8 Conceptual Site Model and Data Quality Objectives

Two general items that are important when establishing soil background and using it in risk assessment are a conceptual site model (CSM) and data quality objectives (DQOs). The descriptions below are not intended to be comprehensive or detailed, rather they are intended to introduce these concepts and provide key references for additional information.

8.1 Conceptual Site Model

A CSM is the integrated representation of the physical and environmental context, the potential fate and transport of COPC, and the complete and potentially complete exposure pathways associated with each receptor at a cleanup site that is being evaluated (ASTM E2616-09(2014), (ASTM 2014), ASTM E1689-20 (ASTM 2020), ASTM D6169/D6169M (ASTM 2013). The goal of a CSM is to provide an understanding of relevant site features and conditions to understand the extent of COPC and the critical exposure pathways for evaluation in risk assessments. A CSM should provide a thorough understanding of the physical characteristics of the site, as well as the sources of site contamination, potentially contaminated media, contaminant transport pathways, and exposure pathways applicable to receptors. A detailed understanding of a cleanup site that is being evaluated informs the development of an accurate CSM, which in turn provides important information that may be used to determine whether site chemical concentrations represent soil background and to identify potential soil background reference areas. Important concepts that should be included in a CSM are contribution of natural and diffuse anthropogenic inputs versus site-associated releases because all might be present at the site. CSMs may evolve throughout the duration of a project as more information becomes available (USEPA 2011). As noted, a well-developed site CSM aids in selection of background reference areas by ensuring that the site context—including land use, geochemical, and chemical considerations—is understood and background reference areas can be selected that reflect similar inputs, minus site release impacts.

As described in the ITRC TPH document ((ITRC 2018), information on the development of a CSM is readily available in several guidance documents including the following:

- ITRC Triad Implementation Guide, ITRC SCM-3 (ITRC 2007)
- Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA 1992)
- Data Quality Objectives Process for Hazardous Waste Site Investigations: Final Guidance (USEPA 2000)
- Standard Guide for Developing Conceptual Site Models for Contaminated Sites, ASTM E1689-20 (ASTM 2020)
- Environmental Cleanup Best Management Practices: Effective Use of the Project Life Cycle Conceptual Site Model (USEPA 2011)

8.2 Data Quality Objectives

A systematic planning process, such as USEPA's DQO process (USEPA 2006), is a key step in developing a successful sampling and analysis program to ensure the appropriate sampling, analyses, and data evaluations are conducted to meet program objectives. The DQO process is important to use whenever sampling and analysis are conducted as part of establishing soil background and using soil background in risk assessment because this leads to consensus on the type, quality, and quantity of data needed to meet project goals (USEPA 2006).

The DQO process may be used when designing a soil background study intended either to characterize soil background to establish default background for a larger area (for example, a state, a region, or a unique geological area) or to obtain site-specific soil background for a site being evaluated. It also aids in the planning process by establishing the scope and scale of the study required, which can aid in resource planning.

USEPA's DQO process should be applied to soil background studies to help ensure that background data are comparable to data from the site being evaluated and the background dataset is suitable for its intended use in risk assessment.

Details on the USEPA's DQO process can be found in *Guidance on Systematic Planning Using the Data Quality Objective Process* (USEPA 2006). For a complete list of USEPA guidance documents on quality programs for environmental sampling, refer to https://www.epa.gov/quality/agency-wide-quality-program-documents. The initial five steps of the DQO process are focused on defining qualitative criteria, such as the nature of the problem, the decisions or estimates that need to be made, the types of data needed, and a "decision rule" process that defines the logic for how the data will be used to draw conclusions from the study findings. This aids in defining the characteristics and spatial extent of the sampling program necessary to determine soil background.

The sixth step establishes acceptable quantitative criteria on the quality and quantity of the data to be collected. These criteria are known as performance or acceptance criteria, or DQOs. This step is used to define whether data collected or

otherwise used are acceptable or unacceptable for use. Performance criteria form the basis of a project's quality assurance project plan (QAPP), which relates back to the DQOs and ensures that the data are suitable for the intended use (for example, verifying that the analytical reporting limits are lower than background values). The final step of the DQO process involves data collection design that will meet both the qualitative and quantitative criteria to ensure that sampling design and the analytical program generate data acceptable for use. This final step, developing the plan for obtaining the data, is the basis for the sampling and analysis plan (SAP).

SAPs and QAPPs are important for conducting a soil background study, as they document the project's DQOs so that data collection and data analyses generate data suitable for use. The QAPP and SAP are discussed further below.

8.2.1 Quality assurance project plan

The QAPP should define the procedures to collect, preserve, and analyze samples, as well as store and manage analytical data, to ensure that the data collected are of sufficient quality to meet project needs. The QAPP should include at a minimum:

- requirements for field quality control (QC) samples (for example, field duplicates, field blanks)
- methods to prevent cross contamination (for example, field decontamination procedures)
- field equipment, including calibration and maintenance of that equipment
- field documentation methods
- number of samples to be collected for each evaluation, and justification for sample number
- measurement performance criteria (such as bias, precision, and completeness) for each test method proposed

Additional details on QAPPs can be found in guidance documents published by USEPA, including QA/G-5 (USEPA 2002), and in USEPA's Quality Assurance Project Plan Development Tool.

8.2.2 Sampling and analysis plan

A well-designed sampling program is critical when conducting a study to determine soil background concentrations. SAPs are sometimes called field sampling plans (FSPs) and are generally required for projects performed under regulatory orders or as part of a regulatory process. Please refer to Section 9 for additional details.

As outlined in USEPA (2006), a SAP should include the following components:

- rationale for each sample or group of samples based on the project DQOs
- number of samples, along with justification for the number of samples to be collected
- sample type (composite vs. discrete samples)
- sample locations and design, along with justification for how sample locations were selected and the area or quantity that each individual sample represents
- sample collection method (for example, surficial soil sampling versus drilling)
- protocols for sample collection, preservation, handling, and shipping
- analytical methods
- statistical sampling plan