Wildlife Risk Assessment

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This presentation will cover the Superfund ecological risk assessment process and an ecological risk assessment conducted at the LCP Chemicals site in Brunswick, Georgia by the Superfund Program. The focus will be on the wildlife risk assessment part of the much larger ecological risk assessment conducted at the site under the Superfund removal program. Ecological risk assessment is the process that evaluates the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to one or more stressors. The risk assessment process at this site involved applying the eight-step draft Superfund risk assessment guidance (USEPA, 1997) at the site to obtain information to answer important risk questions. This approach contrasts with the former process of collecting extensive data initially at a site and playing what was once referred to as "Million Dollar Jeopardy." The result of the past process was that the Superfund Program literally spent millions of dollars on sites to collect data, but often made decisions based on a small fraction of relevant data.

Risk Assessment Process

The current approach to risk assessment in the Superfund Program is for the risk assessors to work with risk managers during the initial site assessment to meet two objectives: (1) to identify the questions the risk managers need to have answered and (2) to build the scientific framework to support the risk assessment. This up-front planning will avoid the pitfall of reaching the end of the risk assessment process with only the general conclusion that it is a bad site where something needs to be done. The outcome of the ecological risk assessment should be cleanup goals, not lines around the site that define areas where everything inside the boundaries must be cleaned up.

In the Superfund ecological risk assessment process there are eight steps and five decision points which are referred to individually as a scientific management decision point (SMDP). At each decision point, it is the risk assessor's job to explain to the risk manager what has been done. It is critical that the risk manager understands all the information. This is also an appropriate time to share the assessment information with the community and other stakeholders in the process. The risk assessor must be able to communicate clearly to the public what is being done on the site and why it is being done.

The eight-step ecological risk assessment process for Superfund can be summarized as follows:

1. Preliminary problem formulation and ecological effects evaluation
2. Preliminary exposure estimates and risk calculation
3. Problem formulation
4. Study design and data quality objective process
5. Field verification of sampling design
6. Site investigation and analysis phase
7. Risk characterization
8. Risk management

Below is a brief description of each step in the risk assessment process.

The process begins with a preliminary risk assessment (steps 1 and 2) which is the equivalent of a screening risk assessment. The first step in the preliminary assessment includes the site visit, problem formulation, and toxicity evaluation; the second step involves development of preliminary exposure estimates and risk calculation. A preliminary assessment normally includes about 240 chemicals. These chemicals are run through a very preliminary and conservative screen initially to eliminate all the chemicals that show no indication that they need to be considered in the full risk assessment. In rare cases, a preliminary risk assessment can result in termination of the risk assessment if data indicates that there is no significant risk at the site. Both the risk assessors and the risk managers must agree on this determination. This determination is the first scientific management decision point.

The decision to continue the risk assessment initiates the full risk assessment process which is described in program-specific guidance, but follows the Agency framework for risk assessment (USEPA, 1997).

The decision to continue the risk assessment initiates the full risk assessment process, beginning with problem formulation (step 3). The problem formulation phase involves several activities including toxicity evaluation, selection of assessment endpoints, and development of the conceptual model and testable hypotheses. The second SMDP occurs at the end of problem formulation. At this point the involved parties must agree on the assessment endpoints, the conceptual model, the exposure pathways, and questions or risk hypotheses.

The risk asssessment continues with development of the study design and identification of data quality

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objectives and statistical considerations (step 4). This process produces a work plan and sampling and data analysis plan. Agreement on the content of both plans constitutes the third SMDP.

The fifth step in the risk assessment process is verification of the field sampling plan. Field activities during this step will determine sampling feasibility. This step ends with the approval of the work plan and the sampling and analysis plan which is the fourth SMDP. With work plan approval, the risk assessment moves into the site investigation and analysis phase (step 6). The plans define how these activities will be conducted, but they may require modification depending on circumstances such as changing field conditions. An additional SMDP may be necessary to approve plan modifications.

The risk assessment process continues with the risk characterization (step 7). The three primary components of risk characterization are risk estimation, risk description (threshold for effects on assessment endpoints and other risk information), and uncertainty analysis. And finally, the process culminates in risk managers using the results of the risk characterization to make the record of decision (ROD). This decision is the final SMDP.

