



Project Summary

Second Interim Report: Quality Assurance Support for the National Atmospheric Deposition Program and National Trends Network Monitoring Activities 1987-1990

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The full report summarizes the quality assurance activities of the NADP/NTN Quality Assurance Manager from mid-1988 through mid-1989. It presents some accomplishments and makes recommendations for the network.

The full report outlines the progress being made by the NADP/NTN monitoring program in completing documentation of standard operating procedures, responding to field operation and siting deficiencies, and discusses data quality issues relating to the handling of TRACE samples and the quality coding of daily rain amounts. It also contains an evaluation of a second laboratory's participation in the network and reports on a preliminary evaluation of Nipher-shielded Belfort rain gauge performance in the network.

Recommendations emphasize the Quality Assurance Manager's role in coordinating quality assurance activities and the need for more support for the gathering and interpretation of quality assurance data.

This Project Summary was developed by EPA's Atmospheric Research and Exposure Assessment Laboratory, Research Triangle Park,

NC, 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

The National Atmospheric Deposition Program (NADP) monitoring network began operations in July of 1978. The Network used and continues to use cooperating local, state and federal agencies as well as private industry to operate a network of sites according to a single set of protocols. In 1983, NADP assumed responsibility for managing the day-to-day operations of the National Acid Precipitation Assessment Program's National Trends Network (NTN). This action resulted in the combined, cooperative monitoring program now known as the NADP/NTN monitoring network. The NADP/NTN monitoring network serves both the National Atmospheric Deposition Program and the National Acid Precipitation Assessment Program.

Because the NADP/NTN monitoring program both represents and relies on many different public and private agencies to accomplish its goals, it is unique in its structure and mode of operation. For quality assurance, this has meant that responsibility for the

development of quality assurance programs has been, and continues to be, a voluntary effort assumed by each of the agencies that have responsibility for managing specific pieces of the network operations (i.e., Field Sites, Central Analytical Laboratory (CAL), Coordination Office, U.S. Geological Survey, U.S. Environmental Protection Agency). These quality assurance procedures are then reviewed and accepted by the various NADP committees that have responsibility for overseeing each network function. This practice has been strongly encouraged since it would require considerable effort and expertise to centralize this function within a single organization.

A decentralized approach to quality assurance, however, creates its own problems. Many of the network quality assurance procedures are innovative adaptations of recognized quality assurance practices, and as such are reported in the scientific literature, at professional and technical meetings or in various agency reports rather than in a standard network document or operating procedure publication. This lack of centralized quality assurance reporting makes documenting the achievement of network data quality goals and objectives difficult and also makes it difficult to continue some key quality assurance programs once scientific recognition for the techniques has been achieved. The likelihood that those quality assurance activities that cannot be maintained by a single agency, either because of financial or cooperative restraints, will be overlooked is also increased. Finally, decentralized reporting can lead to situations where results from one effort may conflict with another such that no clear picture of "true" data quality can emerge.

Recognizing the need for a more coordinated and thorough quality assurance program, NADP formed a study committee in 1982 to address this issue. The work of this committee resulted in the development of a Quality Assurance Plan to cover all aspects of network operation and the recommendation that a full-time Quality Assurance Manager be appointed to administer this quality assurance program. The desirability of a coordinated quality assurance program was again recognized in the NAPAP Peer Review held in Boulder, Colorado in 1985.

Accomplishments

Coordination of NADP/NTN Quality Assurance Activities

The primary coordination efforts of the Quality Assurance Manager involve attending the frequent NADP Technical and Subcommittee meetings; writing, revising and reviewing NADP/NTN documentation; reviewing agency reports and proposals that use NADP/NTN data or documentation; and disseminating quality assurance information to the various NADP committees and scientists. Each of these activities serves as a vehicle for obtaining and documenting the quality assurance activities of the network and for promoting the evaluation and reporting of quality assurance data.

Two areas of coordination activities received special attention during this past year. These activities were the staffing of a new site liaison in the NADP/NTN Coordination Office and the drafting and review of standard operating procedures identified as missing during the revision of the NADP/NTN Quality Assurance Plan.

Other tasks undertaken by the Quality Assurance Manager as a part of the coordination task included: 1) the participation by the Quality Assurance Manager in *ad hoc* committees to complete a formal procedure for comparing analytical methods and to review the development of a training video for NADP/NTN Site Operators and Supervisors (copies available through the NADP/NTN Coordination Office), 2) the completion of an ASTM standard for choosing locations and sampling strategies and 3) participation in a review of a newly instituted collocated collector program sponsored by the USGS. The Quality Assurance Manager also assisted in training USGS personnel and in locating candidate sites for the program.

