

**United States Environmental Protection Agency, Region 9  
Emergency Response Section  
Generic Data Quality Objectives Process Document  
for  
Emergency Response  
Soil Sampling**

**BACKGROUND**

Requirements

The generic data quality objectives (DQOs) presented in this document are based on typical technical and project directives encountered by the United States Environmental Protection Agency, (EPA) Region 9, Emergency Response Section (ERS) and the Superfund Technical Assessment and Response Team (START) in emergency responses that involve releases to soil. The ERS and START planning process for an emergency response involving soil contamination is reflected in this DQO document. This document, coupled with site-specific output statements, as documented in an emergency response sampling plan, is intended to meet the EPA's DQO process requirements as stated in the ERS quality management plan (QMP) and START's quality assurance project plan (QAPP). The following requirements and preconditions must be fulfilled to effectively implement these DQOs:

- The emergency responders must be familiar with all types of soil sampling procedures and possess sufficient emergency response experience and training to make emergency sampling design decisions.
- The emergency responders must be sufficiently prepared and organized for emergency response situations in order to implement the planning, mobilization, and communications necessary to support expeditious sampling, analyses, and decision making.
- The emergency responders must be familiar with the START QAPP and/or the ERS QMP.
- The emergency responders must be familiar with the EPA's DQO process and the information and objectives indicated in this generic DQO document. The emergency responders must document any additional DQO information and DQO modifications.
- Before any sample collection, the emergency responders must determine site-specific assessment parameters as indicated in the emergency response sampling plan.
- All DQO-related information not specified in this DQO document or the emergency response sampling plan must be recorded in other project documentation (e.g., sampling plans, logbooks, action memos, or pollution reports).

## **STEP 1. THE PROBLEM**

### Background for an Emergency Response Soil Sampling Project

The EPA ERS was notified that a release to soil that may pose a significant imminent threat to human health and/or the environment has been identified. The location of the contaminated soil is within the EPA, Region 9. Because of the nature of the perceived threat, the investigation must proceed immediately. There may be no available data regarding the types of contaminants, or the specific location, extent, or magnitude of soil contamination.

### Planning Team

Primary Decision Maker:	Responding EPA On-Scene Coordinator (OSC)
Plan Development:	START emergency responders and OSC
Plan Approval:	Responding OSC
On-Scene Assistance:	Local first responders
Supplemental Remote or On-Scene Support:	START response manager, START quality assurance (QA) coordinator, START analytical service provider, Emergency Rapid Response Services (ERRS) contractor, EPA Emergency Response Team (ERT), and Eagle Equipment Warehouse

The names and affiliations of the actual planning team will be documented in the field logbook or in the emergency response sampling plan.

### Conceptual Site Model

- A description of the site and a list of the potential contaminants of concern (COCs) are provided in the site's emergency response sampling plan.
- The medium of concern is soil. This medium will include surface soil, subsurface soil, and sediments either in place or in piles.

### Exposure Scenario

- The site is being evaluated by the EPA, Region 9, to determine whether it poses an imminent threat to human health and/or the environment.
- Concerns include migration of contaminants from soil to other media and direct exposure of human and/or environmental receptors to soil contaminants.

### Resources

The planning and preparation for emergency response situations that involve environmental data collection in the EPA, Region 9, are administered and implemented by the EPA ERS and START, at the direction of the EPA OSC.

This is an emergency response under the technical direction of the EPA ERS. Labor resources include:

- The responding OSC, who will typically oversee all data collection operations related to this project. A responding OSC must be capable of responding immediately.
- START personnel with a budget that will not typically exceed \$25,000. START responders must be capable of responding immediately.
- Local first responders.
- Federal, regional, state, or local responders.
- The ERRS contractor. The ERRS contractor must be capable of responding immediately.
- EPA ERS personnel.

Analytical service resources include the following:

- A START laboratory will be assigned upon request. Laboratory assignment will be based on site location or specific analytical requirements.

EPA-owned equipment resources are readily available and accessible for mobilization to an emergency response through the Eagle Warehouse, 888-447-5602 for the San Francisco office and 562-705-4900 for the Long Beach office. Use of EPA equipment can only be requested by EPA ERS personnel. This emergency equipment is accessible 24 hours per day, seven days per week. EPA emergency response equipment is continuously maintained in a response-ready condition. Sample collection media (jars, sorbent tubes, etc.) are available through the START.

Additional emergency sampling equipment and field analytical instruments may be available from the United States Coast Guard Pacific Strike Team in Novato, California, and from the EPA ERT and its emergency response contractor in Edison, New Jersey.

### Resource Constraints

The EPA Region 9 QA Office resources, regional laboratory resources, and Contract Laboratory Program laboratory resources are typically not readily available for emergency response. Leased or rented equipment is not readily accessible for emergency response situations. The abilities and availability of resources other than EPA ERS and START resources will vary with the situation and location.

