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

RAGS PART D WORKGROUP MEMBERS

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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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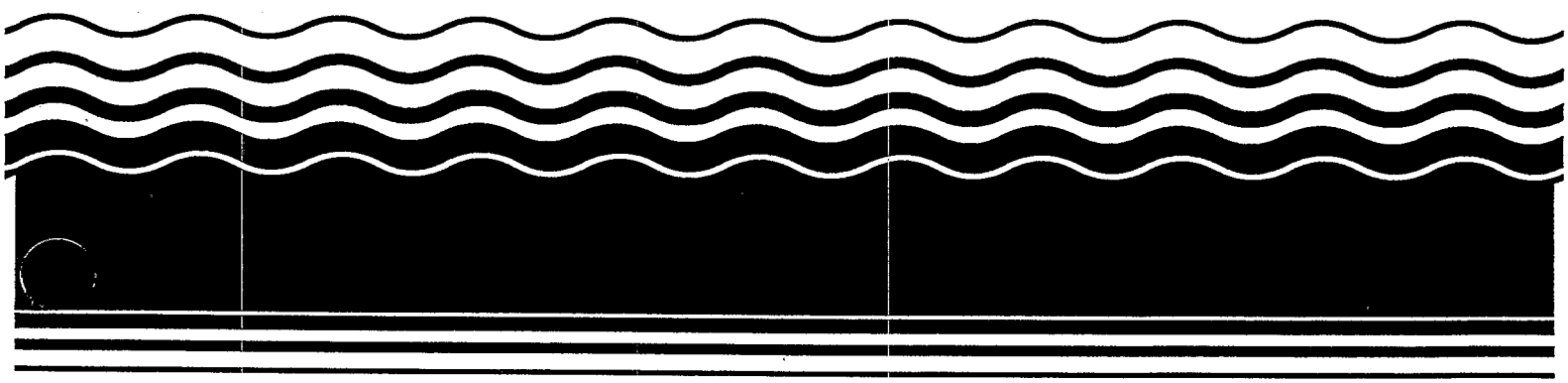
Superfund

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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CONTENTS (Continued)

EXHIBITS

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.

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.

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

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

EPA HEADQUARTERS

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Region 4:	Glenn Adams
Region 5:	Andrew Podowski
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Region 9:	Stan Smucker
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
U.S. Environmental Protection Agency
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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	✓
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...".

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.

→ CERCLA REMEDIAL PROCESS →

CONTINUOUS INVOLVEMENT OF EPA RISK ASSESSOR

(RAGS D - Chapter 1)

During Scoping

- Planning
- Workplans

(RAGS D - Chapter 2)

During Remedial Investigation

- Interim Deliverables
  - Standard Tables (Appendices A and B)
  - Worksheets
  - Supporting Information
  - Confidence and Uncertainty
  - Probabilistic Analysis
- Draft Baseline Risk Assessment Report
- Final Baseline Risk Assessment Report
- Data Transfer to CERCLIS 3

(RAGS D - Chapter 3)

During Feasibility Study

- Remedial Action Objectives
- Remedial Action Goals
- Risks/Hazards of PRGs
- Risks of Remedial Technologies and Alternatives

(RAGS D - Chapter 4)

After Feasibility Study

- Proposed Plan
- ROD
- RD/RA
- ESDs/Amended RODs
- Five-Year Reviews

(RAGS D - Chapter 5)

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.

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.

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.

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)

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.

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.

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 WORKSHEETS. 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 STANDARD TABLE 1	
Standard Table 1 - Selection of Exposure Pathways	One Standard Table for each Risk Assessment.
INTERIM DELIVERABLES ASSOCIATED WITH STANDARD TABLE 2	
Data Useability Worksheet	One Worksheet for each Medium.
Supporting Information on Background Values	Information for all Chemicals listed in Standard Table 2.
Standard Table 2 - Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)	One Standard Table for each unique combination of Scenario Timeframe, Medium, Exposure Medium, and Exposure Point.
INTERIM DELIVERABLES ASSOCIATED WITH STANDARD TABLE 3	
Supporting Information on EPCs	Information for all EPCs presented in Standard Table 3.
Standard Table 3 - Medium-Specific Exposure Point Concentration (EPC) Summary	One Standard Table for each unique combination of Scenario Timeframe, Medium, Exposure Medium, and Exposure Point.
INTERIM DELIVERABLES ASSOCIATED WITH STANDARD TABLE 4	
Supporting Information on Modeled Intake Methodology and Parameters	Information for all Modeled Intake calculations that are not presented in Standard Table 4.
Supporting Information on Chemical-Specific Parameters	Information for all Chemical-Specific Parameters used.
Standard Table 4 - Values Used for Daily Intake Calculations	One Standard Table for each unique combination of Scenario Timeframe, Medium, Exposure Medium, Exposure Point, Receptor Population and Receptor Age.
INTERIM DELIVERABLES ASSOCIATED WITH STANDARD TABLES 5 AND 6	
Supporting Information on Toxicity Data for Special Case Chemicals	Information for each Special Case Chemical.
Standard Table 5 - Non-Cancer Toxicity Data	Three Standard Tables - 5.1 for Oral/Dermal, 5.2 for Inhalation, and 5.3 for Special Case Chemicals.
Standard Table 6 - Cancer Toxicity Data	Three Standard Tables - 6.1 for Oral/Dermal, 6.2 for Inhalation, and 6.3 for Special Case Chemicals.

EXHIBIT 3-1

INTERIM DELIVERABLES FOR EACH SITE (continued)

Interim Deliverable	Scope of Deliverable
INTERIM DELIVERABLES ASSOCIATED WITH STANDARD TABLES 7 AND 8	
Supporting Information on Special Chemical Risk and Hazard Calculations	Information for each Special Case Chemical.
Standard Table 7 - Calculation of Non-Cancer Hazards	One Standard Table for each unique combination of Scenario Timeframe, Medium, Exposure Medium, Exposure Point, Receptor Population, and Receptor Age, for RME and for CT.
Standard Table 8 - Calculation of Cancer Risks	
INTERIM DELIVERABLES ASSOCIATED WITH STANDARD TABLES 9 AND 10	
Standard Table 9 - Summary of Receptor Risks and Hazards for COPCs	One Standard Table for each unique combination of Scenario Timeframe, Receptor Population, and Receptor Age, for RME and CT.
Standard Table 10 - Risk Assessment Summary	One Standard Table for each unique combination of Scenario Timeframe, Receptor Population, and Receptor Age, for RME and CT.
INTERIM DELIVERABLES ASSOCIATED WITH LEAD AND RADIONUCLIDES	
Lead Worksheets (if applicable) TO BE DEVELOPED	Separate Worksheets for Screening Analysis, and Child and Adult Exposures for each Medium.
Radionuclide Worksheets (if applicable) TO BE DEVELOPED	One Worksheet for each Medium.
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	One Summary for each Risk Assessment.

Notes:
1. Each Interim Deliverable will 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 Standard Table/Worksheet
Data Collection	
Develop a conceptual site model	Standard Table 1 - Selection of Exposure Pathways
Gather and report appropriate data	Standard Table 2 - Occurrence, Distribution, and Selection of Chemicals of Potential Concern
Data Evaluation	
Evaluate detection frequency, background data, and site data	Data Useability Worksheet Standard Table 2 - Occurrence, Distribution, and Selection of Chemicals of Concern
Identify chemicals of potential concern and provide rationale for selection and deletion	Standard Table 2 - Occurrence, Distribution, and Selection of Chemicals of Concern
Exposure Assessment	
Characterize physical setting, identify potential pathways and exposed population	Standard Table 1 - Selection of Exposure Pathways
Identify exposure assumptions	Standard Table 4 - Values Used for Daily Intake Calculations
Estimate exposure point concentrations	Standard Table 3 - Medium-Specific Exposure Point Concentration Summary
Estimate exposure intakes	Standard Table 7 - Calculation of Non-Cancer Hazards Standard Table 8 - Calculation of Cancer Risks
Toxicity Assessment	
Determine toxicity values for carcinogenic and non-carcinogenic effects and provide source information	Standard Table 5 - Non-Cancer Toxicity Data Standard Table 6 - Cancer Toxicity Data
Risk Characterization	
Quantify cancer and non-cancer risk by pathway	Standard Table 7 - Calculation of Non-Cancer Hazards Standard Table 8 - Calculation of Cancer Risks
Combine risks by media for different receptors	Standard Table 9 - Summary of Receptor Risks and Hazards for COPCs
Summarize risk drivers for different receptors	Standard Table 10 - Risk Assessment Summary

EXHIBIT 3-3

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.	

EXHIBIT 3-3

DATA USEABILITY WORKSHEET (continued)
Site:
Medium:

Activity	Comment
Data Quality Objectives	
Precision - How were duplicates handled?	
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.	

EXHIBIT 3-3

DATA USEABILITY WORKSHEET (continued)
Site:
Medium:

Activity	Comment
Data Validation and Interpretation	
What are the data validation requirements?	
What method or guidance was used to validate the data?	
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?	

EXHIBIT 3-3

DATA USEABILITY WORKSHEET (continued)
Site:
Medium:

Activity	Comment
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 Risk Assessment text to further expand on the information presented here.

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	Chemicals of Concern	Exposure Route	Receptor Population	Remedial Action Objectives

Example Table 2
VALUES CONSIDERED AS PRGs

Medium:
Receptor Population:

Chemical of Concern	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 of Concern	Maximum Concentration	PRG	Basis for PRG*	Risk at PRG: Cancer	Hazard at PRG: Non-Cancer
			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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U.S. EPA. 1989b. *Interim Final Guidance on Preparing Superfund Decision Documents.* Office of Emergency and Remedial Response, Washington, DC. OSWER Directive 9355.3-02.

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U.S. EPA. 1991c. *Risk Assessment Guidance for Superfund (RAGS): Volume I - Human Health Evaluation Manual Supplemental Guidance: "Standard Default Exposure Factors."* Interim Final. Office of Emergency and Remedial Response, Washington, DC. OSWER Directive 9285.6-03.

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U.S. EPA. 1992a. *Data Quality Objectives Process for Superfund, Interim Final Guidance.* Office of Solid Waste and Emergency Response, Washington, DC. OSWER Directive 9355.9-01. EPA/540/R-93/071.

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* This Reference Section is designed to not only give bibliographic information for documents referred to in the RAGS Part D text, but also to be a source of bibliographic information for documents that are relevant to risk assessment in general.

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 1

SELECTION OF EXPOSURE PATHWAYS

SITE NAME

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

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 (1)	Minimum Qualifier	Maximum Concentration (1)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value (2)	Screening Toxicity Value (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for Contaminant Deletion or Selection (4)

(1) Minimum/maximum detected concentration.
(2) N/A - Refer to supporting information for background discussion.
Background values derived from statistical analysis. Follow Regional guidance and provide supporting information.
(3) Provide reference for screening toxicity value.
(4) Rationale Codes Selection Reason: Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Deletion Reason: Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Definitions: N/A = Not Applicable
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
MCL = Federal Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
J = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic

TABLE 3.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
SITE NAME

Scenario Timeframe:
Medium:
Exposure Medium:
Exposure Point:

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale

Statistics: Maximum Detected Value (Max); 95% UCL of Normal Data (95% UCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T); Mean of Normal Data (Mean-N).

TABLE 4.1

VALUES USED FOR DAILY INTAKE CALCULATIONS

SITE NAME

Scenario Timeframe:
Medium:
Exposure Medium:
Exposure Point:
Receptor Population:
Receptor Age:

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

SITE NAME

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: (3) Target Organ (MM/DD/YY)

N/A = Not Applicable

(1) Refer to RAGS, Part A

(2) Provide equation used for derivation.

(3) For IRIS values, provide the date IRIS was searched.

For HEAST values, provide the date of HEAST.

For NCEA values, provide the date of the article provided by NCEA.

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

SITE NAME

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Adjusted Inhalation RfD (1)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (2) (MM/DD/YY)

N/A = Not Applicable

(1) Provide equation used for derivation in text.

(2) For IRIS values, provide the date IRIS was searched.

For HEAST values, provide the date of HEAST.

For NCEA values, provide the date of the article provided by NCEA.

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

SITE NAME

Chemical of Potential Concern	Chronic/ Subchronic	Value	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of Toxicity: Primary Target Organ	Date (MM/DD/YY)

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

SITE NAME

Chemical of Potential Concern	Oral Cancer Slope Factor	Oral to Dermal Adjustment Factor	Adjusted Dermal Cancer Slope Factor (1)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (2) (MM/DD/YY)

IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

(1) Provide equation for derivation in text.

(2) For IRIS values, provide the date IRIS was searched.
For HEAST values, provide the date of HEAST.
For NCEA values, provide the date of article provided by NCEA.

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

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

SITE NAME

Chemical of Potential Concern	Unit Risk	Units	Adjustment	Inhalation Cancer Slope Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (1) (MM/DD/YY)

IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

Weight of Evidence:

Known/Likely

Cannot be Determined

Not Likely

(1) For IRIS values, provide the date IRIS was searched.