Review and Evaluation of NADP/NTN Network Operations

Three areas of network operations were targeted for review during the past contract year by the Quality Assurance Manager. The reviews covered an evaluation and recommendation for integrating data from a second laboratory into the network data system, an evaluation of a Nipher-shield modification to the standard rain gauge used by the network as a way of improving rain volume measurements made by the

network, and an evaluation of unpublished NADP/CANSAP network collocation activities. The review resulted in two reports, the presentation of one poster at the NADP Technical Committee Meeting held in Provincetown, MA in October 1989, and the initiation of two journal articles.

Evaluation of a Second Laboratory in the NADP/NTN Monitoring Program

Site liaison and chemical analyses of samples from 18 NADP/NTN monitoring sites administered by the National Park Service were performed by a second laboratory from March 24 through September 29, 1987. At the request of the NADP Subcommittee on Network Operations, the Quality Assurance Manager was asked to determine the comparability of the second laboratory data to that of the Central Analytical Laboratory. The evaluation concludes that chemistry data are not of the same quality as previous and subsequent NADP/NTN data. Detection/reporting limits are not comparable, precision is not comparable and an unresolved problem with sulfate analyses and ion balance render the data questionable. Field measurements, however, that were gathered and screened by the second laboratory and then re-evaluated by the Illinois State Water Survey can be used "transparently" with other similar data gathered by the network.

Recommendations for the integration of this information into the NADP/NTN data system include the coding of the second laboratory's data to identify its origin from a laboratory other than the Central Analytical Laboratory, the integration of field data into the standard data base, the entering of the laboratory data into a special data base and the sequestering of all laboratory chemical analysis data from all but very specific requests.

Nipher-Shield Evaluation

In 1987, the U.S. Environmental Protection Agency began a comparison of a Nipher-shielded Belfort rain gauge to the standard Belfort rain gauge used in most deposition monitoring programs throughout the United States. The study uses nine NADP/NTN atmospheric deposition monitoring sites chosen to represent a variety of snow collection conditions that might be found within existing national

deposition monitoring programs. Favorable results taken from deposition monitoring sites, primarily in northeastern North America, have prompted the U.S. Environmental Protection Agency and the Electric Power Research Institute to adopt the Nipher gauge as a standard piece of equipment in the Acid MODES and Operational Evaluation Network monitoring programs, and to propose that it be included as a standard gauge in other North American deposition monitoring programs such as the NADP/NTN network.

Unfortunately, the data collected in the study were not being analyzed since the conclusions of the study will have a direct bearing on the quality of previous precipitation measurements made by the NADP/NTN network. The data might even change the standard basis for determining the representativeness of collector volumes (catch efficiency) used in the network. The Quality Assurance Manager, concerned that the precipitation measurement standard used by the network would be changed without benefit of the results of this important study, thus decided to analyze the data.

Generally, all of the sites showed higher values for Nipher-shielded rain gauges for snow, rain and mixed types of precipitation. The differences ranged from negligible amounts up to 37% of the volume for snow at one site. In weekly data sets, statistically significant differences occurred at only five of the eight sites when all precipitation types (rain, snow, mixed) are analyzed together and in only two of the sites when snow data were analyzed separately. Rain was significantly different at three of the sites. Daily data were analyzed at only two sites but in general supported the conclusions drawn from the weekly data. One site showed significant differences for rain and snow but the other site did not. The study is scheduled to be completed after another year of data has been gathered.

U.S.-Canadian Intercomparisons

Beginning in 1981, the National Oceanic and Atmospheric Administration (NOAA) sponsored a three-year, direct comparison of atmospheric deposition monitoring protocols used by the National Atmospheric Deposition Program (NADP) and the Canadian Network for Sampling Acid Precipitation Program (CANSAP). The purpose of the comparison was to determine if data from these two networks could be used as a single data

set to characterize atmospheric deposition in North America. Preliminary examination of the data during the study revealed serious contamination problems with much of the CANSAP data. Because no final report was ever made and because the results of the comparison still have value for long-term trend analysis and network introspection, the Quality Assurance Manager was asked to complete the analysis of the comparability study.

Preliminary conclusions derived from an analysis of the complete data set are: 1) that the previously noted contamination in CANSAP data may only be a serious problem at unsheltered or locally source rich sites (e.g., poorly sited in regards to local or line sources of emissions) and 2) that the differences at the more rural, emission source deficient locations exhibit quite similar results. It was noted, however, that CANSAP values in general are consistently higher than values from the NADP network. The differences appear to be significant though at only some of the locations.

Review and Revision of the NADP/NTN Quality Assurance Plan

During October 1986, the NADP Quality Assurance Steering Committee began the task of reviewing and revising the NADP Quality Assurance Plan. The Quality Assurance Manager had been given the responsibility for the revision of the Data Management portion of the Plan. This portion was completed in August 1988. More recently, the Quality Assurance Manager was given responsibility for developing another portion of the plan detailing the integrated assessment of quality assurance results. No effort was put into this task pending action by others to complete drafts of other portions of the plan. A working document will be available after the fall of 1990.

