



Project Summary

Direct/Delayed Response Project: Quality Assurance Plan for Soil Sampling, Preparation, and Analysis

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The Direct/Delayed Response Project (DDRP) focuses on regions of the United States that have been identified as potentially sensitive to surface water acidification. The Northeastern Soil Survey includes the New England states of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island, and portions of New York and Pennsylvania. The Southeastern Soil Survey, conducted in the physiographic region known as the Southern Blue Ridge Province, includes the bordering portions of Tennessee, North Carolina, South Carolina, and Georgia.

The specific goals of the DDRP soil surveys are (1) to define soil-physical and soil-chemical characteristics and other watershed characteristics across these regions, (2) to assess the variability of these characteristics, and (3) to determine which of these characteristics are related most strongly to surface-water chemistry.

The purpose of the quality assurance (QA) plan is to specify the policies, organization, objectives, and QA and quality control (QC) activities needed to achieve the data quality goals of DDRP.

This Project Summary was developed by EPA's Environmental Monitoring Systems Laboratory, Las Vegas, NV, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

Quality assurance (QA) objectives are required for three phases of data collection: (1) soil description and sample collection, (2) sample preparation, and (3) laboratory analysis. The approach selected for data collection provides a balance between constraints of time and cost and the quality of data necessary to complete the research objectives of the project. The QA plan is designed to promote estimates of precision and accuracy, representativeness, completeness, and comparability in order to meet the following objectives:

- standardizing sampling, processing, and analytical methods and procedures
- simplifying field operations
- training all personnel
- using QA/QC samples and procedures to verify data
- using field and laboratory audits to ensure that all activities are properly performed and that problems are identified and resolved
- evaluating the reported data and verifying data quality.

Procedures

Sampling Strategy

The objectives of DDRP focus on making regional inferences. For this reason, the watersheds selected for mapping of soils and watershed characteristics must constitute a representative sample of the region. The 773 watersheds included in

Region I of the National Surface Water Survey (NSWS) provided an excellent starting point from which to draw a sub-sample of 150 watersheds for the Northeastern Soil Survey of DDRP for two reasons: (1) the Region I NSWS lakes were selected according to a rigorous probability sampling method, i.e., stratified by five subregions and three alkalinity classes within each subregion, and (2) water chemistry information was available from NSWS for these lakes.

The 150 watersheds studied in the Northeastern Soil Survey also are part of the Phase II Lake Monitoring Program of the NSWS. This provides a data set that contains both water-chemistry and watershed information; therefore, the procedure used to select these watersheds incorporated criteria relevant to both DDRP and NSWS. This procedure identified lakes and watersheds spread across three clusters. The three groups differ primarily in their alkalinities, pH levels, and calcium concentrations. To maintain the ability to regionalize conclusions drawn from the sample of watersheds, the precision of data characterizing each of these watersheds must be comparable, and each cluster must be described at the same level of detail as the others. A similar procedure using stream data is used to selected watersheds in the Southern Blue Ridge Province.

Generally, soil surveys identify and describe soils at the level of series and phases. DDRP is interested in obtaining soil samples that are integrative or representative of the sampling classes in the region. A sampling class may contain six or seven similar soils. The sampling purpose is to describe the characteristics of the sampling class rather than to describe the characteristics of a specific soil phase. All soils within a sampling class are considered similar in soil chemistry; therefore, the specific sampling location within a sampling class can be selected at random. The procedures are intended (1) to describe the range of variability of soil characteristics within each sampling class, and (2) to ensure that each sampling class is characterized at the same level of precision.

Internal Quality Control

After the sampling sites are located, pits large enough for sampling all major horizons are excavated to a depth of 1.5 meters in the Northeast, 2.0 meters in the Southern Blue Ridge Province, or to bedrock. In addition to the routine soil samples, each field crew samples one horizon in duplicate on each day of

sampling activity. The horizon is chosen at the discretion of the field crew but is alternated so that each field crew samples the duplicates across the complete range of possible horizons.

The field duplicates, as well as the routine samples, are processed by a preparation laboratory which also splits one routine sample per batch to provide a preparation duplicate. All processed samples are then analyzed by a contractor analytical laboratory. The results can provide estimates of the variability attributed to sampling, subsampling, and analysis.

Internal QC at the analytical laboratory follows a detailed format that includes clearly defined detection limits and precision goals. Calibration and standardization are continually monitored, and the laboratory procedures make frequent use of duplicate, blank, split, and spike analyses. After each day of analysis, control charts are updated and new control limits are calculated. Internal QC audits are conducted at regular intervals to review the quality of analysis.

Quality Assurance Audits

The project QA auditor conducts an in-depth review of all field operations for compliance with the sampling protocols. Preparation and analytical laboratories undergo multiple on-site evaluations, which are performed to assess facilities, instrumentation, and adherence to protocol. Corrective action is implemented when necessary.