For HEAST values, provide the date of HEAST.

For NCEA values, provide the date of the article provided by NCEA.

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

TABLE 6.3

CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

SITE NAME

Chemical of Potential Concern	Value	Units	Source	Date (1) MM/DD/YY

(1) For IRIS values, provide the date IRIS was searched.
For HEAST values, provide the date of HEAST.
For NCEA values, provide the date of the article provided by NCEA.

TABLE 7.1.RME

CALCULATION OF NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

SITE NAME

Scenario Timeframe:
Medium:
Exposure Medium:
Exposure Point:
Receptor Population:
Receptor Age:

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
												Total Hazard Index Across All Exposure Routes/Pathways	

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

(2) Specify if subchronic.

TABLE 8.1.RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

SITE NAME

Scenario Timeframe:
Medium:
Exposure Medium:
Exposure Point:
Receptor Population:
Receptor Age:

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk

Total Risk Across All Exposure Routes/Pathways

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

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	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
			Total Risk Across[Medium]						Total Hazard Index Across All Media and All Exposure Routes				
			Total Risk Across All Media and All Exposure Routes										

Total [Organ] HI =

Total [Organ] HI =

Total [Organ] HI =

TABLE 10.1.RME
RISK ASSESSMENT SUMMARY
REASONABLE MAXIMUM EXPOSURE
SITE NAME

Scenario Timeframe:	
Receptor Population:	
Receptor Age:	

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total

Total Risk Across [Medium]	
Total Risk Across All Media and All Exposure Routes	

Total Hazard Index Across All Media and All Exposure Routes	

Total [Organ] HI =	
Total [Organ] HI =	

Example Standard Tables

TA

SELECTION OF EXPOSURE PATHWAYS

Dean's Creek Development Company

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
Current	Groundwater	Groundwater	Aquifer 1--Tap Water	Resident	Adult	Dermal	Off-Site	Quant	Residents currently live next to the site, and their wells draw from Aquifer 1.
						Ingestion	Off-site	Quant	Residents currently live next to the site, and their wells draw from Aquifer 1.
					Child	Dermal	Off-site	Quant	Residents currently live next to the site, and their wells draw from Aquifer 1.
						Ingestion	Off-site	Quant	Residents currently live next to the site, and their wells draw from Aquifer 1.
				Trespasser/Visitor	Adult	Dermal	On-site	None	No groundwater seeps or wells on site.
						Ingestion	On-site	None	No groundwater seeps or wells on site.
					Child	Dermal	On-site	None	No groundwater seeps or wells on site.
						Ingestion	On-site	None	No groundwater seeps or wells on site.
		Air	Aquifer 1--Water Vapors at Showerhead	Resident	Adult	Inhalation	Off-site	Quant	Residents currently live next to the site, and their wells draw from Aquifer 1.
					Child	Inhalation	Off-site	None	Children are assumed not to shower.
	Sediment	Sediment	Dean's Creek	Trespasser/Visitor	Adult	Dermal	On-site	None	Interim action was conducted to remove source and contaminated sediment.
						Ingestion	On-site	None	Interim action was conducted to remove source and contaminated sediment.
					Child	Dermal	On-Site	None	Interim action was conducted to remove source and contaminated sediement.
						Ingestion	On-Site	None	Interim action was conducted to remove source and contaminated sediment.
		Animal Tissue	Trout from Dean's Creek	Fisher	Adult	Dermal	Off-site	None	Exposure to contaminants in fish unlikely through dermal pathway.
						Ingestion	Off-site	Quant	Possibility of contaminants in downstream fish previously exposed to contaminated sediments.
					Child	Dermal	Off-site	None	Exposure to contaminants in fish unlikely through dermal pathway.
						Ingestion	Off-site	Quant	Possibility of contaminants in downstream fish previously exposed to contaminated sediments.
Future	Groundwater	Groundwater	Aquifer 1--Tap Water	Resident	Adult	Dermal	Off-site	None	Community will be serviced by public water within 2 years.
						Ingestion	Off-site	None	Community will be serviced by public water within 2 years.
					Child	Dermal	Off-site	None	Community will be serviced by public water within 2 years.
						Ingestion	Off-site	None	Community will be serviced by public water within 2 years.
				Trespasser/Visitor	Adult	Dermal	On-site	None	No groundwater seeps or wells on site.
						Ingestion	On-site	None	No groundwater seeps or wells on site.
					Child	Dermal	On-site	None	No groundwater seeps or wells on site.
						Ingestion	On-site	None	No groundwater seeps or wells on site.
		Air	Aquifer 1--Water Vapors at Showerhead	Resident	Adult	Inhalation	Off-site	None	Community will be serviced by public water within 2 years.
					Child	Inhalation	Off-site	None	Children are assumed not to shower.
	Sediment	Sediment	Dean's Creek	Trespasser/Visitor	Adult	Dermal	On-site	None	Interim action was conducted to remove source and contaminated sediment.
						Ingestion	On-site	None	Interim action was conducted to remove source and contaminated sediment.
					Child	Dermal	On-site	None	Interim action was conducted to remove source and contaminated sediment.
						Ingestion	On-site	None	Interim action was conducted to remove source and contaminated sediment.
		Animal Tissue	Trout from Dean's Creek	Fisher	Adult	Dermal	Off-site	None	Exposure to contaminants in fish unlikely through dermal pathway.
						Ingestion	Off-site	Quant	Possibility of contaminants in downstream fish previously exposed to contaminated sediments.
					Child	Dermal	Off-site	None	Exposure to contaminants in fish unlikely through dermal pathway.
						Ingestion	Off-site	Quant	Possibility of contaminants in downstream fish previously exposed to contaminated sediments.

TABLE 2.1
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Dean's Creek Development Company

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Aquifer 1--Tap Water

CAS Number	Chemical	Minimum (1) Concentration	Minimum Qualifier	Maximum (1) Concentration	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration (2) Used for Screening	Background (3) Value	Screening (4) Toxicity Value		Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag	Rationale for (5) Contaminant Deletion or Selection
7429-90-5	Aluminum	246		3,200		µg/l	MW-3	9/9	1.0 - 10.0	3,200	3,100	N/A		50	SMCL	NO	BSL
7440-38-2	Arsenic	3.2		42		µg/l	MW-4	3/9	1.0-1.0	42	4.9	0.046	C	50	MCL	YES	ASL
7440-39-3	Barium	53.2		173		µg/l	MW-11	9/9	2.0-2.0	173	70	260	N	2,000	MCL	NO	BSL
7440-41-7	Beryllium	1.2		2.1		µg/l	MW-9	2/9	.3-1.0	2.1	0.6	0.019	C	4	MCL	YES	ASL
7440-70-2	Calcium	16,800		30,700		µg/l	MW-3	9/9	5000	30,700	2,162	N/A		N/A	N/A	NO	NUT
75-35-4	1,1-Dichloroethylene	3		75.5		µg/l	MW-5	9/9	1.0-1.0	75.5	N/A	0.054	C	7	MCL	YES	ASL, FD
127-18-4	Tetrachloroethene	14		560		µg/l	MW-11	6/9	1.0-1.0	560	N/A	1.3	C	5	MCL	YES	ASL
75-01-4	Vinyl Chloride	1	J	5	J	µg/l	MW-5	5/9	1.0-1.0	5	N/A	0.023	C	2	MCL	YES	ASL

(1) Minimum/maximum detected concentration.

(2) Maximum concentration used as screening value.

(3) N/A - Refer to supporting information for background discussion.
Background values derived from statistical analysis. Follow Regional guidance and provide supporting information.

(4) Risk-Based Concentration Table, Third Quarter 1993, U.S. EPA Region III, Roy L. Smith, Ph.D, March 1997. (Cancer benchmark value = 1E-06, HQ = 0.1)

(5) Rationale Codes
Selection Reason:
Infrequent Detection but Associated Historically (HIST)
Frequent Detection (FD)
Toxicity Information Available (TX)
Above Screening Levels (ASL)
Deletion Reason:
Infrequent Detection (IFD)
Background Levels (BKG)
No Toxicity Information (NTX)
Essential Nutrient (NUT)
Below Screening Level (BSL)

Definitions:
N/A = Not Applicable
SQL = Sample Quantitation Limit
COPC = Chemical of Potential Concern
ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
MCL = Federal Maximum Contaminant Level
SMCL = Secondary Maximum Contaminant Level
J = Estimated Value
C = Carcinogenic
N = Non-Carcinogenic

TABLE 3.1
MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY
Dean's Creek Development Company

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Aquifer 1--Tap Water

Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL of Normal Data	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Reasonable Maximum Exposure			Central Tendency		
							Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale	Medium EPC Value	Medium EPC Statistic	Medium EPC Rationale
Arsenic	µg/l	2.61E+01	N/A	4.2E+001		µg/l	3.51E+01	95% UCL-T	W - Test (1)	3.31E+01	Mean-T	W - Test (1)
Beryllium	µg/l	1.40E+00	N/A	2.1E+000		µg/l	1.13E+00	95% UCL-T	W - Test (1)	1.08E+00	Mean-T	W - Test (1)
1,1-Dichloroethylene	µg/l	4.20E+01	8.2E+001	7.6E+001		µg/l	7.55E+01	Max	W - Test (2)	4.20E+01	Mean-N	W - Test (3)
Tetrachloroethene	µg/l	1.90E+02	N/A	5.6E+002		µg/l	5.12E+02	95% UCL-T	W - Test (1)	1.83E+02	Mean-T	W - Test (1)
Vinyl Chloride	µg/l	1.20E+00	2.0E+00	5.0E+000	J	µg/l	2.00E+00	95% UCL-N	W - Test (3)	1.20E+00	Mean-N	W - Test (3)

concentration; for duplicate sample results, the average value was used in the calculation.
nce to RAGS: Calculating the Concentration Term, OSWER Directive 9285.7-081, May 1992.

JCL-N); 95% UCL of Log-transformed Data (95% UCL-T); Mean of Log-transformed Data (Mean-T);
Mean of Normal Data (Mean-N).

(1) Shapiro-Wilk W Test indicates data are log-normally distributed.
(2) 95% UCL exceeds maximum detected concentration. Therefore, maximum concentration used for EPC.
(3) Shapiro-Wilks W Test indicates data are normally distributed.

TABLE 4.1

VALUES USED FOR DAILY INTAKE CALCULATIONS

Dean's Creek Development Company

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Aquifer 1--Tap Water
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CW	Chemical Concentration in Water	µg/l	See Table 3	See Table 3	--	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR-W	Ingestion Rate of Water	liters/day	2	EPA, 1991	--	--	CW x IR x EF x ED x CF1 x 1/BW x 1/AT
	EF	Exposure Frequency	days/year	350	EPA, 1991	--	--	
	ED	Exposure Duration	years	24	EPA, 1991	--	--	
	CF1	Conversion Factor 1	mg/µg	0.001	--	--	--	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	EPA, 1989	--	--	
Dermal	CW	Chemical Concentration in Water	µg/l	See Table 3	See Table 3	--	--	CDI (mg/kg-day) =
	CF1	Conversion Factor 1	mg/µg	0.001	--	--	--	CW x SA x CF1 x PC x ET x EF x
	PC	Permeability Constant	cm/hr	See Text	(1)	--	--	ED x CF2 x 1/BW x 1/AT
	ET	Exposure Time	hr/day	0.33	(2)	--	--	
	CF2	Conversion Factor 2	l/cm3	0.001	EPA, 1989	--	--	
	SA	Skin Surface Area Available for Contact	cm2	18,000	EPA, 1989	--	--	
	EF	Exposure Frequency	days/years	350	EPA, 1991	--	--	
	ED	Exposure Duration	years	24	EPA, 1991	--	--	
	BW	Body Weight	kg	70	EPA, 1991	--	--	
	AT-C	Averaging Time (Cancer)	days	25,550	EPA, 1989	--	--	
	AT-N	Averaging Time (Non-Cancer)	days	8,760	EPA, 1989	--	--	

(1) Refer to Supporting Information.

(2) Professional Judgement.

Sources:

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

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

TABLE 4.3

VALUES USED FOR DAILY INTAKE CALCULATIONS

Dean's Creek Development Company

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Aquifer 1--Water Vapors at Showerhead
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	(1)	(1)	(1)	(1)	(1)	--	--	Foster & Chrostowski Shower Inhalation Model

(1) See Route-Specific EPC and Modeled Intake Supporting Information.

TABLE 5.1

NON-CANCER TOXICITY DATA -- ORAL/DERMAL

Dean's Creek Development Company

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (MM/DD/YY) (3)
Arsenic	Chronic	3.0E-04	mg/kg-day	95%	2.9E-04	mg/kg-day	Skin	3	IRIS:NCEA	12/01/96
	Subchronic	3.0E-03	mg/kg-day	N/A	N/A	mg/kg-day	Skin	30	IRIS	12/01/96
Beryllium	Chronic	5.0E-03	mg/kg-day	1%	5.0E-05	mg/kg-day	NOEL	100	IRIS:NCEA	12/01/96
	Subchronic	5.0E-02	mg/kg-day	N/A	N/A	mg/kg-day	NOEL	1000	IRIS	12/01/96
1,1-Dichloroethylene	Chronic	9.0E-03	mg/kg-day	100%	9.0E-03	mg/kg-day	Liver	1000	IRIS	12/01/96
Tetrachloroethene	Chronic	1.0E-02	mg/kg-day	100%	1.0E-02	mg/kg-day	Liver	1000	IRIS:NCEA	12/01/96
Vinyl Chloride	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A = Not Applicable

(1) Refer to RAGS, Part A

(2) Provide equation used for derivation.

