NADP Quality Management Plan

National Atmospheric Deposition Program

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Abbreviations

AIRMoN	Atmospheric Integrated Research Monitoring Network
AMNet	Atmospheric Mercury Network
AMoN	Ammonia Monitoring Network
ANSI	American National Standards Institute
ASQC	American Society for Quality Control
BAC	Budget Advisory Committee
CAL	Central Analytical Laboratory
CSREES	Cooperative State Research, Education, and Extension Service
DMAS	Data Management and Analysis Subcommittee
DQI	Data Quality Indicator
DQO	Data Quality Objective
EC	Executive Committee
EPA	Environmental Protection Agency
EROS	Ecological Response and Outreach Subcommittee
FOF	Field Observer Form
FORF	Field Observer Report Form
HAL	Mercury (Hg) Analytical Laboratory
ISWS	Illinois State Water Survey
MDN	Mercury Deposition Network
MOF	Mercury Observer Form
NADP	National Atmospheric Deposition Program
NAPAP	National Acid Precipitation Assessment Program
NED	Network Equipment Depot
NOS	Network Operations Subcommittee
NRSP	National Research Support Project
NTN	National Trends Network
PDA	Personal Digital Assistant
PO	Program Office
QA	Quality Assurance
QAAG	Quality Assurance Advisory Group
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QC	Quality Control
QMP	Quality Management Plan
QMS	Quality Management System
QR	Quality Rating
SAES	State Agricultural Experiment Stations
SOP	Standard Operating Procedure
SOW	Statement of Work
USDA	United States Department of Agriculture
U.S. EPA	United States Environmental Protection Agency
USGS	United States Geological Survey

1.0 Introduction

The National Atmospheric Deposition Program (NADP) was established in 1977 under State Agricultural Experiment Station (SAES) leadership. The Program was established to address the problem of atmospheric deposition and its effects on agricultural crops, forests, rangelands, surface waters, and other natural and cultural resources. By the summer of 1978, the NADP began collecting and analyzing weekly precipitation samples from a network of monitoring stations across the United States. Samples were analyzed for acids, nutrients, and base cations. This network merged with the National Acid Precipitation Assessment Program's (NAPAP) National Trends Network (NTN) in the 1980s, with the designation NADP/NTN. Later, the network designation was shortened to NTN.

Data from the NTN are used to characterize geographic patterns and temporal trends in chemical deposition for sulphate (SO_4^{2-}), nitrate (NO_3^-), ammonium (NH_4^+), calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^+), potassium (K^+), free acidity (H^+ as pH), and specific conductance. The data also are used to identify source-receptor relationships.

A second network, the Atmospheric Integrated Research Monitoring Network (AIRMoN) joined the NADP in 1992. AIRMoN measures the same chemical species as the NTN, but sampling is done daily rather than weekly, and samples remain refrigerated after collection and until analysis. The higher resolution data help researchers evaluate the effectiveness of emissions controls on precipitation chemistry and are important for atmospheric chemistry model development and validation.

A third network, the Mercury Deposition Network (MDN), joined the NADP in 1996. MDN samples are collected weekly and analyzed for total mercury. Methyl mercury and trace metals are measured at some MDN sites. Data from this network are used to evaluate the role of precipitation as a transport mechanism for mercury entering terrestrial and aquatic ecosystems.

A primary goal of the NADP is to ensure uniformity of siting criteria, sampling protocols, analytical methods, and data validation procedures. This uniformity, in conjunction with long-term site operation, is essential to the collection of quality data that can be used to assess changes to the nation's ecoregions. Such changes may occur over seasons, years, or decades.

Activities and requirements described in this document form the basis for the NADP Quality Management System (QMS). This document supercedes the NADP Quality Management Plan (QMP) of December 2003.

2.0 NADP Quality Management System (QMS)

The NADP Quality Management System (QMS) ensures that data quality needs of NADP data users are met. This is achieved by developing, documenting, and maintaining a structured system for managing the Quality Assurance (QA) and Quality Control (QC) activities within the NADP and its networks. Documents supporting the Quality Management System include this document (the Quality Management Plan, QMP), Quality Assurance Plans (QAPs), Standard

Operating Procedures (SOPs), training materials, assessment program materials, and the NADP Governance Handbook. Table 1 identifies activities within the NADP QMS, and the associated documentation. Documented referenced in Table 1 are available from the NADP website (http://nadp.isws.illinois.edu).