Data Management

The QA Plan provides for a data base management system that assembles and stores data generated for DDRP. The system provides a basic report of the survey results, performs statistical analyses, and ensures data security. The information is stored in three major data sets: (1) raw data base, (2) verified data base, and (3) validated data base. The intra-relationship of data bases is shown in Figure 1.

After the field and laboratory raw data are received, the EMSL-LV QA staff reviews the information, and requests confirmation of data or reanalysis, if necessary, to assure the quality of data in the verified data base. In the verified data base, the QA staff flags data with information describing their quality. Descriptive field parameters can be analyzed for consistency in use. For all data, input errors can be identified and corrected, and suspect data can be flagged. The verified data base is evaluated further,

which results in a validated data base. It is suitable for generating reports, maps, and statistics as well as for use in mathematical models describing watershed responses to acidic deposition.

Supplements

The QA plan is a pivotal document for the DDRP soil surveys. A series of reports will discuss the results of the soil sampling as well as the laboratory preparation and analysis of soil samples.

This QA plan contains a significant appendix section that displays the data entry forms that are used during each step of the data collection and analysis process. A full set of legends and index sheets explaining the parameters of each datum is also provided. A list of contents follows:

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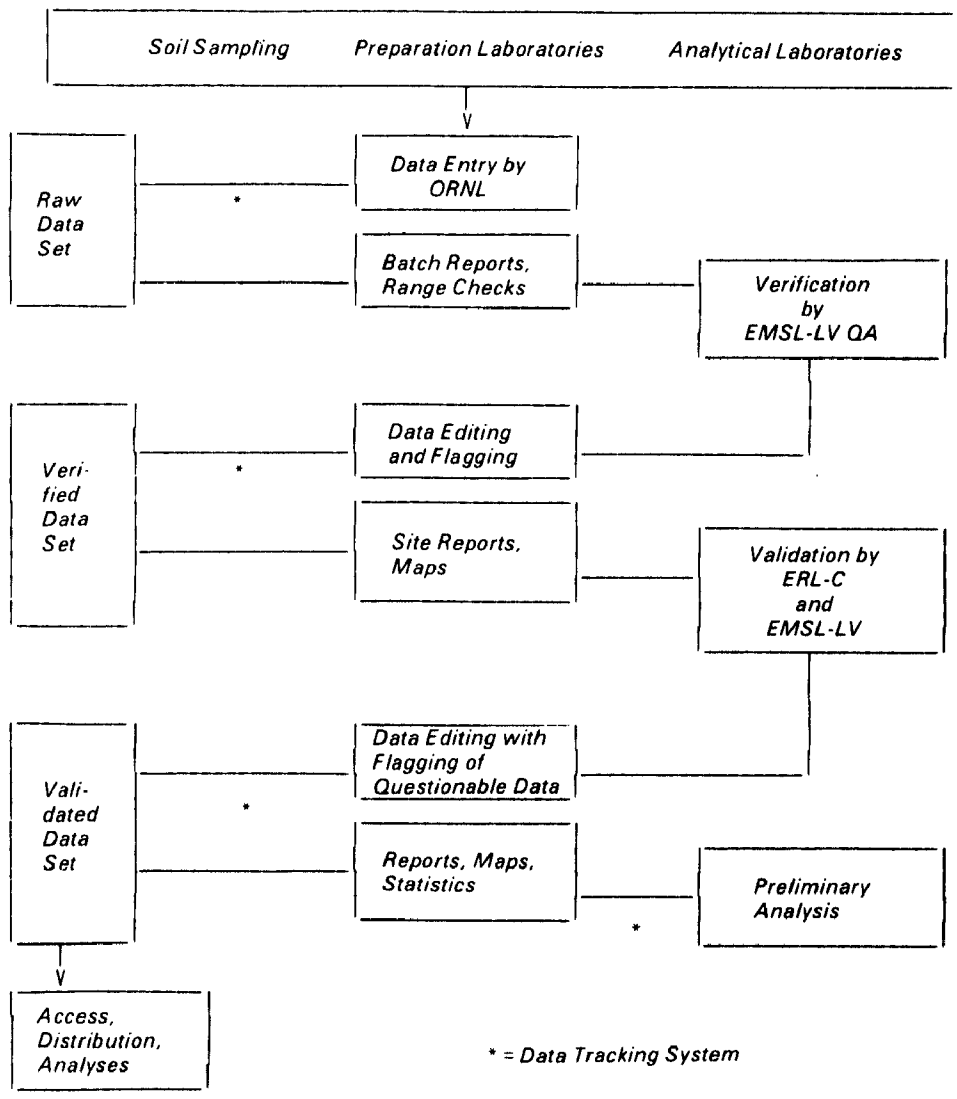


Figure 1. Data management for the DDRP Soil Surveys.

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16.0 REFERENCES

Appendices

- Forms and Legends for Reporting Field Data
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The complete report, entitled "Direct/Delayed Response Project: Quality Assurance Plan for Soil Sampling, Preparation and Analysis," (Order No. PB 88-103 825/AS; Cost: \$36.95, subject to change) will be available only from:

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