(3) For IRIS values, provide the date IRIS was searched.
For HEAST values, provide the date of HEAST.
For NCEA values, provide the date of the article provided by NCEA.

TABLE 5.2

NON-CANCER TOXICITY DATA -- INHALATION

Dean's Creek Development Company

Chemical of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Adjusted Inhalation RfD (1)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of RfC:RfD: Target Organ	Dates (MM/DD/YY) (2)
1,1-Dichloroethylene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethylene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl Chloride	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A = Not Applicable

(1) Provide equation used for derivation in text.

(2) For IRIS values, provide the date IRIS was searched.

For HEAST values, provide the date of HEAST.

For NCEA values, provide the date of the article provided by NCEA.

TABLE 5.3

NON-CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

Dean's Creek Development Company

Chemical of Potential Concern	Chronic/ Subchronic	Value	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Sources of Toxicity: Primary Target Organ	Date (MM/DD/YY)
--	--	--	--	--	--	--	--

TABLE 6.1

CANCER TOXICITY DATA -- ORAL/DERMAL

Dean's Creek Development Company

Chemical of Potential Concern	Oral Cancer Slope Factor	Oral to Dermal Adjustment Factor	Adjusted Dermal Cancer Slope Factor (1)	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (2) (MM/DD/YY)
Arsenic	1.75	95%	1.84E+00	(mg/kg-day)$^{-1}$	A	IRIS	10/01/94
Beryllium	4.3	1%	4.30E+02	(mg/kg-day)$^{-1}$	B2	IRIS	12/01/96
1,1-Dichloroethylene	6.0E-001	100%	6.00E-01	(mg/kg-day)$^{-1}$	C	IRIS	12/01/96
Tetrachloroethene	5.0E-002	100%	5.20E-02	(mg/kg-day)$^{-1}$	B2	IRIS	12/01/96
Vinyl Chloride	1.9	100%	1.90E+00	(mg/kg-day)$^{-1}$	A	HEAST	05/95

IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

(1) Provide equation for derivation in text.

(2) For IRIS values, provide the date IRIS was searched.
For HEAST values, provide the date of HEAST.
For NCEA values, provide the date of article provided by NCEA.

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

TABLE 6.2

CANCER TOXICITY DATA -- INHALATION

Dean's Creek Development Company

Chemical of Potential Concern	Unit Risk	Units	Adjustment (1)	Inhalation Cancer Slope Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source	Date (MM/DD/YY)
1,1-Dichloroethylene	5.0E-005	$(ug/m3)^{-1}$	3,500	1.75E-001	$(mg/kg\text{-}day)^{-1}$	C	IRIS	12/01/96
Tetrachloroethylene	5.8E-007	$(ug/m3)^{-1}$	3,500	2.03E-003	$(mg/kg\text{-}day)^{-1}$	B2	NCEA	12/01/96
Vinyl Chloride	8.4E-005	$(ug/m3)^{-1}$	3,500	3.00E-001	$(mg/kg\text{-}day)^{-1}$	A	HEAST	5/95

IRIS = Integrated Risk Information System

HEAST= Health Effects Assessment Summary Tables

Weight of Evidence:

Known/Likely

Cannot be Determined

Not Likely

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

(1) Adjustment Factor applied to Unit Risk to calculate inhalation Slope Factor = 70kg x 1/20m3/day x 1000ug/mg

(2) For IRIS values, provide the date IRIS was searched.
For HEAST values, provide the date of HEAST.
For NCEA values, provide the date of the article provided by NCEA.

TABLE 6.3

CANCER TOXICITY DATA -- SPECIAL CASE CHEMICALS

Dean's Creek Development Company

Chemical of Potential Concern	Value	Units	Source	Date (1) MM/DD/YY
--	--	--	--	--

(1) For IRIS values, provide the date IRIS was searched.
For HEAST values, provide the date of HEAST.
For NCEA values, provide the date of the article provided by NCEA.

TABLE 7.1.RME
CALCULATION OF NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
Dean's Creek Development Company

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Aquifer 1--Tap Water
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Ingestion	Arsenic	3.5E+01	µg/l	3.5E+01	µg/l	M	9.6E-004	mg/kg-day	3.0E-004	mg/kg-day	N/A	N/A	3.2E+000
	Beryllium	1.1E+00	µg/l	1.1E+00	µg/l	M	3.0E-005	mg/kg-day	5.0E-003	mg/kg-day	N/A	N/A	6.0E-003
	1,1-Dichloroethylene	7.6E+01	µg/l	7.6E+01	µg/l	M	2.1E-003	mg/kg-day	9.0E-003	mg/kg-day	N/A	N/A	2.3E-001
	Tetrachloroethene	5.1E+02	µg/l	5.1E+02	µg/l	M	1.4E-002	mg/kg-day	1.0E-002	mg/kg-day	N/A	N/A	1.4E+000
	Vinyl Chloride	2.0E+00	µg/l	2.0E+00	µg/l	M	5.5E-005	mg/kg-day	--	mg/kg-day	N/A	N/A	--
	(Total)												4.8E+000
Dermal	Arsenic	3.5E+01	µg/l	3.5E+01	µg/l	M	4.6E-007	mg/kg-day	2.9E-004	mg/kg-day	N/A	N/A	1.60E-003
	Beryllium	1.1E+00	µg/l	1.1E+00	µg/l	M	1.4E-008	mg/kg-day	5.0E-005	mg/kg-day	N/A	N/A	2.90E-004
	1,1-Dichloroethylene	7.6E+01	µg/l	7.6E+01	µg/l	M	9.9E-005	mg/kg-day	9.0E-003	mg/kg-day	N/A	N/A	1.10E-002
	Tetrachloroethene	5.1E+02	µg/l	5.1E+02	µg/l	M	2.0E-003	mg/kg-day	1.0E-002	mg/kg-day	N/A	N/A	2.00E-001
	Vinyl Chloride	2.0E+00	µg/l	2.0E+00	µg/l	M	1.2E-006	mg/kg-day	--	mg/kg-day	N/A	N/A	--
	(Total)												2.1E-001
												Total Hazard Index Across All Exposure Routes/Pathways	5.0E+000

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

(2) Specify if subchronic.

TABLE 7.3.RME

CALCULATION OF NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

Dean's Creek Development Company

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Aquifer 1--Water Vapors at Showerhead
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Hazard Calculation (1)	Intake (Non-Cancer)	Intake (Non-Cancer) Units	Reference Dose (2)	Reference Dose Units	Reference Concentration	Reference Concentration Units	Hazard Quotient
Inhalation	1,1-Dichloroethylene	7.6E+01	µg/l	3.5E+001	µg/l	R	3.3E-003	mg/kg-day	--	mg/kg-day	N/A	N/A	--
	Tetrachloroethene	5.1E+02	µg/l	1.9E+002	µg/l	R	1.8E-002	mg/kg-day	--	mg/kg-day	N/A	N/A	--
	Vinyl Chloride	2.0E+00	µg/l	1.0E+000	µg/l	R	1.0E-004	mg/kg-day	--	mg/kg-day	N/A	N/A	--
	(Total)												--
												Total Hazard Index Across All Exposure Routes/Pathways	--

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for hazard calculation.

(2) Specify if subchronic.

TABLE 8.1.RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

Dean's Creek Development Company

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Groundwater
Exposure Point: Aquifer 1--Tap Water
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Ingestion	Arsenic	3.5E+01	µg/l	3.5E+01	µg/l	M	3.3E-04	mg/kg-day	1.75E+00	$(mg/kg\text{-}day)^{-1}$	5.8E-04
	Beryllium	1.1E+00	µg/l	1.1E+00	µg/l	M	1.1E-05	mg/kg-day	4.30E+00	$(mg/kg\text{-}day)^{-1}$	4.5E-05
	1,1-Dichloroethylene	7.6E+01	µg/l	7.6E+01	µg/l	M	7.1E-04	mg/kg-day	6.00E-01	$(mg/kg\text{-}day)^{-1}$	4.3E-04
	Tetrachloroethene	5.1E+02	µg/l	5.1E+02	µg/l	M	4.8E-03	mg/kg-day	5.20E-02	$(mg/kg\text{-}day)^{-1}$	2.5E-04
	Vinyl Chloride	2.0E+000	µg/l	2.0E+000	µg/l	M	1.9E-005	mg/kg-day	1.90E+00	$(mg/kg\text{-}day)^{-1}$	3.6E-005
	(Total)										1.3E-003
Dermal	Arsenic	3.5E+01	µg/l	3.5E+01	µg/l	M	1.6E-007	mg/kg-day	1.84E+00	$(mg/kg\text{-}day)^{-1}$	2.9E-007
	Beryllium	1.1E+00	µg/l	1.1E+00	µg/l	M	4.9E-009	mg/kg-day	4.30E+02	$(mg/kg\text{-}day)^{-1}$	2.1E-006
	1,1-Dichloroethylene	7.6E+01	µg/l	7.6E+01	µg/l	M	3.4E-005	mg/kg-day	6.00E-01	$(mg/kg\text{-}day)^{-1}$	2.0E-005
	Tetrachloroethene	5.1E+02	µg/l	5.1E+02	µg/l	M	6.8E-004	mg/kg-day	5.20E-02	$(mg/kg\text{-}day)^{-1}$	3.6E-005
	Vinyl Chloride	2.0E+000	µg/l	2.0E+000	µg/l	M	4.1E-007	mg/kg-day	1.90E+00	$(mg/kg\text{-}day)^{-1}$	7.7E-007
	(Total)										5.9E-005
										Total Risk Across All Exposure Routes/Pathways	1.4E-003

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 8.3.RME

CALCULATION OF CANCER RISKS

REASONABLE MAXIMUM EXPOSURE

Dean's Creek Development Company

Scenario Timeframe: Current
Medium: Groundwater
Exposure Medium: Air
Exposure Point: Aquifer 1--Water Vapors at Showerhead
Receptor Population: Resident
Receptor Age: Adult

Exposure Route	Chemical of Potential Concern	Medium EPC Value	Medium EPC Units	Route EPC Value	Route EPC Units	EPC Selected for Risk Calculation (1)	Intake (Cancer)	Intake (Cancer) Units	Cancer Slope Factor	Cancer Slope Factor Units	Cancer Risk
Inhalation	1,1-Dichloroethylene	7.6E+001	µg/l	3.4E-003	µg/l	R	1.1E-003	mg/kg-day	1.75E-01	$(mg/kg\text{-}day)^{-1}$	2.0E-004
	Tetrachloroethene	5.1E+002	µg/l	1.9E-002	µg/l	R	6.1E-003	mg/kg-day	2.03E-03	$(mg/kg\text{-}day)^{-1}$	1.2E-05
	Vinyl Chloride	2.0E+000	µg/l	1.0E-004	µg/l	R	3.4E-005	mg/kg-day	3.00E-01	$(mg/kg\text{-}day)^{-1}$	1.0E-005
	(Total)										2.2E-004
										Total Risk Across All Exposure Routes/Pathways	2.2E-004

(1) Specify Medium-Specific (M) or Route-Specific (R) EPC selected for risk calculation.

