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QUALITY ASSURANCE PROJECT PLANS AND DATA QUALITY OBJECTIVES FOR RCRA GROUND
WATER MONITORING

United States Environmental Protection Agency
Washington, D.C. 20460
Office of Solid Waste and Emergency Response

July 7, 1993

MEMORANDUM

SUBJECT: Quality Assurance Project Plans for RCRA Ground-Water Monitoring and Corrective Action Activities

FROM: Sylvia Lowrance, Director Office of Solid Waste
H. Matthew Bills, Director Office of Modeling, Monitoring Systems and Quality Assurance Office of Research and Development

TO: Waste Management Division Directors, Regions I-XEnvironmental Service Division Directors, Regions I-X

A fundamental requirement of the RCRA program is the collection of environmental data that are of adequate and documented quality to support our decision making. To meet this requirement, data quality objectives (DQOs) are established through the quality assurance project planning process. This memorandum discusses the application of the DQO process to the ground-water monitoring and corrective action program, and provides additional information sources and guidance documents that are available for quality assurance program development. As a follow-up to this memorandum, we are developing examples of Quality Assurance Project Plans (QAPjPs).

These examples will demonstrate that QAPjPs can be of varying complexity depending upon their associated DQOs, and that review and approval of QAPjPs designed to achieve less complex DQOs can be expedited in certain cases.

The overall level of uncertainty that a decision maker is willing to accept in this decision making process is known as a

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DQO. Quality assurance project plans are used as a management control to ensure that DQOs are defined and documented. QAPjPs may vary in complexity based on acceptable levels of uncertainty associated with the goals of a specific project. The minimum elements of a quality assurance program for all data collection activities in RCRA are outlined in Chapter One (Quality Assurance) of "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (EPA SW-846, Third Edition, as amended by Update One, July 1992), which is currently being issued by the Office of Solid Waste.

Chapter One of SW-846 addresses Quality Assurance (QA) programs and Quality Control (QC) procedures that should be implemented by hazardous waste facility owners and operators conducting ground-water monitoring and remediation programs pursuant to RCRA Chapter One of SW-846 defines fundamental elements of a data collection program that include:

1. Design of a project plan to achieve the data quality objectives (DQOs);

2. Implementation of the project plan;

3. Assessment of the data to determine if the DQOs are met.

The overall acceptable level of uncertainty expressed by the DQO is used to specify the quality of the data, usually in terms of precision, bias, representativeness, comparability and completeness. These terms apply to the entire measurement system (e.g., sampling network design, sample collection and handling, laboratory analyses, etc.), not just the analytical operations. QAPjPs, or equivalents, such as ground-water sampling and analysis plans, should detail the Quality Assurance and Quality Control (QA/QC) goals and protocols for data collection activities that will generate data of adequate quality to achieve the DQOs.

We consider the DQO/QAPjP process to be necessary for adequate data collection in the corrective action program. The process used within a Region for review and approval of QAPjPs should be documented in the Regional Quality Management Plan. How the process is structured is a Regional decision that should consider resources (FTE and time), criteria for the reviews, and available expertise.

In addition, during the Corrective Action Program Reviews, the Regions raised questions about the amount of detail required in QAPjPs and the level of review necessary for QAPjP approval. The DQO process is designed to collect data that are scientifically valid, defensible, and of known precision and accuracy relative to the use for which the data are obtained. Different components of the corrective action process may have different objectives and

data collection uses. This data use may vary in complexity, for example, from field screening to delineate areas of gross contamination ("hot spots"), to detection monitoring scenarios where constituent concentrations are measured in ground water at the parts per billion (ppb) level of sensitivity. For specific project purposes, it may be acceptable for the DQOs for hot spot screening to be of lesser precision than those for the ground water analyses. Similarly, QAPjPs that detail the data acquisition and analysis for less precise DQOs can also be of reduced detail, and may be more quickly reviewed and approved in certain cases. As stated earlier, examples of QAPjPs for field screening and RCRA Facility Investigation (RFI) activities that involve reduced levels of detail but still meet the DQOs are under development, and will be sent to you in the future.

