d
				EV	Event Frequency	1	events/day	EPA, 2001	
				EF	Exposure Frequency	350	days/year	EPA, 2001	
				ED	Exposure Duration	6	years	EPA, 2001	
				BW	Body Weight	15	kg	EPA, 2001	
				AT-C	Averaging Time - Cancer	25,550	days	EPA, 2001	
				AT-N	Averaging Time - Non-Cancer	2,190	days	EPA, 2001	

EXAMPLE SCENARIO 11

TABLE 4.3.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Soil

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
External (Radiation)	Resident	Adult	Soil at Site 1	CSR	Radionuclide Concentration in Soil	See Table 3.3	pCi/g	See Table 3.3	External Exposure (pCi-year/g) =
				ET	Exposure Time	17	hrs/day		CSR x ET x EF x {(Fi x GSFi) + (Fo x GSFo)] x ED x CF
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				Fi	Time Fraction Indoors	0.75	- -		
				Fo	Time Fraction Outdoors	0.25	- -		
				GSFi	Gamma Shielding Factor Indoors	0.8	- -		
				GSFo	Gamma Shielding Factor Outdoors	1	- -		
				ED	Exposure Duration	24	years	EPA, 1991	
				CF	Conversion Factor	0.000114	years/hr	- -	
		Child	Soil at Site 1	CSR	Radionuclide Concentration in Soil	See Table 3.3	pCi/g	See Table 3.3	External Exposure (pCi-year/g) =
				ET	Exposure Time	17	hrs/day		CSR x ET x EF x {(Fi x GSFi) + (Fo x GSFo)] x ED x CF
				EF	Exposure Frequency	350	days/year	EPA, 1991	
				Fi	Time Fraction Indoors	0.875	- -		
				Fo	Time Fraction Outdoors	0.125	- -		
				GSFi	Gamma Shielding Factor Indoors	0.8	- -		
				GSFo	Gamma Shielding Factor Outdoors	1	- -		
				ED	Exposure Duration	6	years	EPA, 1991	
				CF	Conversion Factor	0.000114	years/hr	- -	

EPA 1989: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual, Part A. OERR EPA/540/1-89/002.

EPA 1991: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual - Supplemental Guidance, Standard Default Exposure Factors. Interim Final. OSWER 9285.6-03.

EPA 1995: Assessing Dermal Exposure from Soil, Technical Guidance Manual, Region III, EPA/903-K-95-003.

EPA 1997: Exposure Factors Handbook, Volume 1. EPA/600/P-95/002Fa.

EPA 2001: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim.

NA = Not Available

EXAMPLE SCENARIO 11

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

The Dean Company

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absoprtion Efficiency for Dermal (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD:Target Organ(s)	
		Value	Units		Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
4,4'-DDD	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	1	NA	NA	NA	NA	NA	NA
4,4'-DDT	Chronic	5.0E-004	mg/kg/day	1	5.0E-004	mg/kg/day	Liver	100	IRIS	06/21/2001
4,4'-DDT	Subchronic	5.0E-004	mg/kg/day	1	5.0E-004	mg/kg/day	Liver	100	HEAST	07/01/1997
Bis(2-ethylhexyl)phthalate	Chronic	2.0E-02	mg/kg/day	1	2.0E-02	mg/kg/day	Liver	1000	IRIS	06/21/2001
Bis(2-ethylhexyl)phthalate	Subchronic	2.0E-02	mg/kg/day	1	2.0E-02	mg/kg/day	Liver	1000	HEAST	07/01/1997
Chloroform	Chronic	1.0E-02	mg/kg/day	1	1.0E-02	mg/kg/day	Liver	1000	IRIS	06/21/2001
Chloroform	Subchronic	1.0E-02	mg/kg/day	1	1.0E-02	mg/kg/day	Liver	1000	HEAST	07/01/1997
Heptachlor	Chronic	5.0E-04	mg/kg/day	1	5.0E-04	mg/kg/day	Liver	300	IRIS	06/21/2001
Heptachlor	Subchronic	5.0E-04	mg/kg/day	1	5.0E-04	mg/kg/day	Liver	300	HEAST	07/01/1997
Aluminum	Chronic	1.0E+00	mg/kg/day	1	1.0E+00	mg/kg/day	Central Nervous System	100	NCEA	06/21/2001
Barium	Chronic	7.0E-02	mg/kg/day	0.07	4.9E-03	mg/kg/day	Heart	3	IRIS	02/02/2001
Barium	Subchronic	7.0E-02	mg/kg/day	0.07	4.9E-03	mg/kg/day	Heart	3	HEAST	07/01/1997
Copper	Chronic	3.7E-02	mg/kg/day	1	3.7E-02	mg/kg/day	Gastrointestinal	NA	HEAST	07/01/1997
Copper	Subchronic	3.7E-02	mg/kg/day	1	3.7E-02	mg/kg/day	Gastrointestinal	NA	HEAST	07/01/1997
Iron	Chronic	3.0E-01	mg/kg/day	1	3.0E-01	mg/kg/day	Gastrointestinal	1	NCEA	06/21/2001
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese (nonfood)	Chronic	2.0E-02	mg/kg/day	0.04	8.0E-04	mg/kg/day	Central Nervous System	1	IRIS	06/21/2001
Uranium	Chronic	3.0E-03	mg/kg/day	1	3E-003	mg/kg/day	Kidney	1000	IRIS	06/21/2001

(1) Source: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. Section 4.2 and Exhibit 4-1.

(2) See Risk Assessment text for the derivation of the "Absorbed RfD for Dermal".