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

Dean's Creek Development Company

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

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Aquifer 1--Tap Water	Arsenic	5.8E-04	--	2.9E-007	5.8E-04	Arsenic	skin	3.2	--	0.002	3.2
			Beryllium	4.5E-05	--	2.1E-006	4.7E-05	Beryllium	NOEL	0.006	--	0.0003	0.006
			1,1-Dichloroethylene	4.3E-04	--	2.0E-005	4.5E-004	1,1-Dichloroethylene	liver	0.2	--	0.01	0.2
			Tetrachloroethene	2.5E-04	--	3.6E-005	2.9E-004	Tetrachloroethene	liver	1.4	--	0.2	1.6
			Vinyl Chloride	3.6E-005	--	7.7E-007	3.7E-005	Vinyl Chloride	NOEL	--	--	--	--
			(Total)	1.3E-003	--	5.9E-005	1.4E-003	(Total)		4.8	--	0.2	5
	Air	Aquifer 1--Water Vapors at Showerhead	1,1-Dichloroethylene	--	2.0E-04	--	2.0E-04	1,1-Dichloroethylene	NOEL	--	--	--	--
			Tetrachloroethene	--	1.2E-05	--	1.2E-05	Tetrachloroethene	proteinuria	--	--	--	--
			Vinyl Chloride	--	1.0E-05	--	1.0E-05	Vinyl Chloride	NOEL	--	--	--	--
			(Total)	--	2.2E-004	--	2.2E-004	(Total)		--	--	--	--

Total Risk Across Groundwater	1.6E-03
Total Risk Across All Media and All Exposure Routes	1.6E-03

Total Hazard Index Across All Media and All Exposure Routes	5

Total Liver HI =	1.8
Total Skin HI =	3.2
Total Proteinuria HI =	--

TABLE 10.1.RME

RISK ASSESSMENT SUMMARY

REASONABLE MAXIMUM EXPOSURE

Dean's Creek Development Company

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

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk				Chemical	Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	Exposure Routes Total		Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Aquifer 1--Tap Water	Arsenic	5.8E-04	--	2.9E-007	5.8E-04	Arsenic	skin	3.2	--	0.002	3.2
			Beryllium	4.5E-05	--	2.1E-006	4.7E-05	Tetrachloroethene	liver	1.4	--	0.2	1.6
			1,1-Dichloroethylene	4.3E-04	--	2.0E-005	4.5E-004						
			Tetrachloroethene	2.5E-04	--	3.6E-005	2.9E-004						
			Vinyl Chloride	3.6E-005	--	7.7E-007	3.7E-005						
			(Total)	1.3E-003	--	5.9E-005	1.4E-003	(Total)		4.6	--	0.2	4.8
	Air	Aquifer 1--Water Vapors at Showerhead	1,1-Dichloroethylene	--	2.0E-04	--	2.0E-04			--	--	--	--
			Tetrachloroethene	--	1.2E-05	--	1.2E-05			--	--	--	--
			Vinyl Chloride	--	1.0E-05	--	1.0E-05			--	--	--	--
			(Total)	--	2.2E-004	--	2.2E-004	(Total)		--	--	--	--
							Total Risk Across Groundwater						1.6E-03
							Total Risk Across All Media and All Exposure Routes						1.6E-03
													Total Hazard Index Across All Media and All Exposure Routes					4.8

Total Liver HI = 1.6

Total Skin HI = 3.2

01/28/98

APPENDIX B

INSTRUCTIONS FOR COMPLETION OF THE STANDARD TABLES

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.	
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 only. • Number it Table 1. • The table should contain a row for each Exposure Pathway considered.	***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.	***Current*** ***Future*** ***Current/Future*** ***Not Documented***

INSTRUCTIONS FOR TABLE 1

SELECTION OF EXPOSURE PATHWAYS (continued)

Column 2 - Medium	
Definition: • The environmental substance (e.g., air, water, soil) originally contaminated.	
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 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.*	
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* *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 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.*	
Instructions: • Describe the exposure point as text in the Table (not to exceed 80 characters).	*The text in the Table can not exceed 80 characters.*
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.	*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*

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 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 Absorption*** ***Not Documented*** ***External (Radiation)***
Column 8 - On-Site/Off-Site	
Definition: • The location of potential contact between a person and a chemical (contaminant) as it relates to the site boundary.	
Instructions: • Choose from the picklist to the right.	***On-site*** ***Off-site*** ***On-site/Off-site*** ***Not Documented***

INSTRUCTIONS FOR TABLE 1

SELECTION OF EXPOSURE PATHWAYS (continued)

Column 9 - 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.	***Quant*** **(Quantitative)** ***Qual*** **(Qualitative)** ***None***
Column 10 - 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 a pathway for analysis. Provide a narrative rationale for each exposure route.	***Follow Regional guidance for the rationale codes. The narrative in the Table cannot exceed 200 characters.***

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 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.

INFORMATION DOCUMENTED:

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

TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS:

- Complete one copy of Table 2 for each unique combination of the following four fields that will be quantitatively evaluated in the risk assessment (Scenario Timeframe, Medium, Exposure Medium, and Exposure Point).
- Enter each combination of these four 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 four key fields.

For the example table provided, there should be four copies of Table 2, numbered 2.1, 2.2, 2.3, and 2.4.

Table Number	*Scenario Timeframe*	*Medium*	*Exposure Medium*	*Exposure Point*
2.1	*Current*	*Groundwater*	*Groundwater*	*Aquifer 1 - Tap Water*
2.2	*Current*	*Groundwater*	*Air*	*Aquifer 1 - Water Vapors at Showerhead*
2.3	*Current*	*Sediment*	*Animal Tissue*	*Trout from Dean's Creek*
2.4	*Future*	*Sediment*	*Animal Tissue*	*Trout from Dean's Creek*

It is possible that some Standard Tables may contain the same data associated with different descriptions in the Summary Box in the upper left corner.

In the example Standard Tables, the sediment data in Tables 2.3 and 2.4 will be the same even though the Scenario Timeframes (current and future) are different.

Separate tables are necessary to ensure transparency in data presentation and appropriate information transfer to CERCLIS 3 for each exposure pathway. Replication of information is readily accomplished using spreadsheet software.

INSTRUCTIONS FOR TABLE 2

OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN (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 environmental substance (e.g., air, water, soil) originally contaminated.	
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 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.*	

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* *Spring Water* *Surface Soil* *Subsurface Soil* *Particulates* *Vapors* *Other*
Row 4 - 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 Animal Tissue (the Exposure Medium) and Trout from Dean's Creek (the Exposure Point) is evaluated.*	
Instructions: • Provide the information as text in the Table (not to exceed 80 characters).	
BODY OF THE TABLE	
Column 1 - CAS Number	
Definition: • The Chemical Abstract Registry Number, a unique standardized number which is assigned to chemicals.	

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.	*Include dashes in the CAS number. CAS numbers can be arranged in the order that the risk assessor prefers.*
Column 2 - 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.*
Column 3 - Minimum Concentration	
Definition: • The lowest detected concentration of the chemical in the medium.	
Instructions: • Enter the minimum detected concentration for the medium. • Footnote the heading and provide an explanation of the method used to determine the minimum concentration.	
Column 4 - Minimum Qualifier	
Definition: • The alpha-numeric code assigned to the concentration value by the analytical chemist during data validation for the minimum concentration value.	
Instructions: • Enter the qualifier associated with the minimum concentration for each chemical.	*Provide the definition of each qualifier in the table footnotes or in separate documentation.*

INSTRUCTIONS FOR TABLE 2

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

Column 5 - Maximum Concentration	
Definition: • The highest detected concentration of the chemical in the medium.	
Instructions: • Enter the maximum detected concentration for the medium. • Footnote the heading and provide an explanation of the method used to determine the maximum concentration.	
Column 6 - Maximum Qualifier	
Definition: • The alpha-numeric code assigned to the concentration value by the analytical chemist during data validation for the maximum concentration value.	
Instructions: • Enter the qualifier associated with the maximum concentration for each chemical.	***Provide the definition of each qualifier in the table footnotes or in separate documentation.***
Column 7 - Units	
Definition: • The concentration units for each chemical detected.	
Instructions: • Enter the units for each chemical. Units may vary among matrices/media.	***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).*** ***Refer to Glossary for Units picklist***
Column 8 - Location of Maximum Concentration	
Definition: • The sample number which identifies the location where the sample was taken.	

INSTRUCTIONS FOR TABLE 2

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

Instructions: • Enter the sample identifier which corresponds to the location where the sample was taken.	
Column 9 - Detection Frequency	
Definition: • 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.***
Instructions: • Indicate the number of times a chemical was detected versus the number of times it was analyzed as the "fraction" X/Y.	***For example, 5/9 indicates that a chemical was detected in 5 out of 9 samples.***
Column 10 - Range of Detection Limits	
Definition: • The lowest and highest detection limits.	
Instructions: • Enter the lowest and highest detection limit for the chemical in the medium.	
Column 11 - Concentration Used for Screening	
Definition: • 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.***
Instructions: • Enter a concentration for each chemical being evaluated for the medium. • Footnote the heading and provide a reference/explanation of the concentration value.	

INSTRUCTIONS FOR TABLE 2

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

Column 12 - Background Value	
Definition: • The background value for the chemical in that medium as defined by Regional guidance. ***If Regional guidance requires a "t-test" or other test which requires backup information, this supporting information should be provided separately.***	***Refer to Regional guidance for how background values are determined and whether and how background values are considered for COPC screening.***
Instructions: • Enter the numerical value in the column, consistent with Regional guidance. • Footnote the heading and provide a reference/explanation for the derivation of the background value.	***For example, literature value, data from a nearby site, statistical tool.***
Column 13- Screening Toxicity Value	
Definition: • 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.***
Instructions: • Enter the screening toxicity value, in accordance with Regional guidance. • If no toxicity value is available for the chemical, enter "N/A." • Also indicate, with an "N" or "C" whether the value is based on non-cancer or cancer effects, respectively. • Footnote the heading and provide a reference/explanation for the source of the screening values used.	***N* (non-cancer)** ***C* (cancer)**
Column 14 - Potential ARAR/TBC Value	
Definition: • Applicable or relevant and appropriate requirements (ARAR) and to be considered (TBC) values.	***Refer to Regional guidance regarding the requirements for this column. For example, MCL values, soil cleanup level values, or other values to be considered.***

INSTRUCTIONS FOR TABLE 2

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

Instructions: • Enter appropriate values, consistent with Regional guidance. • If no value is available or appropriate, enter "N/A".	
Column 15 - Potential ARAR/TBC Source	
Definition: • The type or source of the ARAR/TBC value entered into Column 14.	***For example, MCL or SMCL.***
Instructions: • Enter the type or source of ARAR/TBC value which corresponds to the value in Column 14.	
Column 16 - COPC Flag	
Definition: • A code which identifies whether the chemical has been selected as a COPC, based on Regional screening guidance.	
Instructions: • Enter "Yes" or "No" to indicate whether the chemical has been retained as a COPC.	***Yes*** ***No***
Column 17 - Rationale for Contaminant Deletion or Selection	
Definition: • The reason that the chemical was selected or not selected for quantitative or qualitative analysis.	***Follow Regional guidance for the rationale codes.***
Instructions: • Enter the rationale codes in accordance with Regional guidance for selection/deletion of chemicals of potential concern. • Footnote the heading and define the rationale codes in the footnotes.	***The example data table provides rationale codes for example purposes only. Regional guidance may suggest additional/different codes.***

INSTRUCTIONS FOR TABLE 3

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY

PURPOSE OF THE TABLE:

- To provide the reasonable maximum and central tendency medium-specific 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 Medium EPCs for chemicals detected in each medium
- The reasonable maximum exposure (RME) Medium EPC and the central tendency (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 medium-specific or Medium EPC is the same for a particular medium regardless of exposure route. The Medium EPC does not consider the transfer of contaminants from one medium to another, unlike the Route EPC presented on Tables 7 and 8. See Tables 7 and 8 for additional information on Medium EPC and Route EPC.

TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS:

- Complete one copy of Table 3 for each unique combination of the following four fields that will be quantitatively evaluated (Scenario Timeframe, Medium, Exposure Medium, and Exposure Point).
- Enter each combination of these four 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 four key fields.

For the example data provided, there should be four copies of Table 3, numbered 3.1, 3.2, 3.3 and 3.4.

Table Number	*Scenario Timeframe*	*Medium*	*Exposure Medium*	*Exposure Point*
3.1	*Current*	*Groundwater*	*Groundwater*	*Aquifer 1 - Tap Water*
3.2	*Current*	*Groundwater*	*Air*	*Aquifer 1 - Water Vapors at Showerhead*
3.3	*Current*	*Sediment*	*Animal Tissue*	*Trout from Dean's Creek*
3.4	*Future*	*Sediment*	*Animal Tissue*	*Trout from Dean's Creek.*

It is possible that some tables may contain the same data associated with different descriptions in the Summary Box in the upper left corner.

In the example Standard Tables, the sediment data in Tables 3.3 and 3.4 may be the same even though the Scenario Timeframes (current and future) are different.

Separate tables are necessary to ensure transparency in data presentation and appropriate information transfer to CERCLIS 3 for each exposure pathway. Replication of information is readily accomplished using spreadsheet software.

INSTRUCTIONS FOR TABLE 3

MEDIUM-SPECIFIC 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. • Refer to Regional guidance 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 highest detected value is the RME, so the 95% UCL may not need to be calculated, particularly, if only one data point is being considered.*** ***For 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.***
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 environmental substance (e.g., air, water, soil) originally contaminated.	