## **STEP 2. THE DECISION**

### Principal Study Questions

#### Primary Questions:

- #1 What are the COCs?
- #2 What is the general area (areal extent) of soil contamination?
- #3 Has contamination migrated laterally beyond the area of the release?
- #4 What are the estimated contaminant concentrations within the contaminated area?
- #5 What are the contaminants and contaminant concentrations for specific selected samples that may be used as enforcement documentation?

#### Secondary Questions:

- #6 Based on the answers to the primary questions, what is the rough estimated volume of soil with contamination that exceeds the action level?
- #7 Based on the answers to the primary questions, what is the contaminant(s) of predominant concern?

### Actions that Could Result from the Resolution of Study Questions

- 1) The EPA would initiate no further action on the site in relation to the soil contamination.
- 2) The EPA would initiate a further investigation of the soil contamination.
- 3) The EPA would initiate a removal action to mitigate or remove the contaminated soil.
- 4) The EPA would initiate legal action.
- 5) The EPA would defer any direct EPA action to local or state regulators. The EPA would supply technical support and information to regulators.
- 6) The EPA would defer any direct EPA action and support to local, regional, or state regulators. The EPA would supply regulators with information collected during the response.

### Decision Statements (Directives)

- Determine the COCs and the action levels for the COCs.
- Roughly estimate the lateral extent and concentrations of contamination.
- Roughly estimate the volume of soil that might contain COCs above action levels.
- Determine what contaminant(s) is of predominant concern and whether an expeditious sampling and analysis protocol can be used to screen for that contaminant(s).
- Document contamination to support project decisions and future legal activities.
- Visually determine whether COCs in soil might have migrated (or are migrating) to other media. Provide documentation to support determination.

### **STEP 3.**

### **DECISION INPUTS**

#### Specific Data Required

- Information regarding the types of hazardous substances that may have been released to soil.
- Action levels for potential COCs.
- Analytical data capable of providing a rough estimate regarding the extent and concentration levels of contamination.
- Analytical data that are capable of legally documenting specific contamination of selected samples.
- Physical characteristics (e.g., topography and geology) of the site.
- Chemical and physical properties and characteristics of COCs.
- Analytical data for COCs that are capable of documenting and supporting emergency decisions.
- Specific data needs will be indicated in the site's emergency response sampling plan.

#### Sources for Study Information

- Spill report information from first responders and responsible parties.
- Material safety data sheets for the site, and site chemical inventory information or local Toxic Release Inventory (TRI) database information (TRI information is generally managed by local response agencies).
- Chemical reference books and databases.
- Verbal or written information from witnesses, first responders, and other on-scene personnel.
- Site information collected during the emergency response.
- Screening data generated during the emergency response.
- Definitive analytical data generated during the emergency response.
- Data collection activities specified in the site's emergency response sampling plan.

#### Information Needed to Establish Action Level

- Because a preliminary (emergency) action level may be based on the expected analytical reporting limits (of the laboratory providing the analysis), the analytical reporting limits for COCs are needed.
- EPA, Region 9, soil preliminary remediation goals or soil screening levels are needed for COCs.
- If available, the local applicable or relevant and appropriate requirements for each COC.

#### Confirm that Measurement Methods Exist to Provide Data

- EPA SW-846 Methods are typically used for all measurements.
- Analytical methods for this project are specified in the site's emergency response sampling plan.

## **STEP 4.**

### **STUDY BOUNDARIES**

#### Specify Characteristics that Define the Population Being Studied

- The approximate COC concentrations in soil throughout the area of concern (AOC)
- The specific COC concentrations of selected enforcement samples.
- Potential COCs are specified in the site's emergency response sampling plan.

#### Geographic Boundary of Investigation

- The geographic boundary of sampling will be determined during the emergency response based on professional judgment and experience of the responders.
- Geographic boundaries are specified in the site's emergency response sampling plan and referenced as the AOC.

#### Temporal Boundary of Investigation

Data must be generated promptly to facilitate the on-scene emergency decision-making process. Unless otherwise specified and documented, the temporal boundaries are as follows:

- Sample planning will take place just before sample collection.
- Sample collection will generally take place immediately following verbal directives or approval from the OSC.
- Analytical field data (i.e., data generated on scene using field-screening techniques) that are needed to make on-scene emergency decisions must be generated and reported immediately.
- Analytical data (definitive or non-definitive) used for on-scene emergency decisions must be generated within 24 to 48 hours after samples are collected.
- Estimations derived from field-generated data that are used for on-scene emergency decisions must be generated and reported immediately.
- All other preliminary definitive and non-definitive data will be reported within four weeks of sample collection.
- Validated data will be reported approximately eight weeks after sample collection.