Site Summary

The LCP Chemicals site in Brunswick, Georgia offers a case study for Superfund wildlife risk assessment. The site initially contained a petroleum refinery which operated for more than 10 years. In 1955 it was sold to a chemical company that built a chloralkali plant on the property to manufacture caustic soda, chlorine, and hydrochloric acid. The plant continued to produce these chemicals at the site through the 1980s. Early in the risk assessment process some highly contaminated areas were identified within the site that all parties agreed needed remediation. PCBs measuring in the thousands of parts per million (ppm) were found in sediments from these areas. The Superfund removal program initiated some actual cleanups in these areas prior to the completion of the risk assessment. Elevated levels of mercury and lead were also found in sediments near the site.

The site is tidally influenced with a tidal range of about 8 feet. The tidal marsh at the site covers about 500 acres. It provides a very diverse habitat for wildlife, including a number of endangered species. Contaminants from the outfall area have been released through tributaries into the marsh. The question being addressed here was what needed to be done to restore the habitat not only for aquatic life, but also for wildlife. In this case, the primary objective was to restore and maintain the ecological health of the salt marsh community, particularly with respect to the structure and function of the marsh.

Assessment Endpoints and Results

The assessment endpoints are what risk assessors and managers target for ecological protection. Results from other sites indicate that current wildlife assessment endpoints are not particularly good. The Superfund Program is providing additional resources to ecologists to determine more specifically the critical ecological functions that require protection to maintain diverse wildlife habitats such as salt marshes. This information would allow risk assessors to derive better assessment endpoints and to define better measurement endpoints for wildlife risk assessment.

[Dr. Charters discussed how they evaluated contaminant concentrations in wildlife at the LCP Chemicals site, particularly for terrapins, otters, and racoons. His discussion focused on evaluation of mercury measurements. Selected data sets and related graphics presented at the conference are not available for publication in this paper. Please contact Dr. Charters directly for further information on the site-specific wildlife data for this Superfund site in Brunswick, Georgia. For additional information on EPA's Environmental Response Team, you may visit their website on the Internet at http://www.ert.org]

Summary

The LCP Chemicals site is one of the first Superfund sites to undergo evaluation using the eight-step risk assessment process. It is a site where the Superfund Program expanded the scope of the risk assessment to consider impacts to semi-aquatic and terrestrial animals living around the aquatic environment. That was a point of departure from the normal EPA approach of being heavily oriented to protection of aquatic organisms. The Superfund Program has recognized that a lot of sites have some terrestrial component associated with them. The program is working very hard to come up with appropriate numbers to use for screening aquatically or terrestrially. This would allow the program to do a better job of identifying semi-aquatic and terrestrial species that are significantly impacted by bioaccumulative compounds at these sites.

Going through the eight-step process, the Superfund Program is starting to address some of the issues that have been addressed in the aquatic community up to the fish level. The program is beginning to focus on higher species that utilize fish as forage and introduce contamination into the terrestrial environment, including ones that have not been evaluated in the past. Sediment bioaccumulation is an important part of the wildlife evaluation not only from a question of sediment uptake directly into these species, but also from the view that significant impacts can result from contaminant-induced changes in behavior.

References

USEPA. 1997. *Process for designing and conducting ecological risk assessments—interim final.* EPA 540/R-97/006. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC.

Ecological Risk Assessment Guidance for Superfund:

Process for Designing and Conducting Ecological Risk Assessments

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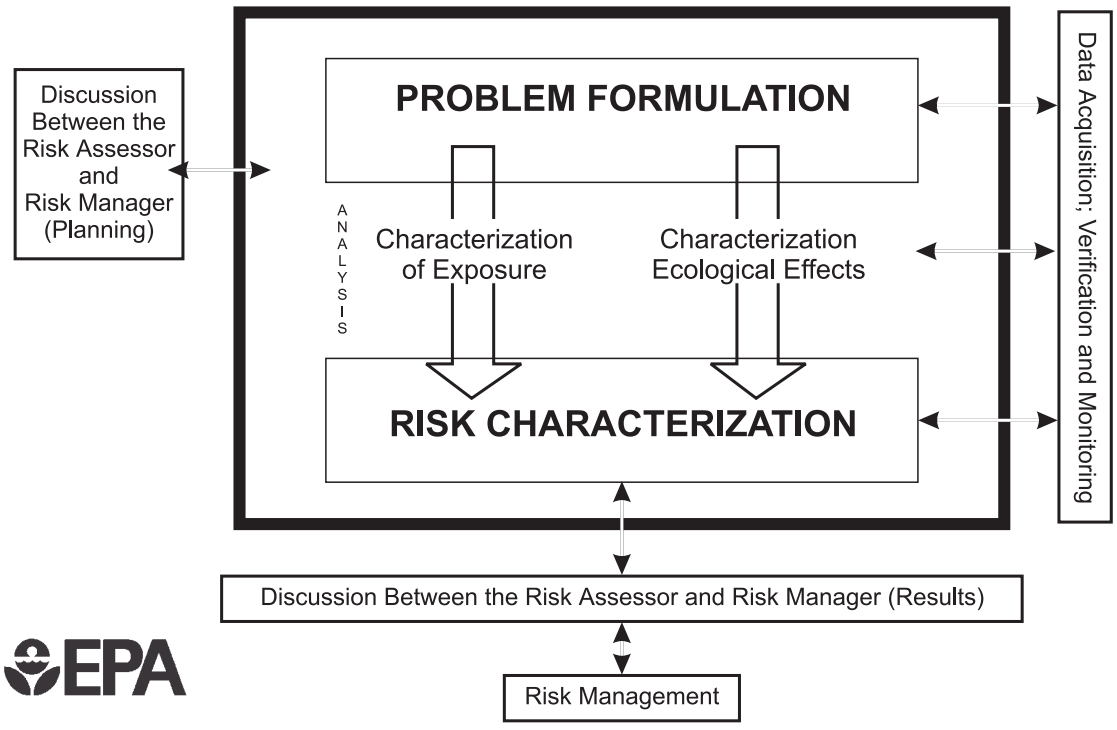
Ecological Risk Assessment Framework (U.S. EPA, 1992a)