INSTRUCTIONS FOR TABLE 3

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY (continued)

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 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.*	
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* *Spring Water* *Surface Soil* *Subsurface Soil* *Particulates* *Vapors*

INSTRUCTIONS FOR TABLE 3

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY (continued)

Row 4 - 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 Animal Tissue (the Exposure Medium) and Trout from Dean's Creek (the Exposure Point) is evaluated.*	
Instructions: • Provide the information as text in the Table (not to exceed 80 characters).	
BODY OF 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 which were selected as COPCs from Table 2.	*Chemicals can be grouped in the order that the risk assessor prefers.*
Column 2 - Units	
Definition: • The concentration units for each chemical detected.	
Instructions: • Enter units for each chemical. Units may vary among matrices/media.	*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).*

INSTRUCTIONS FOR TABLE 3

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY (continued)

Column 3 - Arithmetic Mean	
Definition: • The arithmetic average of detected concentrations.	
Instructions: • Enter the arithmetic average of detected concentrations. • Footnote the heading and provide an explanation of the method used to determine the arithmetic mean.	*For duplicate samples, multiple rounds of sampling, and other data evaluation questions, refer to Regional guidance.*
Column 4 - 95% UCL of Normal Data	
Definition: • The statistic for the 95% Upper Confidence Limit on the arithmetic mean of measured data.	*Refer to National guidance (Supplemental Guidance to RAGS: Calculating the Concentration Term, OSWER Directive: 9285.7-08I, May 1992) and Regional guidance for calculating this term.*
Instructions: • Enter the 95% UCL for each COPC. • Footnote the heading and indicate any assumptions made in calculating the term. • Supporting information should be provided.	*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.*
Column 5 - Maximum Detected Concentration	
Definition: • The highest detected concentration of the chemical in the medium at the exposure point which is above the sample quantitation limit.	
Instructions: • Enter the maximum concentration value.	
Column 6 - Maximum Qualifier	
Definition: • The alpha-numeric code assigned to the concentration value by the analytical chemist during data validation for the maximum concentration value.	

INSTRUCTIONS FOR TABLE 3

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY (continued)

Instructions: • Enter the qualifier associated with the maximum concentration.	*Provide the definitions of each qualifier in the table footnotes or in supporting information.*
Column 7 - EPC Units	
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.	*Follow Regional guidance for preferences for different media (e.g., ug/L for groundwater; mg/kg for soil).*
Column 8 - Medium EPC Value (for RME)	
Definition: • 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. *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.*	*The Medium EPC Value may be developed from a statistical derivation of measured data or from modeled data.*
Instructions: • Enter the value in the column. • Footnote the heading and explain how the value was derived.	*Refer to Regional guidance concerning how to determine this value.*

INSTRUCTIONS FOR TABLE 3

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY (continued)

Column 9 - Medium EPC Statistic (for RME)	
Definition: • The statistic selected to represent the Medium EPC Value (for RME), based on Regional guidance, the distribution of the data, number of data points, etc.	*Often this is 95% UCL of the log-transformed data.*
Instructions: • Enter the statistic used by choosing from the picklist to the right. • 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)* *Mean - N (Mean of Normal Data)* *Mean - T (Mean of Log-transformed Data)*
Column 10 - Medium EPC Rationale (for RME)	
Definition: • The reason the cited statistic was used to represent the EPC for RME.	
Instructions: • Enter the rationale for the selection.	
Column 11 - Medium EPC Value (for CT)	
Definition: • 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. *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.*	*The Medium EPC Value may be developed from a statistical derivation of measured data or from modeled data.*
Instructions: • Enter the value in the column.	*Refer to Regional guidance concerning how to determine this value.*

INSTRUCTIONS FOR TABLE 3

MEDIUM-SPECIFIC EXPOSURE POINT CONCENTRATION SUMMARY (continued)

Column 12 - Medium EPC Statistic (for CT)	
Definition: • The statistic selected to represent the Medium EPC Value (for CT), based on Regional guidance, the distribution of the data, number of data points, etc.	*Often this is a Mean for a normally distributed data set.*
Instructions: • Enter the statistic used by choosing from the picklist to the right. • If the statistic used is not on the picklist, enter an abbreviation in Column 12, 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)* *Mean - N (Mean of Normal Data)* *Mean - T (Mean of Log-transformed Data)*
Column 13 - Medium EPC Rationale (for CT)	
Definition: • The reason the cited statistic was used to represent the EPC for CT.	
Instructions: • Enter the rationale for the selection.	

INSTRUCTIONS FOR TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS

PURPOSE OF THE TABLE:

- 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.

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:

- Complete one copy of Table 4 for each unique combination of the following six fields that will be quantitatively evaluated (Scenario Timeframe, Medium, Exposure Medium, Exposure Point, Receptor Population, and Receptor Age).
- Enter each combination of these six 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 six key fields.

For the example data provided, there should be seven copies of Table 4, numbered 4.1 through 4.7

Table Number	*Scenario Timeframe*	*Medium*	*Exposure Medium*	*Exposure Point*	*Receptor Population*	*Receptor Age*
4.1	*Current*	*Groundwater*	*Groundwater*	*Aquifer 1-- Tap Water*	*Resident*	*Adult*
4.2	*Current*	*Groundwater*	*Groundwater*	*Aquifer 1-- Tap Water*	*Resident*	*Child*
4.3	*Current*	*Groundwater*	*Air*	*Aquifer 1-- Water Vapors at Showerhead*	*Resident*	*Adult*
4.4	*Current*	*Sediment*	*Animal Tissue*	*Trout from Dean's Creek*	*Fisher*	*Adult*
4.5	*Current*	*Sediment*	*Animal Tissue*	*Trout from Dean's Creek*	*Fisher*	*Child*
4.6	*Future*	*Sediment*	*Animal Tissue*	*Trout from Dean's Creek*	*Fisher*	*Adult*
4.7	*Future*	*Sediment*	*Animal Tissue*	*Trout from Dean's Creek*	*Fisher*	*Child*

It is possible that some tables may contain the same data associated with different descriptions in the Summary Box in the upper left corner.

In the example Standard Tables, the sediment data in Tables 4.4 through 4.7 may be the same, even though the Scenario Timeframes and Receptor Ages are different.

Separate tables are necessary to ensure transparency in data presentation and appropriate information transfer to CERCLIS 3 for each exposure pathway. Replication of information is readily accomplished using spreadsheet software.

INSTRUCTIONS FOR TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS (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 environmental substance (e.g, air, water, soil) which has been contaminated.	
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 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.*	

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* *Spring Water* *Surface Soil* *Subsurface Soil* *Particulates* *Vapors*
Row 4 - 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 Animal Tissue (the Exposure Medium) and Trout in Dean's Creek (the Exposure Point) is evaluated.*	
Instructions: • Provide the information as text in the Table (not to exceed 80 characters).	*The field can not exceed 80 characters.*
Row 5 - 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 4

VALUES USED FOR DAILY INTAKE CALCULATIONS (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* *Other*
Row 6 - 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: • 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 - Exposure Route	
Definition: • The way a chemical comes in contact with a person (e.g., by ingestion, inhalation, dermal contact).	
Instructions: • Choose from the picklist to the right.	*Inhalation* *Ingestion* (i.e., Inhalation and Ingestion) *Combined* *Dermal Absorption* *Not Documented* *External (Radiation)*

INSTRUCTIONS FOR TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS (CONTINUED)

Column 2 - Parameter Code

Definition:

- The code used for parameters in the intake equation.

Instructions:

- Enter the appropriate code for the intake parameter from the picklist below.
- Develop additional intake parameter codes as necessary.

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 Freqeuncy (Food)*	*meals/year*

Do not provide detailed information regarding modeled intakes in this table. This information should be provided separately. The table should list the name of the model used or the equation with a footnote providing a reference to the supporting information regarding route-specific EPCs and modeled intake development.

Column 3 - Parameter Definition

Definition:

- The parameter used in the intake equation.

Instructions:

- Enter the parameter definition, consistent with the picklist defined under Column 2.
- Develop additional intake parameter definitions as necessary.

Do not provide detailed information regarding modeled intakes in this table. This information should be provided separately. The table should list the name of the model used or the equation with a footnote providing a reference to the supporting information regarding route-specific EPCs and modeled intake development.

INSTRUCTIONS FOR TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS (CONTINUED)

Column 4 - 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 2. • Develop additional intake parameter units as necessary.	***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).*** ***Refer to Glossary for Units picklist***
Column 5 - RME Value	
Definition: • The parameter value used for the RME intake calculation.	
Instructions: • Enter the values used for RME calculations. • For the CS and CW (chemical concentrations in soil and water, respectively) parameters, refer to Table 3.n or supporting documentation, as appropriate.	***Refer to Regional guidance for intake parameter values appropriate for each exposure pathway.***
Column 6 - RME Rationale/Reference	
Definition: • The reason and reference for the parameter value used.	***This rationale may be based upon Regional or National guidance.***
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 7 - CT Value	
Definition: • The parameter value used for the CT exposure intake calculation.	

INSTRUCTIONS FOR TABLE 4

VALUES USED FOR DAILY INTAKE CALCULATIONS (CONTINUED)

Instructions: • Enter the values used for CT exposure calculations. • For the CS and CW (chemical concentrations in soil and water, respectively) parameters, refer to Table 3.n or supporting documentation, as appropriate.	*Refer to Regional guidance for intake parameter values appropriate for each exposure pathway.*
Column 8 - CT Rationale/Reference	
Definition: • The reason and reference for the parameter value used.	*This rationale may be based on Regional or National guidance.*
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 9 - Intake Equation/Model Name	
Definition: • The calculation, equation, or model used for intake estimates for each exposure route.	
Instructions: • Enter the National and/or Regional guidance for intake calculations, equations, and/or models.	*Do not provide detailed information regarding modeled intakes in this table. This information should be provided separately. The table should list the name of the model used or the equation footnote providing a reference to the supporting information regarding route-specific EPCs and modeled intake development.*

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.	
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 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.***

INSTRUCTIONS FOR TABLE 5.1

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

Column 2 - Chronic/Subchronic	
Definition: • 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).***
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 as necessary.	***Refer to Regional guidance to determine if there is a preference regarding the units to be used.***

INSTRUCTIONS FOR TABLE 5.1

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

Column 5 - Oral to Dermal Adjustment Factor	
Definition: • The adjustment factor used to convert oral RfD values to dermal RfD values.	
Instructions: • Enter the adjustment factor in this column.	
Column 6 - Adjusted Dermal RfD	
Definition: • The adjusted RfD for each COPC detected that is derived from the oral RfD.	
Instructions: • Enter the value that was derived from the adjustment factor in Column 5.	***Derivations of the adjusted dermal RfD should be performed in accordance with Regional guidance.***
Column 7 - Units (for Adjusted Dermal RfD)	
Definition: • The adjusted dermal RfD units for each COPC.	
Instructions: • Enter units for each adjusted RfD as necessary.	***Refer to Regional guidance to determine if there is a preference regarding the units to be used.***
Column 8 - Primary Target Organ	
Definition: • 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.	
Instructions: • Enter the name of the most affected organ or organ system in the column.	***If there are two organs that are equally affected, enter the names of both, separated by a '/'.***

INSTRUCTIONS FOR TABLE 5.1

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

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 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.	*Refer to IRIS/HEAST for these values.*
Column 10 - Sources of RfD/Target Organ (Information)	
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 between the two information sources if the sources of information are different for RfD and target organ.	*IRIS* *HEAST* *NCEA*
Column 11 - Dates (MM/DD/YY)	
Definition: • The date of the document that was consulted for the RfD information and the target organ information in MM/DD/YY format.	*The MM/DD/YY format refers to month/day/year.*
Instructions: • Enter the date, in MM/DD/YY format, for both RfD and target organ information. Use a colon to delineate between the two dates, if the sources 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 article provided by NCEA.*	*For example, the MM/DD/YY version of the date March 30, 1995 is 03/30/95.*

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 organ effects of each of the COPCs • References for RfCs and organ effects.	
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.*

INSTRUCTIONS FOR TABLE 5.2

NON-CANCER TOXICITY DATA - INHALATION (continued)

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.	***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).***
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***
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 - Units for Inhalation RfC	
Definition: • The RfC units for each chemical detected.	
Instructions: • Enter units for each RfC as necessary.	***Refer to Regional guidance to determine if there is a preference regarding the units to be used.***

INSTRUCTIONS FOR TABLE 5.2

NON-CANCER TOXICITY DATA - INHALATION (continued)

Column 5 - Adjusted Inhalation RfD	
Definition: • The inhalation RfD for each COPC that is derived from the RfC value.	*The derivation of the RfD from an RfC should be performed in accordance with Regional guidance.*
Instructions: • Enter the derived RfD factor in this column.	*The equation to derive the RfD from the RfC is to be included as a footnote in the table.*
Column 6 - Units (for Adjusted Inhalation RfD)	
Definition: • The adjusted RfD units for each COPC.	
Instructions: • Enter units for each adjusted RfD as necessary.	*Refer to Regional guidance to determine if there is a preference regarding the units to be used.*
Column 7 - Primary Target Organ	
Definition: • 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.	
Instructions: • Enter the name of the most affected organ or organ system in the column.	*If there are two organs that are equally affected, enter the names of both, separated by a '/'.*
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 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.	*Refer to IRIS/HEAST for these values.*

INSTRUCTIONS FOR TABLE 5.2

NON-CANCER TOXICITY DATA - INHALATION (continued)

Column 9 - Sources of RfC:RfD:Target Organ (Information)	
Definition: • The sources of the RfC, RfD, and target organ information.	
Instructions: • Enter the sources of the RfC, RfD, and target organ information. Use a colon to delineate between the information sources if the sources of information are different for RfC, RfD, and target organ.	*IRIS* *HEAST* *NCEA*
Column 10 - Date (MM/DD/YY)	
Definition: • The dates of the documents that were consulted for the RfC/RfD information and the target organ information in MM/DD/YY format.	***The MM/DD/YY format refers to month/day/year.***
Instructions: • Enter the dates, in MM/DD/YY format, for RfC, RfD and target organ information. Use a colon to delineate between the dates, if the sources of information are different for RfC, 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 article provided by NCEA.***	***For example, the MM/DD/YY version of the date March 30, 1995 is 03/30/95.***