Table 1. Documents Supporting the NADP Quality Management System.

Activity	*Governance Handbook*	*QMP*	*Network QAP*	*CAL QAP*	*HAL QAP*	*External QAPs and SOPs*
Project organization/ management	X	X				
QA policy/general requirements		X				
Establishment/ maintenance of field sites			X			
Field sample collection procedures			X			
Laboratory analysis/QA				X	X	
Data validation/ verification				X	X	
Public data release protocols		X				
External QA programs						X

2.1 NADP Governance Handbook

The NADP Governance Handbook defines and describes the mission of the NADP, its organization both in terms of funding and operation, and its management. The Handbook provides the basis for NADP operations and its QMS.

The Handbook is available from the NADP website (http://nadp.isws.illinois.edu). The QA Manager will review this document on an annual basis. Updates to this document are made with input from the EC and the Program Coordinator.

2.2 Quality Management Plan (QMP)

This QMP is intended to meet the requirements of "Part A: Management Systems" of the consensus standard ANSI/ASQC E4-2004 (ANSI/ASQC, 2004), and is consistent with the U.S. EPA's Quality System Requirements (U.S. EPA, 2000b), and the ISWS QMP (ISWS, 2008). The Program Coordinator and QA Manager are responsible for implementation of the QMP and its elements.

The NADP QA Manager reviews the QMP on an annual basis. Updates to this document are made with input from the Quality Assurance Advisory Group (QAAG) and the NADP subcommittees. The NADP subcommittees are defined and described in the NADP Governance Handbook.

2.3 Quality Assurance Plans (QAPs)

Quality Assurance Plans (QAPs) may be referred to as Quality Assurance Project Plans (QAPPs). Though the two terms are interchangeable, this document will use the term QAP. QAPs are documents that describe the specific QA and QC activities required for a specific project. The goal of a QAP is to ensure that project deliverables are of sufficient quality to meet the project Data Quality Objectives (DQOs).

Data Quality Objectives (DQOs) are qualitative and quantitative statements that specify the required technical characteristics of NADP data. These requirements are specified by the NADP Executive Committee (EC), with input from the NADP subcommittees. DQOs include the confidence level, tolerance goals, and the level of data validation and verification for the Data Quality Indicators (DQIs). DQIs include: accuracy, comparability, completeness, precision, and representativeness. Each network and laboratory within the NADP will have its own DQOs. The QAP and Statement of Work (SOW) for each network and laboratory will reflect the required DQOs, and will identify the party responsible for implementing the necessary QA/QC protocols to meet the DQOs.

The QAPs for the NADP networks and the associated analytical laboratories describe the activities that ensure their work will meet specified criteria. These documents are designed to meet the requirements of "Part B: Collection and Evaluation of Environmental Data" of the consensus standard ANSI/ASQC E4-2004 (ANSI/ASQC, 2004), and the U.S. EPA's Requirements for Quality Assurance Project Plans (U.S. EPA, 2001b). The Program Coordinator and QA Manager are responsible for ensuring that NADP QAPs are implemented and maintained.

QAPs should be reviewed on an annual basis by the QA Manager. In the case of the laboratory QAPs, the QA staff for the laboratory should review the document on an annual basis. Laboratory QA staff should update the QAP at least once every three years. Revisions to the Laboratory QAP are approved by the Program Coordinator and QA Manager.

2.4 Statement of Work (SOW)

The SOW identifies the DQOs for a network, and describes how the DQOs will be met. Table 2 lists required content of an SOW for an NADP network. The SOW is one of the documents that will be used by a review team when evaluating the NADP QMS, and when evaluating the performance of an NADP affiliated Laboratory.

Table 2. Required content for an NADP SOW.

Item	Description
scope of work	detailed description of the work to be done
period of performance	start and end dates for the project, number of billable hours
location of work	where work is to be performed
schedule of deliverables	date(s) by which documentation (QAP, SOPs), data, reports should be submitted
acceptance criteria	criteria used to determine whether the work is acceptable. Includes: bias, precision, completeness, and representativeness of the data
applicable standards	specific standards that must be met
special requirements	travel requirements, certifications, education degrees, special skills or knowledge, clearance

2.5 Standard Operating Procedures (SOPs)

SOPs are documents that detail the procedures for chemical analyses, data management, instrument service, sample collection, etc. The goal of an SOP is to ensure that all participants perform the procedure consistently over time.