Eight-Step Ecological Risk Assessment Process for Superfund

Compile Existing Information

STEP 1: PRELIMINARY
- Site Visit
- Problem Formulation
- Toxicity Evaluation

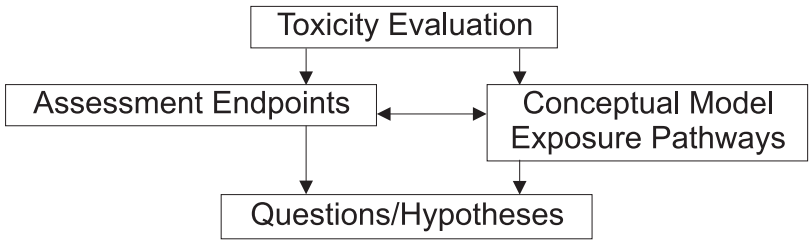
Risk Assessor & Risk Manager Agreement

STEP 2: PRELIMINARY
- Exposure Estimate
- Risk Calculation

SMDP

Data Collection

STEP 3: PROBLEM FORMULATION



SMDP

STEP 4: STUDY DESIGN AND DQO PROCESS
- Lines of Evidence
- Measurement Endpoints

Work Plan and Sampling and Analysis Plan

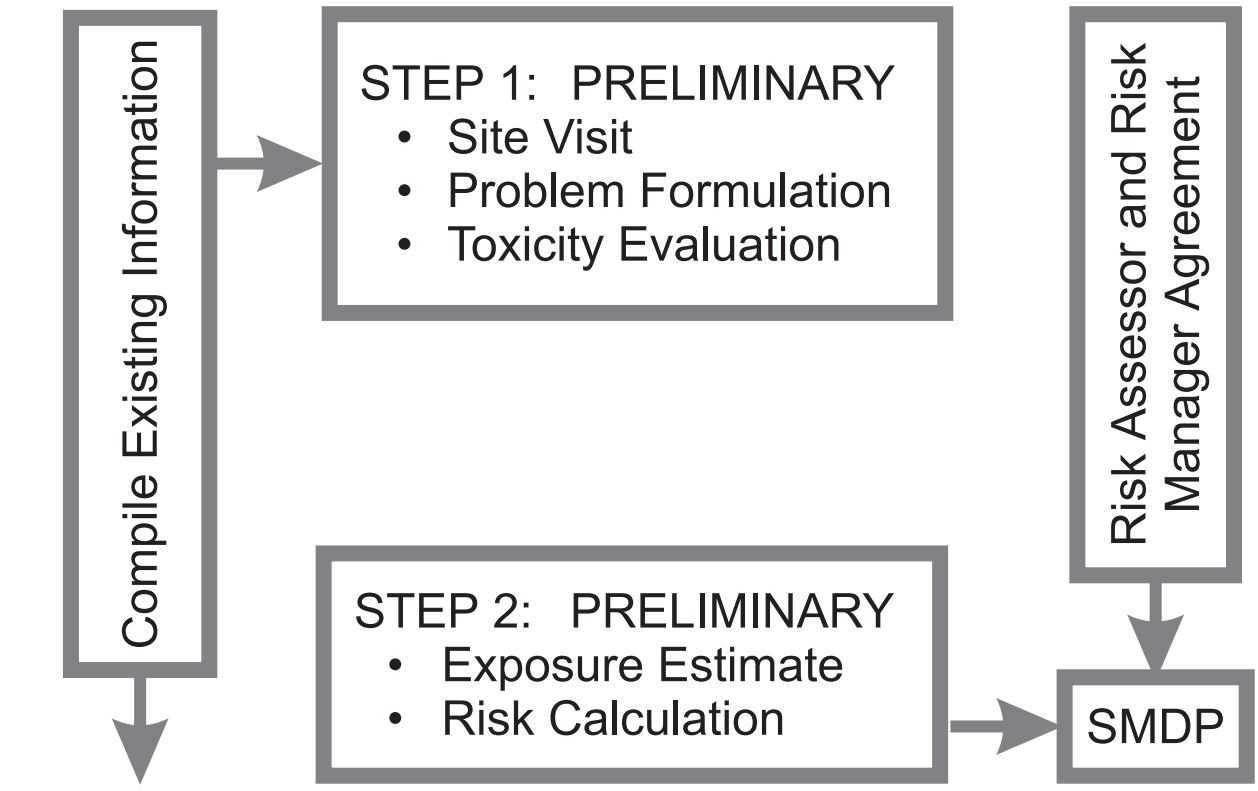
SMDP

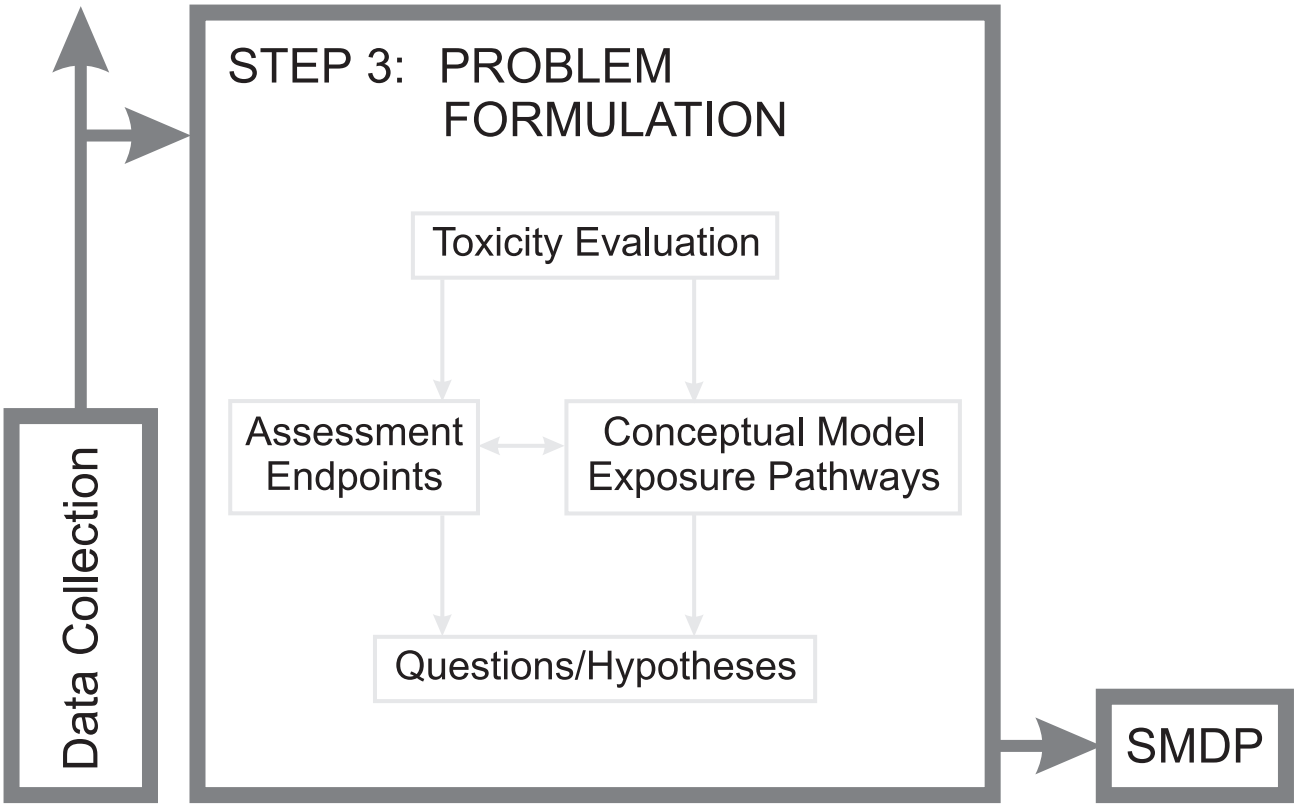