Definitions: NA = Not Available

IRIS = Integrated Risk Information System

HEAST = Health Effects Assessment Summary Table, July 1997

NCEA = National Center for Environmental Assessment

EXAMPLE SCENARIO 11

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

The Dean Company

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
4,4'-DDD	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDE	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	Chronic	3.0E-04	mg/m3	8.6E-05	mg/kg/day	Nasal	1000	NCEA	06/21/2001
Chloroform	Subchronic	3.0E-03	mg/m3	8.6E-4	mg/kg/day	Nasal	100	NCEA	06/21/2001
Heptachlor	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aluminum	Chronic	5.0E-03	mg/m3	1.4E-03	mg/kg/day	Central Nervous System	300	NCEA	06/21/2001
Barium	Chronic	5.0E-04	mg/m3	1.4E-04	mg/kg/day	Fetus	1000	HEAST	07/01/1997
Barium	Subchronic	5.0E-03	mg/m3	1.4E-03	mg/kg/day	Fetus	100	HEAST	07/01/1997
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese (nonfood)	Chronic	5.0E-05	mg/m3	1.4E-05	mg/kg/day	Central Nervous System	1000	IRIS	06/21/2001
Uranium	NA	NA	NA	NA	NA	NA	NA	NA	NA

(1) See Risk Assessment text for the derivation of the "Extrapolated RfD".

Definitions: NA = Not Available

IRIS = Integrated Risk Information System

HEAST = Health Effects Assessment Summary Table, July 1997

NCEA = National Center for Environmental Assessment

EXAMPLE SCENARIO 11

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

The Dean Company

Chemical of Potential Concern	Chronic/ Subchronic	Parameter			Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	Parameter:Target Organ(s)	
		Name	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)

Not Applicable

There are no special case chemicals in this risk assessment. As a result, the table is blank.

EXAMPLE SCENARIO 11

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

The Dean Company

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal (1)	Absorbed Cancer Slope Factor for Dermal (2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
4,4'-DDD	2.4E-01	1/mg/kg/day	1	2.4E-01	1/mg/kg/day	B2	IRIS	06/21/2001
4,4'-DDE	3.4E-01	1/mg/kg/day	1	3.4E-01	1/mg/kg/day	B2	IRIS	06/21/2001
4,4'-DDT	3.4E-001	1/mg/kg/day	1	3.4E-001	1/mg/kg/day	B2	IRIS	06/21/2001
Bis(2-ethylhexyl)phthalate	1.4E-02	1/mg/kg/day	1	1.4E-02	1/mg/kg/day	B2	IRIS	06/21/2001
Chloroform	6.1E-03	1/mg/kg/day	1	6.1E-03	1/mg/kg/day	B2	IRIS	06/21/2001
Heptachlor	4.5E+00	1/mg/kg/day	1	4.5E+00	1/mg/kg/day	B2	IRIS	06/21/2001
Aluminum	NA	NA	1	NA	NA	NA	NA	NA
Barium	NA	NA	0.07	NA	NA	NA	NA	NA
Copper	NA	NA	1	NA	NA	NA	NA	NA
Iron	NA	NA	1	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA
Manganese (nonfood)	NA	NA	0.04	NA	NA	NA	NA	NA
Uranium	NA	NA	NA	NA	NA	NA	NA	NA

(1) Source: Risk Assessment Guidance for Superfund. Volume 1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. Section 4.2 and Exhibit 4-1.

(2) See Risk Assessment text for the derivation of the "Absorbed Cancer Slope Factor for Dermal".

Definitions: NA = Not Available

IRIS = Integrated Risk Information System

B2 = Probable Human Carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

EXAMPLE SCENARIO 11

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

The Dean Company

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
4,4'-DDD	NA	NA	NA	NA	NA	NA	NA
4,4-DDE	NA	NA	NA	NA	NA	NA	NA
4,4'-DDT	9.7E-005	1/ug/m3	3.4E-001	1/mg/kg/day	B2	IRIS	06/21/2001
Bis(2-ethylhexyl)phthalate	NA	NA	NA	NA	NA	NA	NA
Chloroform	2.3E-05	1/ug/m3	8.1E-02	1/mg/kg/day	B2	IRIS	06/21/2001
Heptachlor	1.3E-03	1/ug/m3	4.5E+00	1/mg/kg/day	B2	IRIS	06/21/2001
Aluminum	NA	NA	NA	NA	NA	NA	NA
Barium	NA	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA
Manganese (nonfood)	NA	NA	NA	NA	NA	NA	NA
Uranium	NA	NA	NA	NA	NA	NA	NA

Definitions: NA = Not Available

IRIS = Integrated Risk Information System

B2 = Probable Human Carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

TABLE 6.3

CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

The Dean Company

Chemical of Potential Concern	Parameters			Source(s)	Date(s) (MM/DD/YYYY)
	Name	Value	Units		
Not Applicable					

There are no special case chemicals in this risk assessment. As a result, this table is blank.

TABLE 6.4

CANCER TOXICITY DATA -- EXTERNAL (RADIATION)

The Dean Company

Chemical of Potential Concern	Cancer Slope Factor		Source(s)	Date(s) (MM/DD/YYYY)
	Value	Units		
Uranium 238	6.2E-011	Risk/pCi	HEAST	07/01/1997
	5.3E-008	Risk/year per pCi/g soil	HEAST	07/01/1997
Radium 226	3.0E-010	Risk/pCi	HEAST	07/01/1997
	6.7E-006	Risk/year per pCi/g soil	HEAST	07/01/1997

HEAST = Health Effects Assessment Summary Table, July 1997

EXAMPLE SCENARIO 11

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Receptor Population: Resident