To assist you in the development of QAPjPs and DQOs, we are forwarding several recently published guidance documents that address data quality. These documents include:

1. Chapter One of "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" (EPA SW-846, Update to Third Edition, July 1992),

2. Ground-Water Monitoring: Draft Technical Guidance (EPA/530-R-93-001; November 1992),

3. Handbook of RCRA Ground-Water Monitoring Constituents: Chemical and Physical Properties (EPA/530-R-92-022; September 1992),

4. Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities: Addendum to Interim Final Guidance (EPA/530-R-93-003; July 1992),

5. Ground-Water Information Tracking System and Statistical Analysis Software (GRITS/STAT) and User Manual (July 1992).

We hope that the enclosed materials are helpful in assisting with the development of DQOs and QAPjPs. If you or your staff members have any questions or additional suggestions on how to improve data quality, please contact Charles Sellers, OSW's Quality Assurance Officer at (202) 260-3282.

Enclosures (5)

cc: Dave Fagan, OSW, Ken Gigliello, OWPE; Charles Sellers, OSW; Nancy Wentworth, ORD; Regional RCRA Branch Chiefs; Regional Quality Assurance Managers

# Attachment B

# Soil Screening DQOs for Surface Soils and Subsurface Soils

## Soil Screening DQOs for Surface Soils Using the Max Test

| DQO Process Steps | Soil Screening Inputs/Outputs |
|---|---|
| **State the Problem** | |
| Identify scoping team | Site manager and technical experts (e.g., toxicologists, risk assessors, statisticians) |
| Develop conceptual site model (CSM) | CSM development (described in Step 1) |
| Define exposure scenarios | Direct ingestion and inhalation of fugitive particulates in a residential setting; dermal contact and plant uptake for certain contaminants |
| Specify available resources | Sampling and analysis budget, scheduling constraints, and available personnel |
| Write brief summary of contamination problem | Summary of the surface soil contamination problem to be investigated at the site |
| **Identify the Decision** | |
| Identify decision | Do mean soil concentrations for particular contaminants (e.g., contaminants of potential concern) exceed appropriate screening levels? |
| Identify alternative actions | Eliminate area from further study under CERCLA<br>or<br>Plan and conduct further investigation |
| **Identify Inputs to the Decision** | |
| Identify inputs | Ingestion and particulate inhalation SSLs for specified contaminants<br>Measurements of surface soil contaminant concentration |
| Define basis for screening | Soil Screening Guidance |
| Identify analytical methods | Feasible analytical methods (both field and laboratory) consistent with program-level requirements |
| **Define the Study Boundaries** | |
| Define geographic areas of field investigation | The entire NPL site, (which may include areas beyond facility boundaries), except for any areas with clear evidence that no contamination has occurred |
| Define population of interest | Surface soils (usually the top 2 centimeters, but may be deeper where activities could redistribute subsurface soils to the surface) |
| Divide site into strata | Strata may be defined so that contaminant concentrations are likely to be relatively homogeneous within each stratum based on the CSM and field measurements |
| Define scale of decision making | Exposure areas (EAs) no larger than 0.5 acre each (based on residential land use) |
| Define temporal boundaries of study | Temporal constraints on scheduling field visits |
| Identify practical constraints | Potential impediments to sample collection, such as access, health, and safety issues |
| **Develop a Decision Rule** | |
| Specify parameter of interest | "True mean" ($\mu$) individual contaminant concentration in each EA. However, since the determination of the "true mean" would require the collection and analysis of many samples, another sample statistic, the maximum composite concentration, or "Max Test" is used. |
| Specify screening level | Screening levels calculated using available parameters and site data (or generic SSLs if site data are unavailable) |
| Specify "if..., then..." decision rule | Ideally, if the "true mean" EA concentration exceeds the screening level, then investigate the EA further. If the "true mean" is less than the screening level, then no further investigation of the EA is required under CERCLA. |