STEP 5: VERIFICATION OF FIELD SAMPLING PLAN — SMDP

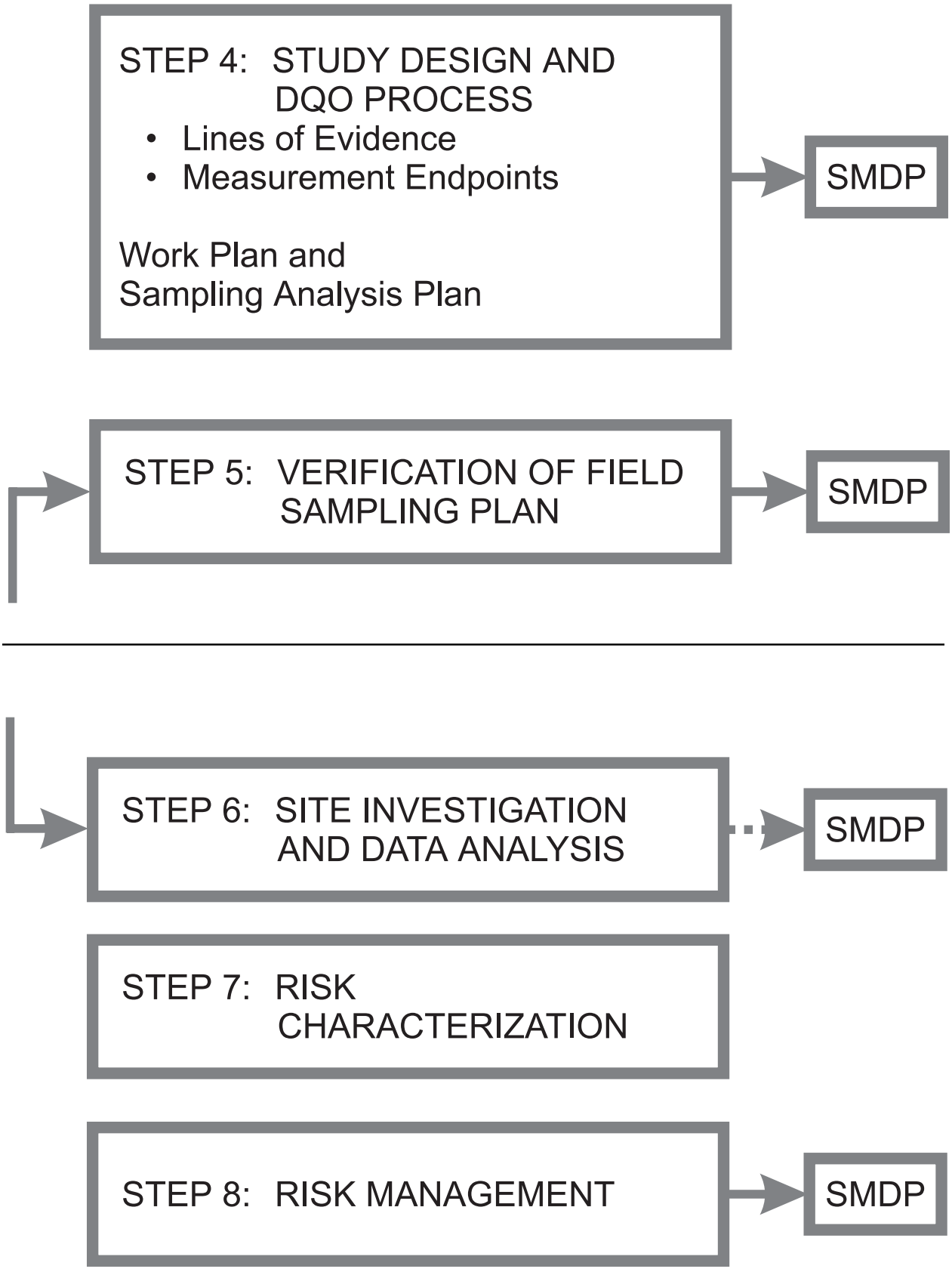
STEP 6: SITE INVESTIGATION AND DATA ANALYSIS — (SMDP)

STEP 7: RISK CHARACTERIZATION

STEP 8: RISK MANAGEMENT — SMDP







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