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Aquifer 1 - Tap Water	Ingestion	Bis(2-ethylhexyl)phthalate	0.005	mg/l	4.7E-005	mg/kg/day	1.4E-002	1/mg/kg/day	7E-007	1.4E-004	mg/kg/day	2.0E-002	mg/kg/day	0.007
				Chloroform	0.009	mg/l	8.5E-005	mg/kg/day	6.1E-003	1/mg/kg/day	5E-007	2.5E-004	mg/kg/day	1.0E-002	mg/kg/day	0.03
				Heptachlor	0.03	mg/l	2.8E-004	mg/kg/day	4.5E+000	1/mg/kg/day	1E-003	8.1E-004	mg/kg/day	5.0E-004	mg/kg/day	2
				Barium	0.489	mg/l	4.6E-003	mg/kg/day	NA	NA	NA	1.3E-002	mg/kg/day	7.0E-002	mg/kg/day	0.2
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	12.5	mg/l	1.2E-001	mg/kg/day	NA	NA	NA	3.4E-001	mg/kg/day	2.0E-002	mg/kg/day	17
				Uranium	0.375	mg/l	3.8E-05	mg/kg/day	NA	NA	NA	1.0E-02	mg/kg/day	3.0E-03	mg/kg/day	3
			Exp. Route Total								1E-003					22
			Dermal	Bis(2-ethylhexyl)phthalate	0.005	mg/l	7.2E-005	mg/kg/day	1.4E-002	1/mg/kg/day	1E-006	2.1E-004	mg/kg/day	2.2E-002	mg/kg/day	0.01
				Chloroform	0.009	mg/l	1.7E-004	mg/kg/day	6.1E-003	1/mg/kg/day	1E-006	4.9E-004	mg/kg/day	1.0E-002	mg/kg/day	0.05
				Heptachlor	0.03	mg/l	1.3E-004	mg/kg/day	4.5E+000	1/mg/kg/day	6E-004	3.9E-004	mg/kg/day	5.0E-004	mg/kg/day	0.8
				Barium	0.489	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	12.5	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Uranium	0.375	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Exp. Route Total								6E-004					0.9
		Exposure Point Total									2E-003					23
	Exposure Medium Total										2E-003					23
	Air	Water Vapors from	Inhalation	Bis(2-ethylhexyl)phthalate	0.005	mg/l	2.3E-006	mg/kg/day	NA	NA	NA	3.6E-006	mg/kg/day	NA	NA	NA
		Showerhead		Chloroform	0.009	mg/l	1.3E-004	mg/kg/day	8.1E-002	1/mg/kg/day	1E-005	3.9E-004	mg/kg/day	8.6E-005	mg/kg/day	5
				Heptachlor	0.03	mg/l	2.6E-004	mg/kg/day	4.5E+000	1/mg/kg/day	1E-003	7.7E-004	mg/kg/day	NA	NA	NA
			Exp. Route Total								1E-003					5
		Exposure Point Total									1E-003					5
	Exposure Medium Total										1E-003					5
Groundwater Total											3E-003					28

EXAMPLE SCENARIO 11

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future

Receptor Population: Resident

Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Soil	Soil	Soil at Site 1	Ingestion	4,4'-DDD	0.452	mg/kg	2.1E-07	mg/kg/day	2.4E-01	1/mg/kg/day	5E-08	6.2E-07	mg/kg/day	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	3.2E-06	mg/kg/day	3.4E-001	1/mg/kg/day	1E-06	9.3E-06	mg/kg/day	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	1.3E-005	mg/kg/day	3.4E-001	1/mg/kg/day	5E-06	3.9E-05	mg/kg/day	5.0E-04	mg/kg/day	0.08
				Aluminum	9964	mg/kg	4.7E-003	mg/kg/day	NA	NA	NA	1.4E-02	mg/kg/day	1.0E+00	mg/kg/day	0.01
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	201	mg/kg	9.5E-005	mg/kg/day	NA	NA	NA	2.8E-04	mg/kg/day	1.4E-01	mg/kg/day	0.002
				Uranium	675	mg/kg	3.2E-004	mg/kg/day	NA	NA	NA	9.2E-04	mg/kg/day	3.0E-03	mg/kg/day	0.3
			Exp. Route Total								6E-06					0.4
			Dermal	4,4'-DDD	0.452	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	1.6E-006	mg/kg/day	3.4E-001	1/mg/kg/day	5E-007	4.7E-06	mg/kg/day	5.0E-04	mg/kg/day	0.009
				Aluminum	9964	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	201	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Uranium	675	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Exp. Route Total								5E-07					0.009
		Exposure Point Total									7E-006					0.4
	Exposure Medium Total										7E-006					0.4
Soil Total											7E-006					0.4
										Total of Receptor Risks Across All Media	3E-003				Total of Receptor Hazards Across All Media	28

(1) Lead is evaluated for the resident using the IEUBK model. See Risk Assessment text for discussion of results and appendix for the lead modeling run results.

