



Project Summary

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

David S. Bigelow

The full report summarizes the quality assurance activities of the NADP/NTN Quality Assurance Manager from mid-1987 through mid-1988. The report presents some accomplishments and makes recommendations for the network.

The report discusses data quality issues relating to site representativeness, field versus laboratory measurements of pH, site operator turnover rates and various monitoring network reviews. The report also contains the previously released "NADP/NTN Instruction Manual for Site Operation" and the "Quality Assurance Report of NADP/NTN Deposition Monitoring for Laboratory Operations" as well as an NADP/NTN quality assurance bibliography.

Recommendations emphasize the quality assurance manager's role in coordinating quality assurance activities, the need for more integrated quality assurance evaluations, the need to standardize quality assurance data reporting formats and data transfer protocols in the network and the need for establishing a method for estimating overall precision and accuracy in spatial and temporal data summary statistics.

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 uses 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 Precitation 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 Precitation 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 who have responsibility for managing specific network operations (i.e., Field Sites, Central Analytical Laboratory, 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 who 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 Plan Implementation

The primary coordination efforts have involved attending the frequent NADP Technical and Subcommittee meetings; writing, revising and reviewing NADP/NTN documentation; reviewing agency reports and proposals that utilize 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.

An additional part of the coordination effort has involved overseeing the Site Visitation program and providing administrative assistance to the program's auditors. The Quality Assurance Manager is responsible for distributing the results of the site audits and for initiating corrective action to correct any discovered deficiencies. As with all of the external quality assurance programs, results are reported separately by each sponsoring agency.

Review and Revision of the NADP/NTN Quality Assurance Plan

During October of 1986, the NADP Quality Assurance Steering Committee began the task of reviewing and revising the NADP Quality Assurance Plan. As part of this process, external reviewers were asked to make suggestions to improve the plan. By 1987 reviewer comments had been received and assignments made for revising all portions of the Plan. This process continues with the Quality Assurance Manager taking a lead role in the development of the Data Management portion of the Plan. A first revised working draft was completed in August of 1988.

As part of this revision and in response to reviewer comments, a Remedial Action Plan (RAP) was developed for correcting instances of non-compliance detected during network operations. The RAP was completed and approved in November 1987. It outlines for the first time the responsibilities of the subcommittees and

program managers for resolving network deficiencies.

Review and Evaluation of NADP/NTN Network Operations

Four areas of Network operations were targeted for review during the past year by the Quality Assurance Manager. The reviews covered regional representativeness of NADP/NTN monitoring data; differences between NADP/NTN laboratory and field data, turnover rates of NADP/NTN site operators and the review and revision of the site operator's instruction manual.

Future Needs of the NADP/NTN Monitoring Network

Precision and Bias Estimates

A proposal for establishing NADP/NTN network precision and accuracy was developed and submitted for funding in September 1987. The proposal outlined a duplicate sampling program to determine the precision and accuracy of NADP/NTN weekly data, seasonal summaries and regional estimates of deposition based upon monitoring network data. Estimates of precisions were to come from a proposed within network collocated sampling program. Bias and accuracy were to be estimated using data from existing between network collocated sampling programs and the proposed collocated sampling program. The proposal was accepted but not funded. Unfortunately this leaves the network without the means to establish the precision and accuracy estimates called for in the NADP Quality Assurance Plan. Data from which estimates of precision can be made are available at only two locations and for limited time periods. One location in North Carolina produces data only for one year. The second location in Wisconsin has only 18 months of data. Neither location can be considered as representative of the entire network and neither can be used for estimates of bias.

In addition to duplicate sampling, the proposal described a second program for determining precision and bias of rain gauge measurements. In this second program, precision would have been determined by the rain gauge's ability to weigh a known amount of sand at two reference points within the instrument's working range. The reproducibility of the difference between the known sand bottle

weight and that measured by the instrument at the reference points would have been a measure of the precision or random error. The magnitude of the difference would have been a measure of bias or systematic error. The lack of funding of this portion of the proposal leaves the network with no means to establish rain gauge performance in the network. Similar rain gauge performance tests were discontinued in 1983 due to lack of funding.

Overall seasonal and regional estimates of precision and accuracy of NADP/NTN rain and chemistry data will have to be inferred from other monitoring network data (e.g., Electric Power Research Institute's daily Operational Evaluation Network, National Weather Service's climate center, etc.) or be computed piece-meal from the volume of agency information specific to each network related study. The quality and completeness of this latter approach has never been assessed. Even if this latter approach were successful, it is anticipated that much of the error estimates used in computing overall error estimates will have to come from 'related studies.'

Addition of a Second Laboratory to the NADP/NTN Monitoring Program

One of the more time consuming tasks of the past contract period has been the addition of a second laboratory to the NADP/NTN monitoring program. Because of contracting requirements, site liaison and the chemical analysis 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. During this time period, the Quality Assurance Manager was required to provide additional SOP and QA documentation to the second laboratory as well as coordinate the start up of internal and external quality assur-

ance programs that would eventually allow the evaluation of the second laboratory's data in relation to the data from the original laboratory. At the request of the National Park Service, two audits of the new laboratory were conducted, one prior to the start of operations and one approximately four months into the contract. Completed data and some documentation became available in the early summer of 1988.