#### Other Constraints on Data Collection

- It may not be possible to generate high-quality data that are thoroughly documented in an expeditious time frame.
- The turn-around times for data are always estimated and cannot be ensured. Sample and system problems may indiscriminately increase data turn-around times.
- Because some analytical data may be required immediately in order to facilitate the on-scene emergency decision-making process, it may be necessary to forgo some QA measures, including data review, in order to meet this requirement.
- Definitive data will be validated before final reporting.
- All other data used to make decisions will be reviewed before final reporting.
- Physical constraints, such as rough terrain, bodies of water, barriers, lack of

- lighting, and poor weather conditions, may exist and will be addressed on scene based on the experience and professional judgment of the responders.
- Civil constraints, such as legal site access, permit requirements, and unfriendly neighborhoods, may exist and will be addressed on scene based on the situation.

## **STEP 5.**

### **DECISION RULE**

#### Statistical Parameter

Unless otherwise specified and documented, this investigation is interested in the worst-case values for each decisional unit. Unless otherwise specified and documented, the decisional unit for this investigation is the entire AOC.

#### Action Levels

The action levels are specified in the emergency response sampling plan. Unless otherwise specified in the site's emergency response sampling plan or other project documents, the action levels for the site will be the laboratory's achieved analytical reporting limits.

#### Decision Rules

- If the COC concentration at a sample location is less than the action level, then soil represented by that sample will not be considered contaminated and may not be subject to any removal action.
- If the COC concentration at a sample location exceeds the action level, then soil represented by that sample will be considered contaminated and may be subject to additional investigations.
- If the COC concentration at a sample location exceeds the action level, then soil represented by that sample will be considered contaminated and may be subject to an EPA removal action.
- If the COC concentration at a sample location exceeds the action level, then soil represented by that sample will be considered contaminated and the EPA may defer additional action to regional, state, or local regulators.
- If the COC concentration at a sample location exceeds the action level, then soil represented by that sample will be considered contaminated and may be subject to a removal action by the responsible party. The EPA, Region 9, may oversee removal or defer the oversight to regional, state, or local regulators.

During an on-scene emergency response or before data reporting, the OSC could develop additional decision rules that could involve additional actions. Additional decision rules

will be recorded with the project documentation (e.g., sampling plan, logbook, OSC action memo, or pollution report).



## **STEP 6.**

### **LIMITS ON DECISION ERRORS**

#### Range of the Parameters of Interest

The COC concentrations may range from nondetect to several thousand times the action level. However, for emergency responses, concentrations above the action level that are of immediate danger to public health and the environment are of principal concern.

#### The Null Hypothesis or Baseline Condition

The COC concentration in soil exceeds the action level.

#### Alternative Hypothesis

The COC concentration in soil is less than the action level.

Decision Errors

<b><u>DECISION ERRORS</u></b> <b>Soil</b> <b>Emergency Response</b>		
<b>Decision Error</b>	Deciding that the sample concentration <u>exceeds</u> the action level when it does not.	Deciding that the sample concentration <u>does not exceed</u> the action level when it does.
<b>True Nature of Decision Error</b>	The sample concentration does not exceed the action level.	The sample concentration does exceed the action level.
<b>The Consequence of Error</b>	Areas of soil represented by the sample will undergo additional investigation or may be immediately excavated or treated. Each situation would cost the EPA, Region 9, additional resources of time, money, and manpower.	1) The community could be directly exposed to COCs in areas of contaminated soil. Exposure would be an imminent threat to human health and the environment. 2) The COCs in areas of contaminated soil could migrate from the soil to a drinking or agricultural water source. Exposure would be an imminent threat to human health. 3) The COCs in soil could migrate from soil to air. Exposure would be an imminent threat to human health and the environment. 4) The COCs in areas of contaminated soil could migrate from soil to sensitive environments. Exposure would be an imminent threat to the environment.
<b>Which Decision Error Has More Severe Consequences near the Action Level?</b>	<b>LESS SEVERE</b>	<b>MORE SEVERE</b> because the contaminated soil may pose risks to human health and/or the environment.
<b>Error Type Based on Consequences</b>	<b>False Negative Decision</b>  A decision that the soil contaminant concentrations are greater than the action level when they actually are not.	<b>False Positive Decision</b>  A decision that the soil contaminant concentrations are less than the action level when they actually are greater.
<b>Definitions</b> False Negative Decision = A false negative decision error occurs when the null hypothesis is not rejected when it is false. False Positive Decision = A false positive decision error occurs when the null hypothesis is rejected when it is true. See the EPA document titled, <i>Guidance for the Data Quality Objective Process</i> , Chapter 6, (EPA QA/G-4) for additional guidance regarding decision error.		