EXAMPLE SCENARIO 11

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Aquifer 1 - Tap Water	Ingestion	Bis(2-ethylhexyl)phthalate	0.005	mg/l	2.7E-005	mg/kg/day	1.4E-002	1/mg/kg/day	4E-007	3.2E-004	mg/kg/day	2.0E-002	mg/kg/day	0.02
				Chloroform	0.009	mg/l	4.9E-005	mg/kg/day	6.1E-003	1/mg/kg/day	3E-007	5.8E-004	mg/kg/day	1.0E-002	mg/kg/day	0.06
				Heptachlor	0.03	mg/l	1.6E-004	mg/kg/day	4.5E+000	1/mg/kg/day	7E-004	1.9E-003	mg/kg/day	5.0E-004	mg/kg/day	4
				Barium	0.489	mg/l	2.7E-003	mg/kg/day	NA	NA	NA	3.1E-002	mg/kg/day	7.0E-002	mg/kg/day	0.4
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	12.5	mg/l	6.8E-002	mg/kg/day	NA	NA	NA	8.0E-001	mg/kg/day	2.0E-002	mg/kg/day	40
				Uranium		mg/l	2.1E-003	mg/kg/day	NA	NA	NA	2.4E-002	mg/kg/day	3.0E-003	mg/kg/day	8
			Exp. Route Total								7E-004					52
			Dermal	Bis(2-ethylhexyl)phthalate	0.005	mg/l	3.1E-005	mg/kg/day	1.4E-002	1/mg/kg/day	4E-007	3.6E-004	mg/kg/day	2.2E-002	mg/kg/day	0.02
				Chloroform	0.009	mg/l	7.2E-005	mg/kg/day	6.1E-003	1/mg/kg/day	4E-007	8.4E-004	mg/kg/day	1.0E-002	mg/kg/day	0.08
				Heptachlor	0.03	mg/l	5.7E-005	mg/kg/day	4.5E+000	1/mg/kg/day	3E-004	6.7E-004	mg/kg/day	5.0E-004	mg/kg/day	1
				Barium	0.489	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	12.5	mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Uranium		mg/l	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Exp. Route Total								3E-004					1
		Exposure Point Total									1E-003					1
	Exposure Medium Total										1E-003					53
Groundwater Total											1E-003					53
Soil	Soil	Soil at Site 1	Ingestion	4,4'-DDD	0.452	mg/kg	5.0E-07	mg/kg/day	2.4E-01	1/mg/kg/day	1E-07	5.8E-06	mg/kg/day	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	7.4E-06	mg/kg/day	3.4E-001	1/mg/kg/day	3E-06	8.7E-05	mg/kg/day	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	3.1E-005	mg/kg/day	3.4E-001	1/mg/kg/day	1E-005	3.7E-004	mg/kg/day	5.0E-04	mg/kg/day	0.7
				Aluminum	9964	mg/kg	1.1E-002	mg/kg/day	NA	NA	NA	1.3E-001	mg/kg/day	1.0E+00	mg/kg/day	0.1
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	201	mg/kg	2.2E-004	mg/kg/day	NA	NA	NA	2.6E-003	mg/kg/day	1.4E-01	mg/kg/day	0.02
				Uranium		mg/kg	7.4E-004	mg/kg/day	NA	NA	NA	8.6E-003	mg/kg/day	3.0E-003	mg/kg/day	3
			Exp. Route Total								1E-005					4

EXAMPLE SCENARIO 11

TABLE 7.2.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
Soil (continued)	Soil (continued)	Soil at Site 1 (continued)	Dermal	4,4'-DDD	0.452	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				4,4'-DDE	6.8	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				4,4'-DDT	28.6	mg/kg	2.6E-006	mg/kg/day	3.4E-001	1/mg/kg/day	9E-007	3.1E-005	mg/kg/day	5.0E-004	mg/kg/day	0.06
				Aluminum	9964	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
				Manganese	201	mg/kg	NA	NA	NA	NA	NA	NA	NA	MA	NA	NA
				Uranium		mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
			Exp. Route Total								9E-07					0.06
		Exposure Point Total									1E-005					4
	Exposure Medium Total										1E-005					4
Soil Total											1E-005					4
											Total of Receptor Risks Across All Media	1E-03				Total of Receptor Hazards Across All Media	57

(1) Lead is evaluated for the resident using the IEUBK model. See Risk Assessment text for discussion of results and appendix for the lead modeling run results.

TABLE 8.2

CALCULATION OF RADIATION CANCER RISKS

The Smith Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Risk Calculation Approach	Cancer Risk Calculations				
					Value	Units		Intake/External Dose		CSF/Conversion Factor		Cancer Risk
								Value	Units	Value	Units	
Groundwater	Groundwater	Aquifer 1 - Tap Water	Ingestion	Uranium 238	8.3E+000	pCi/l	USEPA RAGS	1.7E+004	pCi	6.2E-011	Risk/pCi	1E-006
				Radium 226	4.0E+000	pCi/l	USEPA RAGS	8.4E+003	pCi	3.0E-010	Risk/pCi	3E-006
			Exp. Route Total									4E-006
		Exposure Point Total										4E-006
	Exposure Medium Total											4E-006
Groundwater Total												4E-006
Soil	Soil	Soil at Site 1	Ingestion	Uranium 238	3.4E+000	pCi/g	USEPA RAGS	1.4E+003	pCi	6.2E-011	Risk/pCi	9E-008
				Radium 226	3.9E+000	pCi/g	USEPA RAGS	1.6E+003	pCi	3.0E-010	Risk/pCi	5E-007
			Exp. Route Total									6E-007
			External (Radiation)	Uranium 238	3.4E+000	pCi/g	USEPA RAGS	1.1E+001	pCi-yr/g	5.3E-008	Risk/yr per pCi/g soil	6E-007
				Radium 226	3.9E+000	pCi/g	USEPA RAGS	1.3E+001	pCi-yr/g	6.7E-006	Risk/yr per pCi/g soil	9E-005
			Exp. Route Total									9E-005
		Exposure Point Total										9E-005
	Exposure Medium Total											9E-005
Soil Total												9E-005
							Total of Receptor Risks Across All Media =					9E-005