A number of inconsistencies with previous NADP practices have prevented a full evaluation of the data. Work is currently scheduled, subject to funding, for the fall of 1988 to reevaluate field data in a manner consistent with prior NADP/NTN practice. Chemistry data will require more documentation before an evaluation of comparability can be initiated. Audit reports are available through the National Park Service's Acid Rain Coordinator in Washington, DC.

Briefly, no serious deficiencies were found in the laboratory's operations. Many of the 'problems' noted in the audit were associated with data management and site liaison activities. Most were correctable. Some of the noted deficiencies might have been more easily correctable if better documentation of NADP/NTN standard operating procedures in these areas was available. The quality of chemistry results simply lacked documentation. This does not necessarily indicate a lack of quality, only that quality is undefined.

The NADP/NTN quality assurance activities and their sponsoring agencies are listed in Table 1.

Recommendations

- The Quality Assurance Manager's participation in auditing, document reviews and scientific meetings should continue to be supported. These are the windows through which the QA Manager can view the network operations.

- Standard formats and transfer protocols for external quality assurance data needs to be established to eliminate redundant data entry and to enable the timely transfer of quality assurance data from the agencies to the NADP/NTN Coordination Office.
- Continue to evaluate and document 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.
- Studies like the field versus laboratory pH evaluation should be increased to further document the limitations and strengths of the NADP/NTN data set.
- Establish the Quality Assurance Manager and quality assurance technician roles as full time positions. This should help increase 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.
- The network should continue to organize and gather information which profiles each of its monitoring stations. This information should be maintained and organized in such a way as to facilitate the selection of sites for regional and topical data analysis.
- 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.
- The comparability of NADP/NTN data to that of other major networks operating in North America should be established.

Table 1. NADP/NTN Monitoring Network Quality Assurance Activities and Their Sponsoring Agencies

Task No.	Task Name	Operating Agency*	Program Name
<i>Field Site Operations:</i>			
1.	Quality Control of Field Operations	CAL	CAL Site Interactions
2.	Quality Assurance of Field Operations	CSU	Across Site Network Analysis
3.	Systems and Performance Audit of Field Operations	EPA (RTI)	NADP/NTN Site Visitation Program
4.	Quality Assurance of Site Chemical Analysis	USGS	Intersite Comparisons
<i>Laboratory Operations:</i>			
5.	Laboratory Quality Control	CAL	CAL QA Program
6.	Laboratory Quality Assurance	CAL	Interlaboratory Comparisons
7.	Laboratory Systems Audit	NADP Subcommittee 2	
<i>Data Management:</i>			
8.	Quality Control of Site/Chemical Analysis Data through Data Management	CAL	Data Screening and Coding
8.	Quality Control of Site/Chemical Analysis Data through Data Management	CSU	Data Screening, Coding and Summary Reporting
9.	Quality Control of Data Management	PNL	Acid Deposition System (ADS) for Statistical Reporting
10.	Quality Assurance of Network Data Management	QA Steering Committee	Systems and Performance Audit of the Data Management Program
<i>Network Operations:</i>			
11.	Performance Audit of Field and Laboratory Chemical Analysis	USGS	Blind Audit Program
12.	Laboratory Quality Assurance	USGS	Interlaboratory Comparisons
13.	Performance Audit of the Network	CSU	Network Intercomparison's with CANSAP/CAPMoN
14.	Special Studies which Assess Various Components of Network Performance	ALL	Published Scientific Research Results
15.	Systems Review of the Deposition Monitoring Network	TASK GROUP 4	NAPAP Annual Review
15.	Systems Review of the Deposition Monitoring Network	QA Steering Committee	IR-7 Annual Review

*CAL—Central Analytical Laboratory, Illinois State Water Survey
 CSU—Natural Resource Ecology Laboratory, Colorado State University
 EPA—Environmental Monitoring Systems Laboratory, Environmental Protection Agency
 PNL—Battelle's Pacific Northwest Laboratory
 RTI—Research Triangle Institute, Research Triangle Park, NC
 USGS—National Water Quality Laboratory, U.S. Geological Survey
 Task Group 4—National Acid Precipitation Assessment Program (NAPAP)
 QA Steering Committee—National Atmospheric Deposition Program

*David S. Bigelow is with the Colorado State University, Fort Collins, CO.
Berne I. Bennett is the EPA Project Officer (see below).
The complete report, entitled "Interim Report: Quality Assurance Support for the
National Atmospheric Deposition Program and National Trends Network
Monitoring Activities: 1987-1990" (Order No. PB 89-155 220/AS; Cost: \$36.95,
subject to change) will be available only from:
National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650
The EPA Project Officer can be contacted at:
Atmospheric Research and Exposure Assessment Laboratory
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711*

United States
Environmental Protection
Agency

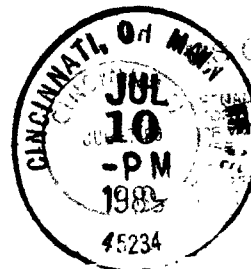
Center for Environmental Research
Information
Cincinnati OH 45268

Official Business
Penalty for Private Use \$300

EPA/600/S3-89/012

0000329 PS

U S ENVIR PROTECTION AGENCY
REGION 5 LIBRARY
230 S DEARBORN STREET
CHICAGO IL 60604



OFFICIAL MAIL
U.S. POSTAGE
35