



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
 REGION VIII (8HWM-SM)
 999 18th STREET - SUITE 500
 DENVER, COLORADO 80202-2466



REGION 8 SUPERFUND TECHNICAL GUIDANCE

No. **RA-05: Site Conceptual Models for BRAs**
 Risk Assessment (Short Title / Key Words)

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TITLE: *Model Site Conceptual Model for RI/FS Baseline Risk Assessments of Human and Ecological Health*

authors: **Region 8 Toxicologists**

contact: **Dr. Chris Weis**
 ph: 303-294-7655

approvals:
 (initials)

PSA 5/11/95
 Chief, TS /date

Carol L. Campbell 5/11/95
 Chief, SM /date

Chris Weis 5/11/95
 Director, HW/M /date

HAZARDOUS WASTE MANAGEMENT DIVISION, SUPERFUND MANAGEMENT BRANCH, TECHNICAL SECTION

SUMMARY

EPA Region VIII requires the development of a site specific conceptual model of human and environmental receptor exposure for each remedial or removal project. The site conceptual model should be developed early in the site investigation process and used as a communication tool to direct risk-specific site sampling and site assessment. Risk-based remedial activity should focus on breaking one or more pathways defined in the site conceptual model. A general description and specific format for site conceptual models for Region VIII is included herein.

PREPARATION OF CONCEPTUAL SITE MODEL

INTRODUCTION

The USEPA Region VIII is developing a series of Regional Guidances that provide technical information and policy clarification on a variety of topics to RPMs and risk assessors working on Superfund sites in Region VIII. This guidance provides guidelines for preparation of conceptual site models for use in risk assessments. The site conceptual model should be developed by the technical team early in the remedial or removal process and should be refined as necessary as site information becomes available.

PURPOSE

The primary purpose of a conceptual site model is to help the reader of the RI and the risk assessment understand what is known regarding where

contamination originated, how it moved or is continuing to move, and how humans or environmental receptors may come into contact with contaminated media. The site conceptual model is a requirement for all Region VIII risk assessments conducted within the Remedial or Removal programs. The specific purposes of conceptual models are manifold and include: (1) the complete definition of all exposure pathways. Pathways of exposure are defined by the site conceptual model as discussed below; (2) as communication tools among team members. Team members should review and agree upon all exposure pathways prior to sampling. Often, the model can provide insight into areas or media to be sampled to better define actual or potential site risk; (3) as communication tools for public

interaction. Often, there are strong technical rationale for excluding certain pathways of exposure from the sampling process or quantitative risk assessment. It is essential that when such exclusion occurs the rationale is documented in the site conceptual model; and (4) as a tool for risk assessment review. A site conceptual model should clearly indicate which pathways of exposure were quantified in the risk assessment. In an adequately developed site conceptual model, a reviewer can easily determine which pathways have been addressed in the quantitative portions of the risk assessment and which have been addressed qualitatively.

BACKGROUND

Existing USEPA guidance requires that a conceptual site model be included as part of all Superfund risk assessments (EPA 1989). The items which must be included in the model are:

- Contamination Sources
- Contaminated Media
- Potential Exposure Pathways, including
 - Exposure Points
 - Exposure Routes
 - Receptors

This SOP provides guidelines intended to standardize the content and graphical format of conceptual site models used in risk assessments prepared for sites in Region VIII.

CONTENT

It is important that the conceptual site model include all sources, media and exposure pathways that are of **reasonable or at least plausible** concern, now or in the future. That is, the model should not exclude certain sources or pathways because it has been decided that these are minor and will not be investigated or quantified. Rather, the model should

show such pathways, and the text should explain why they have not been investigated or quantified. Note that this concept should not be carried to extremes. For example, a tertiary pathway by which contaminated fish are used for fertilizer in a garden, thereby leading to contamination of garden vegetables, can usually be omitted. The principles that allow such a pathway to be excluded are as follows:

- A pathway from a medium to a receptor need not be included in the site model if exposure to the medium occurs by one or more other routes that are clearly of greater importance. In this example, it is clear that if the fish are also eaten directly by the exposed population, this exposure pathway will contribute greater exposure than the indirect fish→soil→vegetable pathway.

- A pathway need not be included if there is only a very remote possibility that the pathway will ever be complete. In this case, unless there is some special reason to think that the use of fish to fertilize a garden is likely, it is reasonable to suppose that this pathway will not be complete. Because this criterion is subjective, and because there is often a range of opinions as to the likelihood that a particular activity will or will not occur, exclusion of a pathway on this basis should be done with caution.

GRAPHICAL FORMAT

Figure 1 presents an example site model that should be used as a format example for Region VIII risk assessments. The pathways and exposure pathways shown are intended to be representative for a mining/smelting site, but the specific

media, pathways and populations will vary from site to site.

Begin preparation of the figure by listing in a vertical column all media that are presently contaminated, or might become contaminated in the future. Then work to the right listing the exposure routes (oral, inhalation, dermal) for each medium that could lead to exposure of one or more of the populations of potential concern. Indicate which of these exposure pathways will be evaluated quantitatively, which will be evaluated qualitatively, and which are considered to be negligible or incomplete. If the figure is in black and white, use cross-hatching rather than shading, since shading usually does not xerox well.