EXAMPLE SCENARIO 11

RADIATION DOSE ASSESSMENT WORKSHEET

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Radionuclide of Potential Concern	EPC		Dose Approach	Internal/External Dose		Standard for Comparison(1)	Conversion Factor			Risk
					Value	Units		Value	Units		Value	Units	Source	
Groundwater	Groundwater	Aquifer 1 -- Tap Water	Ingestion	Uranium 238	8.3E+000	pCi/l	NA	NA	NA	NA	NA	NA	NA	NA
				Radium 226	4.0E+000	pCi/l	NA	NA	NA	NA	NA	NA	NA	NA
			Exp. Route Total					NA	NA					NA
		Exposure Point Total						NA	NA					NA
Soil	Soil	Soil at Site 1	Ingestion	Uranium 238	3.4E+000	pCi/g	NA	NA	NA	NA	NA	NA	NA	NA
				Radium 226	3.9E+000	pCi/g	NA	NA	NA	NA	NA	NA	NA	NA
			Exp. Route Total											
			External (Radiation)	Uranium 238	3.4E+000	pCi/g	NA	NA	NA	NA	NA	NA	NA	NA
				Radium 226	3.9E+000	pCi/g	NA	NA	NA	NA	NA	NA	NA	NA
			Exp. Route Total					NA	NA					NA
		Exposure Point Total						NA	NA					NA

NA = Not Applicable

Total of Receptor Dose Across All Media: NA NA

Total of Receptor Risks Across All Media: NA

EXAMPLE SCENARIO 11

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Aquifer 1 - Tap Water	Bis(2-ethylhexyl)phthalate	7E-07	- -	1E-06	- -	2E-06	Liver	0.007	- -	0.01	0.02
			Chloroform	5E-07	- -	1E-06	- -	2E-06	Liver	0.03	- -	0.05	0.08
			Heptachlor	1E-03	- -	6E-04	- -	2E-03	Liver	2	- -	0.8	3
			Barium	- -	- -	- -	- -	- -	Heart	0.2	- -	- -	0.2
			Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Manganese	- -	- -	- -	- -	- -	Central Nervous System	17	- -	- -	17
			Uranium	- -	- -	- -	- -	- -	Kidneys	3	- -	- -	3
			Chemical Total	1E-03	- -	6E-04	- -	2E-03		22	- -	0.9	23
			Uranium 238	9E-06	- -	- -	- -	9E-06					
			Radium 226	2E-05	- -	- -	- -	2E-05					
			Radionuclide Total	3E-05	- -	- -	- -	3E-05					
		Exposure Point Total						2E-03					23
	Exposure Medium Total							2E-03					23
	Air	Water Vapors from	Bis(2-ethylhexyl)phthalate	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
		Showerhead	Chloroform	- -	1E-05	- -	- -	1E-05	Liver	- -	5	- -	5
			Heptachlor	- -	1E-03	- -	- -	1E-03	- -	- -	- -	- -	- -
			Barium	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Manganese	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Uranium	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Chemical Total	- -	1E-03	- -	- -	1E-03		- -	5	- -	5
			Radionuclide Total										
		Exposure Point Total						1E-03					5
	Exposure Medium Total							1E-03					5

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater Total								3E-03					28

EXAMPLE SCENARIO 11

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Soil at Site 1	4,4'-DDD	5E-08	- -	- -	- -	5E-08	- -	- -	- -	- -	- -
			4,4'-DDE	1E-06	- -	- -	- -	1E-06	- -	- -	- -	- -	- -
			4,4'-DDT	5E-06	- -	5E-07	- -	6E-06	Liver	0.08	- -	0.009	0.09
			Aluminum	- -	- -	- -	- -	- -	Central Nervous System	0.01	- -	- -	0.01
			Lead (1)	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
			Manganese	- -	- -	- -	- -	- -	Central Nervous System	0.002	- -	- -	0.002
			Uranium	- -	- -	- -	- -	- -	Kidney	0.3	- -	- -	0.3
			Chemical Total	6E-06	- -	5E-07	- -	7E-06		0.4	- -	0.009	0.4
			Uranium 238	2E-07	- -	- -	2E-06	2E-06					
			Radium 226	1E-006	- -	- -	4E-04	4E-04					
			Radionuclide Total	1E-06			4E-04	4E-04					
		Exposure Point Total						4E-04					0.4
	Exposure Medium Total							4E-04					0.4
Soil Total								4E-04					0.4
Receptor Total								3E-03					28

Total Risk Across All Media: 3E-03

Total Hazard Across All Media: 28

(1) Lead is evaluated for the resident using the IEUBK model. See Risk Assessment text for discussion of results and appendix for the lead modeling run results.

Total Liver HI Across All Media = 8

Total Kidney HI Across All Media = 3

Total Central Nervous System HI Across All Media = 17

TABLE 9.2.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Aquifer 1 - Tap Water	Bis(2-ethylhexyl)phthalate	4E-07	--	4E-07	--	8E-07	Liver	0.02	--	0.02	0.04
			Chloroform	3E-07	--	4E-07	--	7E-07	Liver	0.06	--	0.08	0.1
			Heptachlor	7E-04	--	3E-04	--	1E-03	Liver	4	--	1	5
			Barium	--	--	--	--	--	Heart	0.4	--	--	0.4
			Lead (1)	--	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	--	Central Nervous System	40	--	--	40
			Uranium	--	--	--	--	--	Kidney	8	--	--	8
			Chemical Total	7E-04	--	3E-04	--	1E-03		52	--	1	53
			Uranium 238	1E-06	--	--	--	1E-06					
			Radium 226	3E-06	--	--	--	3E-06					
			Radionuclide Total	4E-06	--	--	--	4E-06					
		Exposure Point Total						1E-03					53
	Exposure Medium Total							1E-03					53
Groundwater Total								1E-03					53