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 that are not covered by Tables 5.1 or 5.2 • 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 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.*

INSTRUCTIONS FOR TABLE 5.3

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

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.	***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).***
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 - Toxicity Value	
Definition: • The toxicity value for each COPC.	
Instructions: • Enter the value for the chronic and/or subchronic toxicity values (as appropriate).	
Column 4 - Toxicity Units	
Definition: • The units associated with the toxicity value for each COPC.	
Instructions: • Enter units for each reference as necessary.	***Refer to Regional guidance to determine if there is a preference regarding the units to be used.***

INSTRUCTIONS FOR TABLE 5.3

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

Column 5 - Primary Target Organ	
Definition: • 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.	
Instructions: • Enter the name of the most affected organ or organ system in the column.	*If there are two organs that are equally affected, enter the names of both, separated by a '/'.*
Column 6 - 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 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.	*Refer to IRIS/HEAST for these values.*
Column 7 - Sources of Toxicity/Primary Target Organ Information	
Definition: • The sources of the toxicity and target organ information.	
Instructions: • Enter the sources of the toxicity and target organ information.	*IRIS* *HEAST* *NCEA*
Column 8 - Date (MM/DD/YY)	
Definition: • The dates of the document that were consulted for the toxicity information and the target organ information in MM/DD/YY format.	*The MM/DD/YY format refers to month/day/year.*

INSTRUCTIONS FOR TABLE 5.3

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

Instructions: • Enter the dates, in MM/DD/YY format, for the toxicity and target organ information. Use a colon to delineate between the 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 article provided by NCEA.***	***For example, the MM/DD/YY version of the date March 30, 1995 is 03/30/95.***

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.	
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 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 may be grouped in the order that the risk assessor chooses.***

INSTRUCTIONS FOR TABLE 6.1

CANCER TOXICITY DATA - ORAL/DERMAL (continued)

Column 2 - Oral Cancer Slope Factor	
Definition: • Cancer slope factor for ingestion.	
Instructions: • Enter the oral cancer slope factor.	***Refer to IRIS and HEAST. If toxicity information is not available, contact EPA's National Center for Environmental Assessment (NCEA) office.***
Column 3 - Oral to Dermal Adjustment Factor	
Definition: • The adjustment factor used to convert the oral RfD values to dermal RfD values.	
Instructions: • Enter the oral to dermal adjustment factor.	***Refer to RAGS and Regional guidance.***
Column 4 - Adjusted Dermal Cancer Slope Factor	
Definition: • The adjusted 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.***
Instructions: • Enter the derived dermal cancer slope factor.	***Provide the equation/adjustment used for derivation.***
Column 5 - Units	
Definition: • The concentration units for each chemical detected.	
Instructions: • Enter the units for the cancer slope factors.	***Typically (mg/kg-day)$^{-1}$*** ***Refer to Regional guidance to determine if there is a preference regarding the units to be used.***

INSTRUCTIONS FOR TABLE 6.1

CANCER TOXICITY DATA - ORAL/DERMAL (continued)

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: • Provide the weight of evidence/cancer guideline description. • Choose from the categories to the right.	***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***
Column 7 - Source	
Definition: • A reference for the weight of evidence/cancer guideline description entry.	
Instructions: • Enter the reference for toxicity information.	***For example:*** ***IRIS*** ***HEAST*** ***NCEA***
Column 8 - Date (MM/DD/YY)	
Definition: • The date of the document that was consulted for the cancer toxicity data in MM/DD/YY format.	***The MM/DD/YY format refers to month/day/year.***

Instructions:
• Enter the date in MM/DD/YY format. Use a comma to delineate between multiple dates, if multiple sources of data were used.
  • ***For IRIS references, provide the date IRIS was selected.***
  • ***For HEAST references, provide the date of the HEAST reference.***
  • ***For NCEA references, provide the date of the article provided by NCEA.***
	For example, the MM/DD/YY version of the date March 30, 1995 is 03/30/95.

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.	
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 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 may be grouped in the order that the risk assessor chooses.***

INSTRUCTIONS FOR TABLE 6.2

CANCER TOXICITY DATA - INHALATION (continued)

Column 2 - Unit Risk	
Definition: • 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.	
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.***
Column 3 - Units	
Definition: • The units used for the unit risk for each chemical detected.	
Instructions: • Enter the units for the unit risk values.	***Refer to Regional guidance to determine if there is a preference regarding the units to be used.***
Column 4 - Adjustment	
Definition: • 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.***
Instructions: • Enter the adjustment factor used to convert unit risk to a cancer slope factor.	***Refer to RAGS/HEAST and Regional guidance.***

INSTRUCTIONS FOR TABLE 6.2

CANCER TOXICITY DATA - INHALATION (continued)

Column 5 - Inhalation Cancer Slope Factor	
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.	
Column 6 - Units	
Definition: • The units used for the inhalation cancer slope factor for each chemical detected.	
Instructions: • Enter the units for the cancer slope factors.	
Column 7 - 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: • Provide the weight of evidence/cancer guideline description. • Choose from the categories to the right.	*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*

INSTRUCTIONS FOR TABLE 6.2

CANCER TOXICITY DATA - INHALATION (continued)

Column 8 - Source	
Definition: • A reference for the weight of evidence/cancer guideline description entry.	
Instructions: • Enter the reference for toxicity information.	***IRIS*** ***HEAST*** ***NCEA***
Column 9 - Date (MM/DD/YY)	
Definition: • The date of the document that was consulted for the cancer toxicity data in MM/DD/YY format.	***The MM/DD/YY format refers to month/day/year.***
Instructions: • Enter the date in MM/DD/YY format. Use a comma to delineate between multiple dates, if multiple sources of information were used. • ***For IRIS references, provide the date IRIS was selected.*** • ***For HEAST references, provide the date of the HEAST reference.*** • ***For NCEA references, provide the date of the article provided by NCEA.***	***For example, the MM/DD/YY version of the date March 30, 1995 is 03/30/95.***

INSTRUCTIONS FOR TABLE 6.3

CANCER TOXICITY DATA - SPECIAL CASE CHEMICALS

PURPOSE OF THE TABLE: • To provide cancer toxicity information for "special case" chemicals.	*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.	
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 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 may be grouped in the order that the risk assessor chooses.*
Column 2 - Toxicity Value	
Definition: • The toxicity value for each chemical of potential concern.	
Instructions: • Enter the toxicity value for each chemical of potential concern.	

INSTRUCTIONS FOR TABLE 6.3

CANCER TOXICITY DATA - SPECIAL CASE CHEMICALS (continued)

Column 3 - Toxicity Units	
Definition: • The units associated with the toxicity value.	
Instructions: • Enter the toxicity units.	*Typically (mg/kg-day)$^{-1}$* ***Refer to Regional guidance to determine if there is a preference regarding the units to be used.***
Column 4 -Source	
Definition: • A reference for the cancer toxicity information.	
Instructions: • Enter the reference for toxicity information.	***IRIS*** ***HEAST*** ***NCEA***
Column 5 - Date (MM/DD/YY)	
Definition: • The date of the document that was consulted for the cancer toxicity data in the MM/DD/YY format.	***The MM/DD/YY format refers to month/day/year.***
Instructions: • Enter the date in MM/DD/YY format. Use a comma to delineate between multiple dates, if multiple sources of information were used. • ***For IRIS references, provide the date IRIS was selected.*** • ***For HEAST references, provide the date of the HEAST reference.*** • ***For NCEA references, provide the date of the article provided by NCEA.***	***For example, the MM/DD/YY version of the date March 30, 1995 is 03/30/95.***

INSTRUCTIONS FOR TABLE 7.1

CALCULATION OF NON-CANCER HAZARDS

PURPOSE OF THE TABLE: • To provide a summary of the variables used to calculate non-cancer hazards • To show the EPC (medium-specific or route-specific) and intake used in the non-cancer hazard calculations • To present the result of the calculation for each exposure route/pathway for each COPC • To provide the total hazard index for all exposure routes/pathways for the scenario timeframe, exposure medium, and receptor presented in this table.	***The medium-specific or Medium EPC is the same for a particular medium regardless of exposure route.*** ***The route-specific or 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.***
INFORMATION DOCUMENTED: • The non-cancer hazard quotient for each COPC for each exposure route/pathway • The values used for EPC, non-cancer intake, reference doses, and reference concentrations.	
TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS: • Complete one copy of Table 7 for each unique combination of the following six fields that will be quantitatively evaluated (Scenario Timeframe, Medium, Exposure Medium, Exposure Point, Receptor Population, and Receptor Age). • Enter each combination of these six fields in the Summary Box in the upper left corner of the table. • 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. • Tables 7.1.RME through 7.n.RME should be completed for RME non-cancer hazard calculations. • Tables 7.1.CT through 7.n.CT should be completed for CT non-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.*** ***In the example Standard Tables, the sediment EPC values in Tables 7.4.RME through 7.7.RME may be the same. However the intakes vary due to differences in the Scenario Timeframes and Receptor Ages.*** ***Separate tables are necessary to ensure transparency in data presentation and appropriate information transfer to CERCLIS 3 for each exposure pathway. Replication of information is readily accomplished using spreadsheet software.***

INSTRUCTIONS FOR TABLE 7.1

CALCULATION OF NON-CANCER HAZARDS (continued)

TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS (continued):

For the example data provided, there should be seven copies of Table 7 for the RME calculations, numbered 7.1.RME through 7.7.RME. Seven corresponding tables should be prepared for CT calculations, numbered 7.1.CT through 7.7.CT.

Table Number	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age
7.1.RME	Current	Groundwater	Groundwater	Aquifer 1--Tap Water	Resident	Adult
7.2..RME	Current	Groundwater	Groundwater	Aquifer 1--Tap Water	Resident	Child
7.3.RME	Current	Groundwater	Air	Aquifer 1--Water Vapors at Showerhead	Resident	Adult
7.4.RME	Current	Sediment	Animal Tissue	Trout from Dean's Creek	Fisher	Adult
7.5.RME	Current	Sediment	Animal Tissue	Trout from Dean's Creek	Fisher	Child
7.6.RME	Future	Sediment	Animal Tissue	Trout from Dean's Creek	Fisher	Adult
7.7.RME	Future	Sediment	Animal Tissue	Trout from Dean's Creek	Fisher	Child

GENERAL NOTES/INSTRUCTIONS FOR THIS TABLE:

- All table entries with the exception of route EPC, intake, and non-cancer hazard 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 for each exposure route is to be summed and the total non-cancer hazard for all exposure pathways is to be presented as a sum at the end of the table.
- This value represents the non-cancer hazard of the various exposure routes/pathways combined.

The medium-specific or Medium EPC is the same for a particular medium regardless of exposure route.

The route-specific or 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.

Medium EPC and Route EPC Examples for Frequently Evaluated Pathways

Medium	Exposure Medium	Exposure Route	Medium EPC	Route EPC	EPC Selected For Calculation
Groundwater	Groundwater	Ingestion	Measured	Measured	M
Groundwater	Groundwater	Dermal	Measured	Modeled	R
Groundwater	Air	Inhalation	Measured	Modeled	R
Soil	Soil	Ingestion	Measured	Measured	M
Soil	Soil	Dermal	Measured	Modeled	R
Soil	Air	Inhalation	Measured	Modeled [1]	R

[1]EPC's will be modeled separately for particulates and vapors.
Measured - Developed from a statistical derivation of measured data.
Modeled - Developed from model based on measured data.
M - Medium EPC R - Route EPC

INSTRUCTIONS FOR TABLE 7.1

CALCULATION OF 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 - Medium	
Definition: • The environmental substance (e.g., air, water, soil) which has been contaminated.	
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 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.***	

INSTRUCTIONS FOR TABLE 7.1

CALCULATION OF NON-CANCER HAZARDS (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* *Spring Water* *Surface Soil* *Subsurface Soil* *Particulates* *Vapors* *Other*
Row 4 - 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 Animal Tissue (the Exposure Medium) and Trout from Dean's Creek (the Exposure Point) is evaluated.*	
Instructions: • Provide the information as text in the Table not to exceed 80 characters).	*The text in the Table can not exceed 80 characters.*
Row 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.	*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*
Row 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*
BODY OF THE TABLE	
Column 1 - Exposure Route	
Definition: • The way a chemical 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 Absorption* *Not Documented* *External (Radiation)*

INSTRUCTIONS FOR TABLE 7.1

CALCULATION OF NON-CANCER HAZARDS (continued)

Column 2 - 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 3 - Medium EPC Value	
Definition: • 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 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. *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.*	*The Medium EPC Value may be developed from a statistical derivation of measured data or from modeled data.*
Instructions: • Enter the medium EPC value for each COPC.	*Table 3 documents medium EPC calculations for RME and CT.*
Column 4 - Medium EPC Units	
Definition: • The units associated with the medium EPC value.	
Instructions: • Enter the units for medium EPC values.	*The units may vary depending on the medium.*

INSTRUCTIONS FOR TABLE 7.1

CALCULATION OF NON-CANCER HAZARDS (continued)

Column 5 - Route EPC Value	
Definition: • 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. ***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 of measured concentrations in groundwater, while the Route EPC will often be a modeled inhalation concentration that is based on the measured concentrations.***	***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.***
Instructions: • Enter the route EPC value for each COPC.	***Supporting information should be provided documenting Route EPC calculations.***
Column 6 - Route EPC Units	
Definition: • The units associated with the route EPC value.	***The units may vary depending on the route of exposure.***
Instructions: • Enter the units for route EPC values.	
Column 7 - EPC Selected for Hazard Calculation	
Definition: • The EPC that will be used to quantify potential non-cancer hazards.	
Instructions: • Identify the type of EPC used for non-cancer hazard calculation for each COPC for each exposure route. • Enter "M" for medium EPC. • Enter "R" for route EPC.	***M* (Medium EPC)** ***R* (Route EPC)** ***Follow Regional guidance for selection of this value.***

INSTRUCTIONS FOR TABLE 7.1

CALCULATION OF NON-CANCER HAZARDS (continued)

Column 8 - Intake (Non-Cancer)	
Definition: • 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 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 9 - Intake Units (Non-Cancer)	
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 10 - Reference Dose	
Definition: • The preferred toxicity value for evaluating non-cancer effects resulting from exposures.	
Instructions: • 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 values for inhalation.	***The reference doses for each COPC are presented in Table 5.***
Column 11 - Reference Dose Units	
Definition: • The units associated with the reference dose.	***Typically reported in mg/kg-day, a dose term.***
Instructions: • Enter the reference dose units for each COPC for each exposure route. • Specify if the reference dose is subchronic by using a footnote.	