Then work back to the left to show how the media which are presently contaminated came to be so. Trace the fate and transport of the contam-

ination all the way back to the original or historic source. Do not struggle to label the various intermediate steps as "secondary source" or "tertiary transport pathway", etc. Simply label the entire process from historic/original release to the present as "Transport Pathways".

Special format items to note include the following:

- Enclose media (past or present) in rectangular blocks, while fate and transport pathways should be indicated by text placed on the arrows that link the different media.
- Use arrows to show the direction of transport or linkage between boxes. Branching lines should be used to indicate links from one box to two or more boxes. Try to minimize the number of locations where lines cross. Where such

crosses do occur, but the boxes are not linked, use a solid horizontal line passing over a broken vertical line to indicate the absence of a linkage. Never allow a junction between lines to be ambiguous (is it connected or not?).

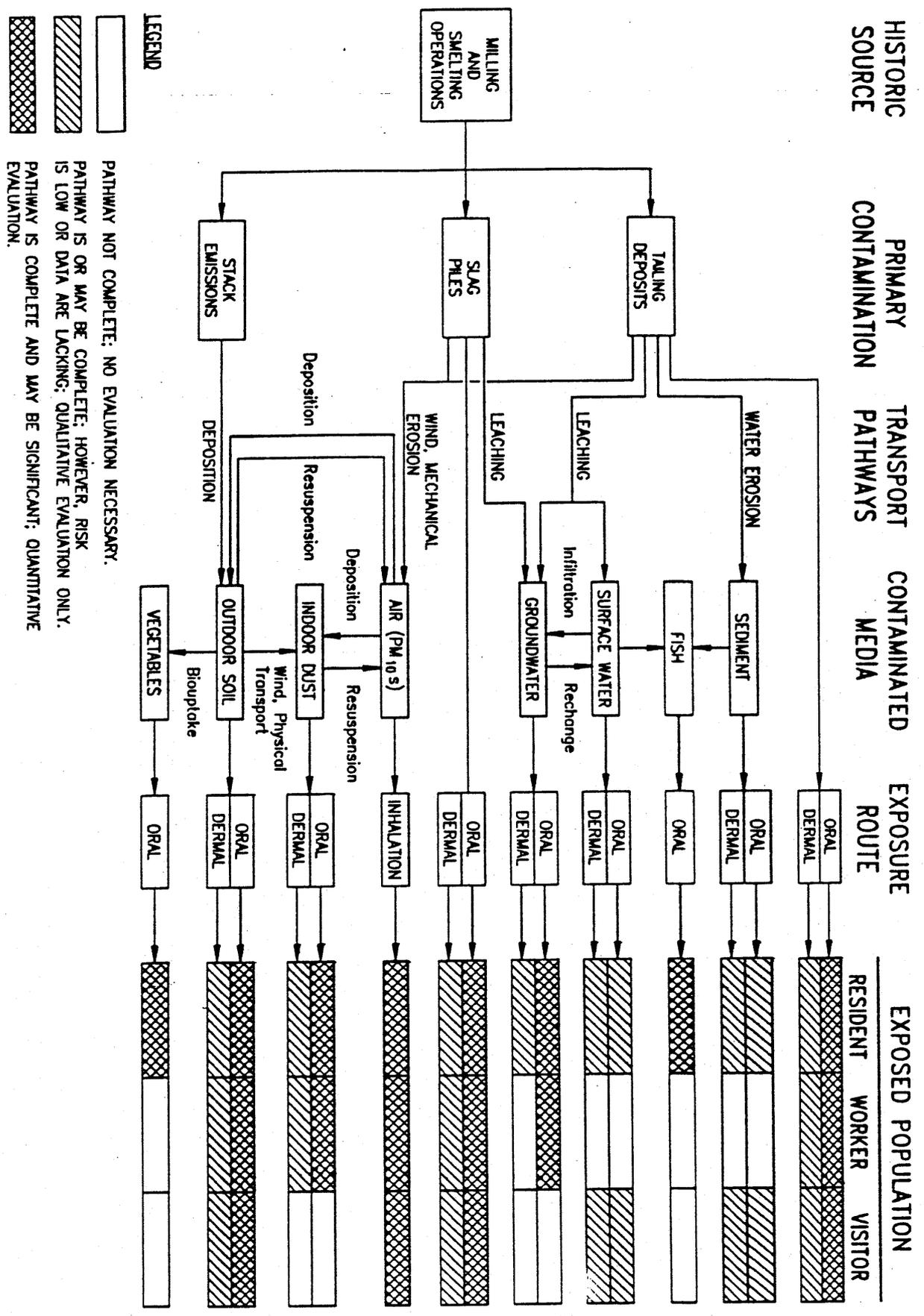


FIGURE 1
CONCEPTUAL SITE MODEL FOR HYPOTHETICAL MINING/SMELTING SITE