TABLE 9.2.RME
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs
REASONABLE MAXIMUM EXPOSURE
The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Soil	Soil	Soil at Site 1	4,4'-DDD	1E-07	--	--	--	1E-07	--	--	--	--	--
			4,4'-DDE	3E-06	--	--	--	3E-06	--	--	--	--	--
			4,4'-DDT	1E-05	--	9E-07	--	1E-05	Liver	0.7	--	0.06	0.8
			Aluminum	--	--	--	--	--	Central Nervous System	0.1	--	--	0.1
			Lead (1)	--	--	--	--	--	--	--	--	--	--
			Manganese	--	--	--	--	--	Central Nervous System	0.02	--	--	0.02
			Uranium	--	--	--	--	--	Kidney	3	--	--	3
			Chemical Total	1E-05	--	9E-07	--	1E-05		4	--	0.06	4
			Uranium 238	9E-08	--	--	6E-07	7E-07					
			Radium 226	5E-07	--	--	9E-05	9E-05					
			Radionuclide Total	6E-07	--	--	9E-05	9E-05					
		Exposure Point Total						1E-04					4
	Exposure Medium Total							1E-04					4
Soil Total								1E-04					4
Receptor Total								1E-03					57

Total Risk Across All Media 1E-03

Total Hazard Across All Media 57

(1) Lead is evaluated for the resident using the IEUBK model. See Risk Assessment text for discussion of results and appendix for the lead modeling run results.

Total Liver HI Across All Media = 6
Total Kidney HI Across All Media = 11
Total Central Nervous System HI Across All Media = 40

EXAMPLE SCENARIO 11

TABLE 10.1.RME

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Aquifer 1 - Tap Water	Bis(2-ethylhexyl)phthalate	7E-07	- -	1E-06	- -	2E-06	- -	- -	- -	- -	- -
			Chloroform	5E-07	- -	1E-06	- -	2E-06	- -	- -	- -	- -	- -
			Heptachlor	1E-03	- -	6E-04	- -	2E-03	Liver	2	- -	0.8	3
			Manganese	- -	- -	- -	- -	- -	Central Nervous System	17	- -	- -	17
			Uranium	- -	- -	- -	- -	- -	Kidney	3	- -	- -	3
			Chemical Total	1E-03	- -	6E-04	- -	2E-03		22	- -	0.8	23
			Uranium 238	9E-06	- -	- -	- -	9E-06	- -	- -	- -	- -	- -
			Radium 226	2E-05	- -	- -	- -	2E-05	- -	- -	- -	- -	- -
			Radionuclide Total	3E-05	- -	- -	- -	3E-05					
		Exposure Point Total						2E-03					23
	Exposure Medium Total							2E-03					23
	Air	Water Vapors from Showerhead	Chloroform	- -	1E-05	- -	- -	1E-05	Liver	- -	5	- -	5
			Heptachlor	- -	1E-03	- -	- -	1E-03	- -	- -	- -	- -	- -
			Chemical Total	- -	1E-03	- -	- -	1E-03		- -	5	- -	5
			Radionuclide Total										
		Exposure Point Total						1E-03					5
	Exposure Medium Total							1E-03					5
Groundwater Total								3E-03					28

EXAMPLE SCENARIO 11

TABLE 10.1.RME

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

The Dean Company

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External	Exposure	Primary	Ingestion	Inhalation	Dermal	Exposure
Soil	Soil	Soil at Site 1	4,4'-DDE	1E-06	- -	'- -	- -	1E-06	- -	- -	- -	- -	- -
			4,4'-DDT	5E-06	- -	5E-007	- -	6E-06	- -	- -	- -	- -	- -
			Chemical Total	6E-06	- -	5E-07	- -	7E-06		- -	- -	- -	- -
			Uranium 238	2E-07	- -	- -	2E-06	2E-06	- -	- -	- -	- -	- -
			Radium 226	1E-006	- -	- -	4E-04	4E-04	- -	- -	- -	- -	- -
			Radionuclide Total	1E-06			4E-04	4E-04					
		Exposure Point Total						4E-04					- -
	Exposure Medium Total							4E-04					- -
Soil Total								4E-04					- -
Receptor Total								3E-03					28

Total Risk Across All Media: 3E-03

Total Hazard Across All Media: 28

Total Liver HI Across All Media = 8

Total Kidney HI Across All Media = 3

Total Central Nervous System HI Across All Media = 17

Cancer risks presented are those greater than 1E-06; Non-cancer risks presented are those greater than 1.

United States Environmental Protection Agency
Office of Solid Waste and Emergency Response
Publication 9285.7-01DFS
EPA/540/F-97/036
PB97-963311
January 1998

EPA

Frequently Asked Questions: RAGS Part D

Office of Emergency and Remedial Response

Quick Reference Fact Sheet

This fact sheet summarizes frequently asked questions regarding the U.S. Environmental Protection Agency's (EPA) Risk Assessment Guidance for Superfund Volume I - Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments) Interim (RAGS Part D). The March 21, 1995 memorandum on Risk Characterization Policy and Guidance from EPA Administrator Browner directed improvement in the transparency, clarity, consistency, and reasonableness of risk assessments at EPA. EPA, over the years, has identified opportunities for improvement in presentation of Superfund risk assessments. Furthermore, the General Accounting Office, members of Congress, and others have called for the betterment of Superfund risk assessments. The October 1995 Superfund Administrative Reform #6A directed EPA to: Establish National Criteria to Plan, Report, and Review Superfund Risk Assessments. EPA has developed an approach to respond to these challenges, which is presented in RAGS Part D.

RAGS Part D was developed by a Workgroup of EPA Headquarters and regional risk assessors (the RAGS Part D Workgroup) in concert with the CERCLIS 3 database development team to help standardize and improve the risk assessment process. The following frequently asked questions have been developed to clarify how and when RAGS Part D should be applied to a risk assessment.