INSTRUCTIONS FOR TABLE 7.1

CALCULATION OF NON-CANCER HAZARDS (continued)

Column 12 - Reference Concentration	
Definition: • 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).	
Instructions: • Enter the reference concentration for each COPC which corresponds to each exposure route.	
Column 13 - Reference Concentration Units	
Definition: • The units associated with the reference concentration.	
Instructions: • Enter the reference concentration units for each COPC for each exposure route.	
Column 14 - Hazard Quotient	
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/pathway. • Sum the hazard quotients for all exposure routes/pathways.	***The Hazard Index represents the total non-cancer hazard for all exposure routes/pathways presented in this table.***

INSTRUCTIONS FOR TABLE 8.1

CALCULATION OF CANCER RISKS

PURPOSE OF THE TABLE: • To provide a summary of the variables used to calculate cancer risks • To show the EPC (medium-specific or route-specific) and intake used in the cancer risk calculations • To present the result of the calculation for each exposure route/pathway for each COPC • To provide the total cancer risks for all exposure routes/pathways for the scenario timeframe, exposure medium, and receptor presented in this table.	*The medium-specific or Medium EPC is the same for a particular medium regardless of exposure route.* *The route-specific or 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.*
INFORMATION DOCUMENTED: • The cancer risk value for each COPC for each exposure route/pathway • The values used for EPC, cancer intake, and cancer slope factor for each COPC for each exposure route.	
TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS: • Complete one copy of Table 8 for each unique combination of the following six fields that will be quantitatively evaluated (Scenario Timeframe, Medium, Exposure Medium, Exposure Point, Receptor Population, and Receptor Age). • Enter each combination of these six 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 six key fields. • Different tables should be prepared to address RME and CT cancer risk calculations. • Tables 8.1. RME through 8.n. RME should be completed for RME cancer risk calculations. • Tables 8.1. CT through 8.n. CT should be completed for CT 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.* *In the example Standard Tables, the sediment EPC values in Tables 8.4.RME through 8.7.RME may be the same. However the intakes may vary due to differences in the Scenario Timeframes and Receptor Ages.* *Separate tables are necessary to ensure transparency in data presentation and appropriate information transfer to CERCLIS 3 for each exposure pathway. Replication of information is readily accomplished using spreadsheet software.*

INSTRUCTIONS FOR TABLE 8.1

CALCULATION OF CANCER RISKS (continued)

TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS (continued):

For the example data provided, there should be seven copies of Table 8 for the RME calculations, numbered 8.1.RME through 8.7.RME. Seven corresponding tables should be prepared for CT calculations, numbered 8.1.CT through 8.7.CT.

Table Number	Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age
8.1.RME	Current	Groundwater	Groundwater	Aquifer 1--Tap Water	Resident	Adult
8.2.RME	Current	Groundwater	Groundwater	Aquifer 1--Tap Water	Resident	Child
8.3.RME	Current	Groundwater	Air	Aquifer 1--Water Vapors at Showerhead	Resident	Adult
8.4.RME	Current	Sediment	Animal Tissue	Trout from Dean's Creek	Fisher	Adult
8.5.RME	Current	Sediment	Animal Tissue	Trout from Dean's Creek	Fisher	Child
8.6.RME	Future	Sediment	Animal Tissue	Trout from Dean's Creek	Fisher	Adult
8.7.RME	Future	Sediment	Animal Tissue	Trout from Dean's Creek	Fisher	Child

GENERAL NOTES/INSTRUCTIONS FOR THIS TABLE:

- All table entries with the exception of 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 the total cancer risk for all exposure pathways is to be presented as a sum at the end of the table. This value represents the cancer risk of the various exposure routes/pathways combined.

The medium-specific or Medium EPC is the same for a particular medium regardless of exposure route.

The route-specific or 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.

Medium EPC and Route EPC Examples for Frequently Evaluated Pathways

Medium	Exposure Medium	Exposure Route	Medium EPC	Route EPC	EPC Selected For Calculation
Groundwater	Groundwater	Ingestion	Measured	Measured	M
Groundwater	Groundwater	Dermal	Measured	Modeled	R
Groundwater	Air	Inhalation	Measured	Modeled	R
Soil	Soil	Ingestion	Measured	Measured	M
Soil	Soil	Dermal	Measured	Modeled	R
Soil	Air	Inhalation	Measured	Modeled [1]	R

[1]EPC's will be modeled separately for particulates and vapors.
Measured - Developed from a statistical derivation of measured data.
Modeled - Developed from model based on measured data.
M - Medium EPC R - Route EPC

INSTRUCTIONS FOR TABLE 8.1

CALCULATION OF CANCER RISKS (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 environmental substance (e.g., air, water, soil) which has been contaminated.	
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 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.*	

INSTRUCTIONS FOR TABLE 8.1

CALCULATION OF CANCER RISKS (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* *Spring Water* *Surface Soil* *Subsurface Soil* *Particulates* *Vapors*
Row 4 - 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 Animal Tissue (the Exposure Medium) and Trout from Dean's Creek (the Exposure Point) is evaluated.*	
Instructions: • Provide the information as text in the Table (not to exceed 80 characters).	*The text in the Table can not exceed 80 characters*
Row 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.	*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*
Row 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*
BODY OF THE TABLE	
Column 1 - Exposure Route	
Definition: • The way a chemical 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 Absorption* *Not Documented* *External (Radiation)*

INSTRUCTIONS FOR TABLE 8.1

CALCULATION OF CANCER RISKS (continued)

Column 2 - 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 3 - Medium EPC Value	
Definition: • 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 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. *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 MediumEPC 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.*	*The Medium EPC Value may be developed from a statistical derivation of measured data or from modeled data.*
Instructions: • Enter the medium EPC value for each COPC.	*Table 3 documents medium EPC calculations for RME and CT.*
Column 4 - Medium EPC Units	
Definition: • The units associated with the medium EPC value.	
Instructions: • Enter the units for medium EPC values.	*The units may vary depending on the medium.*

INSTRUCTIONS FOR TABLE 8.1

CALCULATION OF CANCER RISKS (continued)

Column 5 - Route EPC Value	
Definition: • 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. ***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 of measured concentrations in groundwater, while the Route EPC will often be a modeled inhalation concentration that is based on the measured concentrations.***	***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.***
Instructions: • Enter the route EPC value for each COPC.	***Supporting information should be provided documenting Route EPC calculations.***
Column 6 - Route EPC Units	
Definition: • The units associated with the route EPC value.	***The units may vary depending on route of exposure.***
Instructions: • Enter the units for route EPC values.	
Column 7 - EPC Selected for Risk Calculation	
Definition: • The EPC that will be used to quantify potential cancer risks.	
Instructions: • Identify the type of EPC used for cancer risk calculations for each COPC for each exposure route. • Enter "M" for medium EPC. • Enter "R" for route EPC.	***M* (Medium EPC)** ***R* (Route EPC)** ***Follow Regional guidance for selection of this value.***

INSTRUCTIONS FOR TABLE 8.1

CALCULATION OF CANCER RISKS (continued)

Column 8 - Intake (Cancer)	
Definition: • 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.***
Instructions: • Enter the result of the intake calculations/modeling performed for each COPC and exposure route.	***The intake calculations and/or models are documented in Table 4.***
Column 9 - Intake Units (Cancer)	
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 10 - Cancer Slope Factor	
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.	
Instructions: • Enter the cancer slope factor for each COPC which corresponds to each exposure route.	***The slope factors for each COPC are presented in Table 6.***
Column 11 - Cancer Slope Factor Units	
Definition: • Usually, the cancer slope factor is the upper 95th % confidence limit of the dose-response curve and is expressed as $(mg/kg\text{-}day)^{-1}$.	
Instructions: • Enter the cancer slope factor units for each COPC for each exposure route.	

INSTRUCTIONS FOR TABLE 8.1

CALCULATION OF CANCER RISKS (continued)

Column 12 - Cancer Risk	
Definition: • The result of the cancer risk calculation for each COPC for each exposure route and pathway.	
Instructions: • Enter the cancer risk calculation for each COPC. • Sum the cancer risk results for each exposure route/pathway. • Sum the total cancer risk results for all exposure routes/pathways.	***The sum of all exposure routes represents the total cancer risk for all exposure routes/ pathways.***

INSTRUCTIONS FOR TABLE 9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

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.

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 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.

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.

For the example data provided, there should be six copies of Table 9 for the RME calculations, numbered 9.1.RME through 9.6.RME. Six corresponding tables should be prepared for CT calculations, numbered 9.1.CT through 9.6.CT.

Table Number	*Scenario Timeframe*	*Receptor Population*	*Receptor Age*
9.1.RME	*Current*	*Resident*	*Adult*
9.2.RME	*Current*	*Resident*	*Child*
9.3.RME	*Current*	*Fisher*	*Adult*
9.4.RME	*Current*	*Fisher*	*Child*
9.5.RME	*Future*	*Fisher*	*Adult*
9.6.RME	*Future*	*Fisher*	*Child*

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 are necessary to ensure transparency in data presentation and appropriate information transfer to CERCLIS 3 for each exposure pathway. Replication of information is readily accomplished using spreadsheet software.

INSTRUCTIONS FOR TABLE 9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs (continued)

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 values was presented on Table 7. • Documentation of the carcinogenic risk values was presented on Table 8. • Total cancer risks and non-cancer hazards associated with each receptor are to be presented for each exposure point, across all media and all exposure routes, and for each individual medium.	
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*** ***Other***

INSTRUCTIONS FOR TABLE 9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs (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 environmental substance (e.g., air, water, soil) which has been contaminated.	
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*
Column 2 - Exposure Medium	
Definition: • 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.*	

INSTRUCTIONS FOR TABLE 9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs (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* *Spring Water* *Surface Soil* *Subsurface Soil* *Particulates* *Vapors*
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 Animal Tissue (the Exposure Medium) and Trout from Dean's Creek (the Exposure Point) is evaluated.*	
Instructions: • Provide the information as text in the Table (not to exceed 80 characters).	*The text in the Table can not exceed 80 characters.*
Column 4 - Chemical	
Definition: • The COPCs quantitatively considered in the risk characterization. • The last entry in this column is the term "Total" which refers to a row of totals for the four columns.	
Instructions: • Enter the COPCs from previous tables. • Enter the term "Total" at the end of the list of chemicals for each exposure point.	

INSTRUCTIONS FOR TABLE 9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs (continued)

Columns 5, 6, and 7 - Carcinogenic Risk - Ingestion, Inhalation, Dermal	
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 cancer risk by exposure route for each exposure point.***
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 last row, corresponding to the term "Total" in Column 4.	
Column 8 - 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 cancer risks across the three exposure routes for Columns 5, 6, and 7. • 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. • Enter the total cancer risk across all media and all exposure routes. • Enter the total cancer risk for each individual medium.	
Column 9 - Chemical	
Definition: • The COPCs quantitatively considered in the risk characterization. • The last entry in this column is the term "Total" which refers to a row of Totals for Columns 11, 12, 13 and 14.	
Instructions: • Enter the COPCs from previous tables. • Enter the term "Total" at the end of the list of chemicals for each exposure point.	