Decision Error Limits Goals

<b>Decision Error Limits Goals for <u>Emergency Responses</u></b>		
<b>True Concentration of Sample (% of Action Level)</b>	<b>Typical Decision Error Probability Goals (Based on Professional Judgment)</b>	<b>Type of Decision Error</b>
0-75	Less than 5%	False negative
75-100	Gray area <sup>1</sup>	False negative
100-120	10%-50% <sup>2</sup>	False positive
120-150	5%-10% <sup>2</sup>	False positive
150-200	Less than 5%	False positive
>200	Very small	False positive
<b>The goals in this table are based on professional judgment as relevant to a typical emergency response for soil contamination. Specific project goals may vary with the situation.</b>		
<sup>1</sup> <i>Gray area</i> is where relatively large decision errors are acceptable.  <sup>2</sup> Note that large decision errors are expected when the true contaminant concentrations are 100% to 150% of the action level.		

## **STEP 7.**

### **DESIGN FOR OBTAINING DATA**

All sampling, analytical, and QA activities will proceed under the START QAPP and documents referenced therein. All site-specific planning and activities will be documented either in an emergency response sampling plan or within a bound field logbook. A record of sampling activities must also be documented in a bound field logbook.

START has developed an emergency response quality assurance sampling plan (ER-QASP) for soil and water sampling. This ER-QASP will be used for all emergency response situations that require soil sampling and analysis. When possible, this sampling plan will be completed before the sample collection. In all cases, it will be completed within 30 days of the emergency response sampling event. The ER-QASP comprises four sections: "Background," "Objectives," "Sampling and Analysis Methodology," and "Project Organization and Responsibilities." The ER-QASP, the START QAPP, and the DQOs are intended to meet the EPA, Region 9, planning requirements for emergency response situations.

Before sample collection, the emergency responders should review sampling procedures and relevant QA/quality control (QC) requirements for selected analytical methods.

#### General Design

The collection of background/reference samples, replicates, and field blanks is recommended but not required. All analytical QA/QC and documentation specified in the START QAPP is recommended; however, such QA/QC and documentation may be considered secondary to the expeditious generation of data.

Based on emergency response goals and objectives, statistical measurement and determination of sampling error for emergency soil sampling are not practical or necessary. However, where practicable, sampling and analytical measurement error will be estimated and reported with the data validation report.

Because of the emergency nature of the response, the specific sampling methodology and emergency response sampling design must be chosen in the field based on the experience, training, and professional judgment of the responders. Emergency response decisions will be made by the OSC based on professional judgment and training using analytical and non-analytical information. The analytical information initially generated by sampling will comprise discrete sample data and not statistical data. Concentrations of contaminants in unsampled areas will be estimated based on the professional judgment of the responders.

When possible, analytical measurement error will be minimized through the use of proper

QA/QC practices and conformance to QA limits. Sampling error will be minimized when possible by increasing sampling points, reducing the AOC, and compositing.

The OSC will consider data uncertainty when making decisions based on discrete sampling data and estimated values. For most standardized soil methods, the greatest uncertainty is assumed to lie within reported ranges 60% to 100% of the action level. For unqualified and validated definitive data, the range will be 75% to 100% of action level. The uncertainty range for field-screening methods depends on the method and will be determined and considered before the data's use for decisions. The uncertainty for estimated data (i.e., data based on extrapolations and interpolations) is typically greater than that for discrete data. The use of standard methods and procedures could mitigate all other false positive and false negative decisions.

Data validation, independent of the laboratory, will be performed on all enforcement data and all definitive data that are used in decision making. Data review, independent of project management, will be performed on all non-definitive and screening data used in the decision-making process. Because of the nature of emergency response activities, the validation will be performed after the decision making but before final reporting.

### Hot Spot and Grid Sampling

Because the primary objective of sample collection in an emergency response is to expeditiously identify the significant contaminant threats, the initial sampling approach will concentrate on the search for and identification of contamination hot spots that are significantly above the action level. Systematic grid and search sampling can provide a probabilistic approach to locating a contamination hot spot. When this approach is used, the responder must determine the search parameters before sampling. This information will be specified in the site's emergency response sampling plan.

The lateral extent and concentrations of contamination will be extrapolated and interpolated from sampling grid data.

### Biased and Judgmental Sampling

Additional sampling approaches will generally include sample collection at locations expected to exhibit the worst-case contamination. This biased sampling may be based on direct visual observations or the results of field-screening instruments and techniques.

If physical information suggests that contamination may have migrated to other media (e.g., water and air), then limited judgmental sampling of those media, when practicable, should be included.

### Enforcement Sampling

Biased samples may be collected from selected locations and analyzed in order to document the presence and magnitude of contamination at those locations for legal enforcement. This sampling would include complete documentation regarding the sampling and analysis performed. The samples would be analyzed in a non-time-critical manner to ensure maximum analytical quality and documentation.

Other Sampling Approaches

Random or transect sampling approaches are typically not used during an emergency response. The data that these approaches generate are not needed to meet the emergency response objective.