APPLICABILITY

1. **To what sites will RAGS Part D apply?**
   RAGS Part D will apply to all Superfund risk assessments starting after January 1, 1998. In addition, the use of RAGS Part D is encouraged to the extent it can be efficiently incorporated into ongoing risk assessments started before that time. RAGS Part D is applicable to Remedial, Post-Remedial and SACM sites. The use of RAGS Part D is also encouraged for Removal and RCRA Corrective Action sites. The RAGS Part D Workgroup suggests that RAGS Part D could also be a useful tool for quantitative risk assessment at non-NPL, BRAC, and Brownfields sites, and encourages its use.

2. **At what phase of investigation should the Standard Tables be used at sites?**
   RAGS Part D describes the value that Interim Deliverables, which include the Standard Tables, add to the CERCLA remedial process, beginning with scoping and extending through the completion of the Baseline Risk Assessment.

3. **Has DOD accepted RAGS Part D? Who will be responsible for ensuring that all of the services receive and use the Standard Tables?**
   We are working with DOD Headquarters as well as our EPA Federal Facilities office to introduce the elements of RAGS Part D. So far, we have received positive feedback from the management at DOD. The individual services will be responsible for implementation of RAGS Part D. We are briefing various levels of Federal Facilities (DOD and others) about RAGS Part D and are highlighting the advantages of using it.

   Some Federal department staff were involved in the development of RAGS Part D. The Air Force, Navy, and Army were asked to comment on the draft Standard Table package and many of their comments were incorporated into RAGS Part D.

4. **Should every EPA region use RAGS Part D?**
   Yes

5. **Does this guidance apply to non-NPL sites?**
   While the guidance is specifically targeted for NPL sites, the use of RAGS Part D is also encouraged for Removal and RCRA Corrective Action risk assessments. The principles of continuous involvement of the EPA risk assessor and the use of Standard Tools to plan, report, and review risk assessments would be helpful at any site.

6. **Is RAGS Part D applicable to state agencies?**
   RAGS Part D is applicable to Superfund risk assessments performed under state oversight. The use of

RAGS Part D is also encouraged for Removal and RCRA Corrective Action sites.

7. **Have state agencies been involved in the development of RAGS Part D?**
Several regions have shared drafts of RAGS Part D with states in their region, and the Workgroup considered the state comments when preparing RAGS Part D.

IMPLEMENTATION

8. **Rather than save time and money, it seems that the use of RAGS Part D will slow down the process. How will use of the Standard Tables save time and money? Adding another major review of Interim Deliverables will cause major delays in projects.**
Initially, implementation may take longer than traditional risk assessments; there is a learning curve associated with any new guidance. The road map for continuous involvement of the EPA risk assessor, presented in Chapters 2 through 5 of RAGS Part D, and the Standard Tables, are standard tools to perform a risk assessment that should ultimately make the process more efficient. Specifically, review of Interim Deliverables will increase the likelihood that deliverables will be right the first time and will reduce rework because EPA's expectations for the risk assessment are clear at project initiation to both PRP and EPA contractors.

Preparation, review, and approval time will be shortened when each risk assessment presents information in a consistent manner using the Standard Table format. Consistency of presentation between risk assessments should also lead to better quality risk assessments.

Eliminating manual data entry into CERCLIS 3 will greatly reduce time and resources spent on reporting risk information. On the regional level, eliminating manual data entry will save the regions from having to provide hard copies of risk assessments to EPA Headquarters. In addition, EPA should be able to respond more easily to information requests, such as Congressional inquiries, by accessing electronic databases.

Regarding Interim Deliverables, another review is not being added; instead existing reviews are being phased to occur at the most critical times. Early and continuous involvement of the EPA risk assessor will lead to fewer data gaps and less rework associated with the Draft Baseline Risk Assessment.

9. **The risk assessors in our region are so busy now, how can they possibly be involved in every step of the RI, FS, and other parts of the process? We are going to need more risk assessors if this is the case.**
EPA Headquarters has canvassed the regions and requested resource requirements to implement the elements of RAGS Part D. EPA Headquarters is attempting to supplement the staff in the regions to meet those demands. In addition, the standard reporting formats (Standard Tables) provided in this guidance will make it easier for RPMs to identify risk assessment data requirements if a regional risk assessor is not available to review a risk assessment.

10. **It seems that implementation of RAGS Part D will cost more money, since most PRPs and contractors already have their own standard formats for risk assessments. Why are we reinventing the wheel? How can we estimate the initial increase in cost of this guidance for our contractors?**
Initially, PRPs and contractors may have to amend their spreadsheets to provide appropriate data for the Standard Tables. Regional risk assessors should be able to estimate the initial cost for amending spreadsheets. After this initial effort, the cost should actually decrease because of the standardization of requirements. EPA is implementing RAGS Part D in response to concerns by Congress (and the public) regarding the problems with transparency, clarity, consistency, and reasonableness of risk assessments. Without Standard Table formats, risk assessment information would continue to vary in completeness and clarity, and the data would have to be entered into CERCLIS 3 manually.

11. **Why are the Standard Tables so long and redundant? Why not "nest" information within columns?**
The Standard Table format promotes transparency in data presentation and facilitates subsequent electronic data transfer to CERCLIS 3. The electronic format will enable risk assessors to copy columns rather than retype information, so any repetition should not be burdensome. In addition, because of the eventual link between the Standard Tables and CERCLIS 3, it is necessary to segregate distinct pieces of information in order to make electronic transfer possible.

12. **How will implementation of RAGS Part D add to consistency in risk assessments when we say that risk assessors should refer to regional guidance?**
RAGS Part D adds to consistency of reporting of risk information. Where there is not overarching National guidance, regional differences exist. The risk assessor should refer to the regional office for appropriate guidance on topics such as variations in fish consumption rates, models used for showering scenarios, and selection of default exposure parameters.