## Soil Screening DQOs for Surface Soils Using the Max Test (continued)

| DQO Process Steps | Soil Screening Inputs/Outputs |
|---|---|
| **Specify Limits on Decision Errors*** | |
| Define baseline condition (null hypothesis) | The EA needs further investigation |
| Define the gray region** | From 0.5 SSL to 2 SSL |
| Define Type I and Type II decision errors | Type I error: Do not investigate further ("walk away from") an EA whose "true mean" exceeds the screening level of 2 SSL<br>Type II error: Investigate further when an EA's "true mean" falls below the screening level of 0.5 SSL |
| Identify consequences | Type I error: potential public health consequences<br>Type II error: unnecessary expenditure of resources to investigate further |
| Assign acceptable probabilities of Type I and Type II decision errors | Goals:<br>Type I: 0.05 (5%) probability of not investigating further when "true mean" of the EA is 2 SSL<br>Type II: 0.20 (20%) probability of investigating further when "true mean" of the EA is 0.5 SSL |
| Define QA/QC goals | CLP precision and bias requirements<br>10% CLP analyses for field methods |
| **Optimize the Design** | |
| Determine how to best estimate "true mean" | Samples composited across the EA as physical estimates of EA mean ($\bar{x}$).<br>Use maximum composite concentration as a conservative estimate of the true EA mean. |
| Determine expected variability of EA surface soil contaminant concentrations | A conservatively large expected coefficient of variation (CV) from prior data for the site, field measurements, or data from other comparable sites and expert judgment. A minimum default CV of 2.5 should be used when information is insufficient to estimate the CV. |
| Design sampling strategy by evaluating costs and performance of alternatives | Lowest cost sampling design option (i.e., compositing scheme and number of composites) that will achieve acceptable decision error rates |
| Develop planning documents for the field investigation | Sampling and Analysis Plan (SAP)<br>Quality Assurance Project Plan (QAPjP) |

* Since the DQO process controls the degree to which uncertainty in data affects the outcome of decisions that are based on that data, specifying limits on decision errors will allow the decision maker to control the probability of making an incorrect decision when using the DQOs.

** The gray region represents the area where the consequences of decision errors are minor, (and uncertainty in sampling data makes decisions too close to call).

## Soil Screening DQOs for Subsurface Soils

| DQO Process Steps | Soil Screening Inputs/Outputs |
|---|---|
| **State the Problem** | |
| Identify scoping team | Site manager and technical experts (e.g., toxicologists, risk assessors, hydrogeologists, statisticians). |
| Develop conceptual site model (CSM) | CSM development (described in Step 1). |
| Define exposure scenarios | Inhalation of volatiles and migration of contaminants from soil to potable ground water (and plant uptake for certain contaminants). |
| Specify available resources | Sampling and analysis budget, scheduling constraints, and available personnel. |
| Write brief summary of contamination problem | Summary of the subsurface soil contamination problem to be investigated at the site. |
| **Identify the Decision** | |
| Identify decision | Do mean soil concentrations for particular contaminants (e.g., contaminants of potential concern) exceed appropriate SSLs? |
| Identify alternative actions | Eliminate area from further action or study under CERCLA<br>or<br>Plan and conduct further investigation. |
| **Identify Inputs to the Decision** | |
| Identify decision | Volatile inhalation and migration to ground water SSLs for specified contaminants<br>Measurements of subsurface soil contaminant concentration |
| Define basis for screening | Soil Screening Guidance |
| Identify analytical methods | Feasible analytical methods (both field and laboratory) consistent with program-level requirements. |
| **Specify the Study Boundaries** | |
| Define geographic areas of field investigation | The entire NPL site (which may include areas beyond facility boundaries), except for any areas with clear evidence that no contamination has occurred. |
| Define population of interest | Subsurface soils |
| Define scale of decision making | Sources (areas of contiguous soil contamination, defined by the area and depth of contamination or to the water table, whichever is more shallow). |
| Subdivide site into decision units | Individual sources delineated (area and depth) using existing information or field measurements (several nearby sources may be combined into a single source). |
| Define temporal boundaries of study | Temporal constraints on scheduling field visits. |
| Identify (list) practical constraints | Potential impediments to sample collection, such as access, health, and safety issues. |

**Soil Screening DQOs for Subsurface Soils (continued)**

| | |
|---|---|
| **Develop a Decision Rule** | |
| Specify parameter of interest | Mean soil contaminant concentration in a source (i.e., discrete contaminant concentrations averaged within each boring). |
| Specify screening level | SSLs calculated using available parameters and site data (or generic SSLs if site data are unavailable). |
| Specify "if..., then..." decision rule | If the mean soil concentration exceeds the SSL, then investigate the source further. If mean soil concentration in a source is less than the SSL, then no further investigation is required under CERCLA. |
| **Specify Limits on Decision Errors** | |
| Define QA/QC goals | CLP precision and bias requirements<br>10% CLP analyses for field methods |
| **Optimize the Design** | |
| Determine how to estimate mean concentration in a source | For each source, the highest mean soil boring concentration (i.e., depth-weighted average of discrete contaminant concentrations within a boring). |
| Define subsurface sampling strategy by evaluating costs and site-specific conditions | Number of soil borings per source area; number of sampling intervals with depth. |
| Develop planning documents for the field investigation | Sampling and Analysis Plan (SAP)<br>Quality Assurance Project Plan (QAPjP) |