Future Needs of the NADP/NTN Monitoring Network Data Management Improvement

Data Management activities in the Coordination Office have increased steadily both in size and complexity ever since the monitoring program began. As part of ongoing efforts to reduce the lag in data reporting and the complexity of the data management activity, computer programs, along with software and hardware, have required constant tuning. This has been especially true in the more

recent years as many of the NADP/NTN program co-operators began developing and improving their methods of gathering, processing and distributing data. When, for instance, the CAL develops improved data screening algorithms and improves upon the amount and type of information passed along to the Coordination Office, the Coordination Office must update its data handling programs and data base design to accommodate the new or improved information. These tasks are also further complicated by the NADP policy of implementing improvements in data screening and coding retroactively throughout its data set. The importance of applying these improvements retroactively is one of the many unique features of the NADP program which helps maintain the overall integrity of the NADP data set.

Identification and Handling of TRACE Samples

The NADP/NTN monitoring program has agreed to code weekly precipitation totals as TRACE when the weekly precipitation total is the result of wet deposition only, is not the product of dew, frost, fog or other types of condensate, and represents an amount of precipitation that is below the detection limit of the sampling system. To implement this philosophical definition, the network is forced to use a number of operational definitions to identify TRACE samples in its field, laboratory and data management operations. The methods are not always directly comparable and become somewhat subjective and confusing at best when the network attempts to differentiate TRACE samples from non-precipitation events and when the network attempts to estimate "true" sample volumes and rainfall amounts. At the time of the original analysis of the problem, over 21 different cases were identified that would have to be considered to correctly process TRACE samples.

At the April 1989 joint Network Operations and Data Management and Analysis subcommittee meeting, the Quality Assurance Manager made three recommendations for improving the handling of TRACE samples in the NADP/NTN monitoring program. The recommendations were intended to clarify and make consistent the handling of TRACE samples in the network. The proposal affected approximately 3000 samples out of the entire NADP/NTN data set collected to date.

Data Quality Coding of Daily Rain Values

The NADP/NTN monitoring network has as a matter of policy attempted to code rather than sequester data in instances where network protocols have not been followed exactly. Coding, rather than sequestering, provides users of network data with both a maximum amount of information and a highly qualified data set. For daily rain values, however, this practice was ignored. This was in part due to the emphasis the network placed on weekly totals rather than on daily amounts and the fact that the network would accept volume amounts from the AeroChem Metrics Wet/Dry collector in lieu of "good" rain gauge measurements as an acceptable rainfall amount for a weekly total. Common practice in the Network was to code as missing daily rain values from network records when problems with the rain gauge were detected. In the mid-80's, the practice of coding the samples as missing was greatly curtailed; however, this has led to the maintenance of non-qualified daily rain records in the network data base.

To begin the process of quality coding daily rain values in NADP/NTN data records, the Quality Assurance Manager proposed a minimal set of guidelines for the network to follow. The guidelines were presented to the Data Management and Analysis Subcommittee in April 1989 and are currently being reviewed by that committee.

Recommendations

- Continue to evaluate, document and support network data quality and network procedures through the publication of integrated quality assurance reports. These reports should be inclusive of all years of operation through current time.
- Increased support should be made available to expand and accelerate the gathering and data banking of both external and internal quality assurance data that relate directly to the NADP/NTN data set and to allow the timely review and completion of network documentation activities.
- Staffing levels should be increased to allow for a full-time Quality Assurance Manager and other support staff.

Increased staffing would improve the frequency of integrated quality assurance reports and allow for continuity in the tracking of network quality assurance activities. The current three-quarter time staffing level provides only enough resources to manage the NADP/NTN quality assurance program on a topical basis.

- A quality assurance program specifically designed to estimate network precision and bias should be developed and implemented as soon as possible. Emphasis should be placed on comparisons within NADP/NTN and between peer network data (e.g., daily vs weekly sampling, laboratory A vs laboratory B, etc.).
- The comparability of NADP/NTN data to that of other major networks operating in North America should be expanded.

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The complete report, entitled "Second Interim Report: Quality Assurance Support for the National Atmospheric Deposition Program and National Trends Network Monitoring Activities: 1989-1990," (Order No. PB 90-187 162/AS; Cost: \$17.00, subject to change) will be available only from:

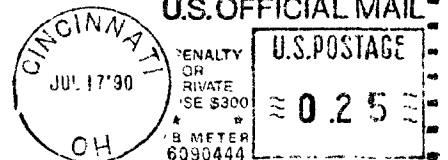
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