TRANSITION

13. **If I am asking my contractors to implement the use of Standard Tables, I will have to amend statements of work for all my sites. This will be a lot of work.**
Sites with risk assessments already underway will be handled on a case-by-case basis and may not need amended SOWs. EPA Headquarters has offered assis-

tance to regions in amending SOWs for EPA contractors performing risk assessments. For PRP lead sites, regions will be responsible for amending consent decrees as needed.

14. **Will RPMs, contractors, etc. be trained in the use of RAGS Part D?**
    There will be training in each region in FY 98 for Federal and state risk assessors, RPMs, and contractors regarding the elements of RAGS Part D.

15. **How will the format of the Standard Tables change in years ahead as new guidance is released?**
    The format of the Standard Tables is the result of an extensive development effort, and we do not expect major changes to the Standard Tables except for additions resulting from new guidance (e.g., lead guidance, Monte Carlo/Probabilistic Analysis, and ecological guidance).

16. **If I have questions on how to complete one of the Standard Tables, who do I contact?**
    The Instructions for the Standard Tables offer detailed guidance for completion of these Tables. EPA is also developing a website and telephone Helpline to assist users in implementing RAGS Part D and as a source of update information. In addition, the RAGS Part D Workgroup member from your region (listed at the end of this Fact Sheet) should be able to assist you and answer questions about the Standard Tables.

PROCEDURES/APPLICATION

17. **Are there comparable tables for ecological risk assessment?**
    Standard Tables for ecological risk assessment are on a different track than the human health Standard Tables. EPA Headquarters representatives are working with regional risk assessors on Standard Tables for ecological risk assessment.

18. **If ecological concerns are driving the site cleanup, what Standard Tables should be used?**
    The Standard Tables for human health risk assessment should be completed if a human health risk assessment is being prepared. Ecological Standard Tables, once finalized, should be used to present ecological risk assessment information. Standard Tables for ecological risk assessment are being developed under another initiative.

19. **EPA just released Monte Carlo guidance. How will this be reflected in the Standard Tables?**
    The current version of the Standard Tables in RAGS Part D does not address Monte Carlo Analysis; however, Chapters 2 and 3 discuss probabilistic analysis. Once the Superfund program completes guidance in these areas, Standard Tables will be developed to implement the guidance. In addition, there will be updates to these tables periodically and a website and Helpline will be available for guidance on changes.

20. **What is the definition of EPA risk assessor?**
    This term refers to the risk assessor responsible for reviewing the risk assessment on behalf of EPA. In general, the EPA risk assessor is employed by EPA. Many EPA regions may also receive contractor, interagency, or state support in performing the role of the EPA risk assessor. The designation is a region-specific matter.

21. **How is lead exposure addressed by the Standard Tables?**
    A separate Standard Table documenting lead exposure, based on the IEUBK model, is under development. When completed, it will be made available through the website (http://www.epa.gov/superfund/oerr/techres/ragsd/ragsd.html) and through the RAGS Part D Workgroup member from your EPA region.

22. **Will Interim Deliverables be subject to enforceable schedules?**
    Enforceable schedules of Interim Deliverables will be handled on a site-specific basis in each region.

23. **Can the Standard Tables be altered?**
    No. The Standard Table formats can not be altered (i.e., columns can not be added, deleted, or changed); however, rows and footnotes can be added as appropriate. Standardization of the Standard Tables is needed to achieve Superfund program-wide reporting consistency and to accomplish electronic data transfer to CERCLIS 3.

24. **When, in the risk assessment process, are Interim Deliverables due?**
    The schedule for Interim Deliverables will be determined on region-specific and site-specific bases.

25. **Does RAGS Part D contradict the format outlined in RAGS Part A?**
    No. RAGS Part D supplements RAGS Parts A, B, and C.

26. **What happens if a chemical is not originally included as a Chemical of Potential Concern, but is later detected?**
    The Standard Tables should reflect the information used in the Baseline Risk Assessment to make the remedy decision. If necessary, the Standard Tables may require modification to reflect new data. The use of electronic spreadsheets makes this an easy task.

CERCLIS 3

27. **How will information be entered into CERCLIS 3?**

The Standard Tables prepared in Lotus® and/or Excel® formats will be electronically transferred to CERCLIS 3 using an upload function that is under development.

28. **Who will enter information into CERCLIS 3?**
Responsibility for entry of CERCLIS 3 risk data during FY 98 has not yet been determined. Use of Standard Tables by the risk assessor will minimize the burden of manual entry of risk data into CERCLIS 3.

29. **Who will have access to the risk data in CERCLIS 3 (e.g., public, DOD, EPA Program Managers, RPMs, risk assessors)?**
The CERCLIS 3 database managers will determine data accessibility. It has been recommended that entities contributing data to CERCLIS 3 be given access to it. At the moment, it is planned for the public to have access to non enforcement-sensitive data. The EPA regional Information Management Coordinators will have information on CERCLIS 3 data accessibility.

FOR FURTHER INFORMATION

The technical details (e.g., equations and assumptions) necessary to complete a risk assessment are available in RAGS. Additional information and guidance can be found in the various OSWER directives that have been released on risk assessment. For additional copies of this Frequently Asked Questions Fact Sheet, or any of the aforementioned risk assessment guidance documents, call the National Technical Information Service (NTIS) at (703) 487-4650 or 1-800-553-NTIS (6847). Alternately, you can access information on RAGS Part D via the Internet at the following location:

http://www.epa.gov/superfund/oerr/techres/ragsd/ragsd.html

The following members of the EPA RAGS Part D Workgroup may also be contacted:

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