INSTRUCTIONS FOR TABLE 9

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs (continued)

Column 10 - Non-Carcinogenic Hazard Quotient - Primary Target Organ	
Definition: • The primary effect reported as a primary target organ effect in IRIS and HEAST.	
Instructions: • Enter the primary target organ effect as reported in IRIS and/or HEAST.	*Refer to Regional guidance 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 last row, corresponding to the term "Total" in Column 9.	*Refer to Regional guidance for summing hazard quotients.*
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 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 COPC and primary target organ. • Enter the sum of the non-cancer hazards in this column for each exposure point. • Enter the total hazard index across all media and all exposure routes. • 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.	*Refer to Regional guidance for specific instructions in summing hazard quotients.*

INSTRUCTIONS FOR TABLE 10

RISK ASSESSMENT 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 cleanup. • *The Risk Assessor should consult the Project Manager to determine what levels of risk may be actionable at the site. The risks shown on Table 10 should be based upon the Project Manager's recommendation. If all risks are below actionable levels, determine with the 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 trigger the need for cleanup (the risk drivers).***
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 pathway for risk drivers • The cancer risk and non-cancer hazard for each medium across all exposure routes for risk drivers • The primary target organs for non-carcinogenic hazard effects.	
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 are necessary to ensure transparency in data presentation and appropriate information transfer to CERCLIS 3 for each exposure pathway. Replication of information is readily accomplished using spreadsheet software.***

INSTRUCTIONS FOR TABLE 10

RISK ASSESSMENT SUMMARY (continued)

TABLE NUMBERING AND SUMMARY BOX INSTRUCTIONS (continued):

For the example data provided, there should be six copies of Table 10 for the RME calculations, numbered 10.1.RME through 10.6.RME. Six corresponding tables should be prepared for CT calculations, numbered 10.1.CT through 10.6.CT.

Table Number	*Scenario Timeframe*	*Receptor Population*	*Receptor Age*
10.1.RME	*Current*	*Resident*	*Adult*
10.2.RME	*Current*	*Resident*	*Child*
10.3.RME	*Current*	*Fisher*	*Adult*
10.4.RME	*Current*	*Fisher*	*Child*
10.5.RME	*Future*	*Fisher*	*Adult*
10.6.RME	*Future*	*Fisher*	*Child*

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 cleanup (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 values was presented on Table 7.
- Documentation of the carcinogenic risk values was presented on Table 8.
- Total cancer risks and non-cancer hazards associated with each receptor are to be presented for each exposure point, across all media and all exposure routes, and for each individual medium.

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 10

RISK ASSESSMENT SUMMARY (continued)

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* *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: • 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 environmental substance (e.g., air, water, soil) which has been contaminated.	*Enter only the media that have risks or hazards exceeding target levels.*

INSTRUCTIONS FOR TABLE 10

RISK ASSESSMENT SUMMARY (continued)

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*
Column 2 - Exposure Medium	
Definition: • 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.*	*Enter only the exposure media that have risks or hazards exceeding target levels.*
Instructions: • Choose from the picklist to the right.	*Groundwater* *Leachate* *Sediment* *Sludge, Soil* *Surface Water* *Debris* *Other* *Liquid Waste* *Solid Waste* *Air , Vapors* *Plant Tissue* *Animal 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 Animal 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 ASSESSMENT SUMMARY (continued)

Instructions: • Provide the information as text in the Table (not to exceed 80 characters).	***The text in the Table can not exceed 80 characters.***
Column 4 - Chemical	
Definition: • The COPCs quantitatively considered in the risk characterization. • The last entry in this column is the term "Total" which refers to a row of totals for the four columns.	***Enter only the chemicals that have risks exceeding target levels.***
Instructions: • Enter the COPCs from previous tables that exceed target levels. • Enter the term "Total" at the end of the list of chemicals for each exposure point.	
Columns 5, 6, and 7 - Carcinogenic Risk - Ingestion, Inhalation, Dermal	
Definition: • The cancer risk value calculated by receptor for each COPC 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 by exposure route for each exposure point.***
Instructions: • Enter the cancer risk value calculated by receptor for each COPC 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, corresponding to the term "Total" in Column 4.	
Column 8 - Carcinogenic Risk - Exposure Routes Total	
Definition: • The total cancer risk for each COPC across all exposure routes at each exposure point.	

INSTRUCTIONS FOR TABLE 10

RISK ASSESSMENT SUMMARY (continued)

Instructions: • Enter the sum of cancer risks across the three exposure routes for Columns 5, 6, and 7. • 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. • Enter the total cancer risk across all media and all exposure routes. • Enter the total cancer risk for each individual medium.	
Column 9 - Chemical	
Definition: • The COPCs quantitatively considered in the hazard characterization. • The last entry in this column is the term "Total" which refers to a row of Totals for Columns 11, 12, 13 and 14.	***Enter only the chemicals that have hazards exceeding target levels.***
Instructions: • Enter the COPCs from previous tables with hazards exceeding target levels. • Enter the term "Total" at the end of the list of chemicals for each exposure point.	
Column 10 - Non-Carcinogenic Hazard Quotient - Primary Target Organ	
Definition: • The primary effect reported as a primary target organ effect in IRIS and HEAST.	***Enter only the target organs that have hazards exceeding target levels.***
Instructions: • Enter the primary target organ effect as reported in IRIS and/or HEAST.	***Refer to Regional guidance 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.	***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 FOR TABLE 10

RISK ASSESSMENT SUMMARY (continued)

Instructions: • Enter the non-cancer hazard value calculated by receptor for each COPC 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 "Total" in Column 9.	*Refer to Regional guidance for summing hazard quotients.*
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 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 COPC and primary target organ. • Enter the sum of the non-cancer hazards in this column for each exposure point. • Enter the total hazard index across all media and all exposure routes. • 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.	*Refer to Regional guidance 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.	
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.***

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
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.***
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.***

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
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).***
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.***

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
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*
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).*

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
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.***
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.	

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
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.***
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.***
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***

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
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.*
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.*

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
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.	
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*

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
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.	
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*

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
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*
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*

GLOSSARY FOR COMPLETION OF STANDARD TABLES

TERM (TABLE LOCATION(S))	DEFINITION	ADDITIONAL INFORMATION
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/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*
Units (for parameter codes) (4)	The units for the parameter code used in the intake equation.	
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: 9285.7-08I, 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:

Requirement	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 USEABILITY WORKSHEET (continued)
Site:
Medium:

Requirement	Comment
Data Quality Objectives	
Precision - How were duplicates handled?	
Accuracy - How were split samples handled?	
Representativeness - Indicate any problems associated with data representativeness (e.g., trip blank or rinsate blank contamination, COC 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 USEABILITY WORKSHEET (continued)
Site:
Medium:

Requirement	Comment
Data Validation and Interpretation	
What are the data validation requirements for this region?	
What method or guidance was used to validate the data?	
Was the data validation method consistent with regional guidance? Discuss any discrepancies.	
Were all data qualifiers defined? Discuss those which were not.	
Which qualifiers represent usable data?	
Which qualifiers represent unusable data?	
How are tentatively identified compounds handled?	

DATA USEABILITY WORKSHEET (continued)
Site:
Medium:

Requirement	Comment
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 Risk Assessment text to further expand on the information presented here.

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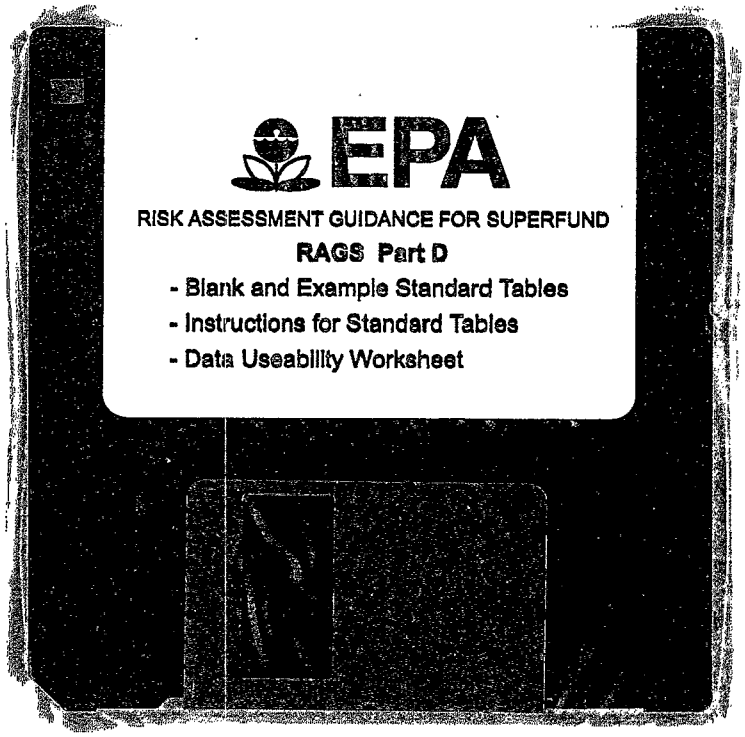
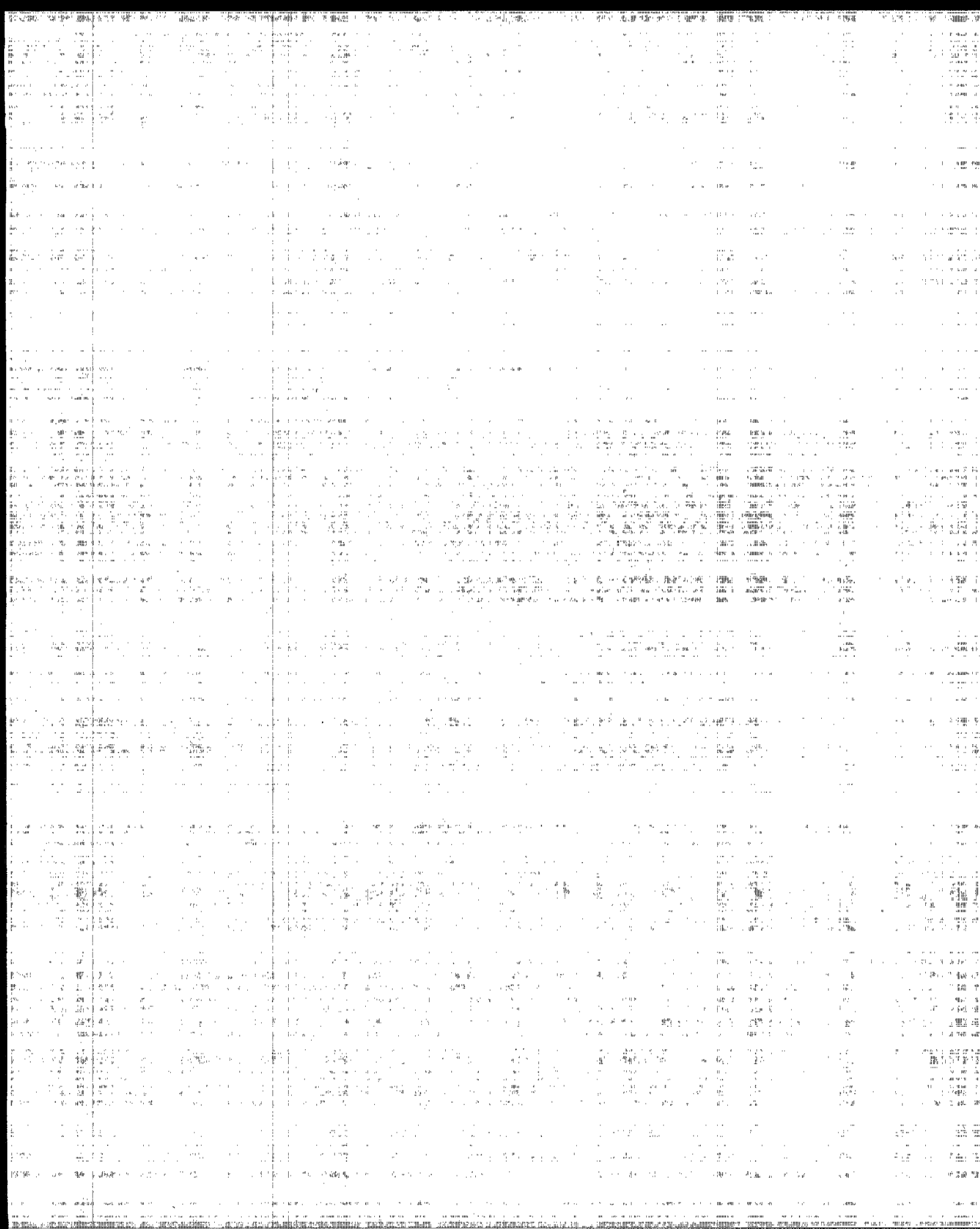

EPA
RISK ASSESSMENT GUIDANCE FOR SUPERFUND
RAGS Part D
- Blank and Example Standard Tables
- Instructions for Standard Tables
- Data Useability Worksheet



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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 assistance 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.

<u>PROCEDURES/APPLICATION</u>

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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