SOPs are developed for each activity that is conducted on a routine basis. Areas appropriate for an SOP include the following: sample collection, equipment operation, laboratory operations, and data management (i.e., verification, screening, and reporting). SOPs should be reviewed by users on an annual basis, for purposes of continued training, and should be available to all users. For the purposes of the NADP Quality Management System, training videos and network operation manuals are considered SOPs.

SOPs may be developed internally, or may be adopted from approved procedures developed by state and federal agencies or by organizations that develop standards. The source for a SOP must be referenced clearly if it originates from an external source.

SOPs should be reviewed by designated personnel (e.g., Site Liaison, Analyst, QA staff, QA Manager) on an annual basis, updating the document when appropriate.

2.6 Other Documents and Records

Documents and records not mentioned above may be required in order to address specific network issues. The EC or Program Coordinator specifies the required format and standards, and the frequency at which these documents should be reviewed and revised.

2.7 Assessment Programs

Assessment Programs are used to evaluate NADP network and laboratory operations. The QA Manager, Network Operations Subcommittee (NOS), and Data Management and Analysis Subcommittee (DMAS) ensure that these programs occur on a regular basis. Assessment Programs verify that QAPs and SOPs are followed, that DQOs are met, and that corrective measures are taken when necessary. As part of an assessment, documentation, operating procedures, data products, and other activities are evaluated for bias, precision, completeness, and representativeness. Individuals who conduct the assessment are independent of the audited process, but have equivalent professional experience in the process or discipline.

Data quality assessments determine whether data meet DQOs and are of sufficient quality to support the intended scientific research. The QAP is used to assess the collected data. The QA Manager and DMAS ensure that periodic data quality assessments occur.

Existing NADP Assessment Programs include: Site Systems and Performance Review program, Laboratory Reviews, Inter-laboratory comparisons, and Field QA programs. Table 3 lists the assessment programs, their frequency, the required documentation, and the required response.

The Precipitation Chemistry Quality Assurance Project is operated by the USGS. Information regarding the Project is available at http://bqs.usgs.gov/precip/frontpage_programs2.htm. The Project operates as an independent evaluation of data quality for the NADP. It operates several programs to evaluate the performance of the NADP networks. These programs include the Field-Audit, Co-located Sampler, and Interlaboratory-Comparison programs for the NTN, and the System-Blank, Blind-Audit, and Interlaboratory-Comparison programs for the MDN. The program specifications are documented in USGS Open-File Reports 2005-1024 and 2007-1170 (U.S. Geological Survey, 2005 and 2007).

The USGS Field-Audit and System-Blank programs are designed to measure the effects of field exposure, handling, and processing on sample chemistry. Sites that participate in the USGS Co-located equipment program operate pairs of equipment. The equipment pairs may be the same make and model, different models from the same manufacturer, or different models from different manufacturers. This program is used to assess the overall error in NADP measurements, and for testing equipment that is proposed for use in an NADP network.

The USGS Interlaboratory-Comparison programs assess the analytical precision of participating laboratories, including the two analytical laboratories used by the NADP. Results from the Interlaboratory-Comparison Programs are used to quantify the bias and precision of NADP chemical analysis data, and to provide a basis for comparison between NADP laboratories and other laboratories performing similar analyses for other monitoring networks. The MDN Blind-Audit program provides an additional evaluation of the accuracy of MDN total mercury analyses. Results from each of these programs are available through the Precipitation Chemistry Quality Assurance Project at the USGS.

Assessment programs not mentioned above may be implemented to provide additional verification of compliance with NADP DQOs.

Table 3. NADP Assessment Programs.

Type	Frequency	Personnel	Documentation	Response and Corrective Action	Conflict Resolution
Program	4th year of 5 year funding, or as necessary	3 peer scientists, one may be a CSREES representative	Written report on multi-state activities presented to NADP EC Chair and Program Coordinator prior to spring meeting of regional SAES Directors. Report documents: 1) quality, technical feasibility, and validity of activity 2) relevance to stated goal 3) likelihood of achieving goal 4) responsiveness to stakeholder needs 5) extent of multidisciplinary, multi-state collaboration	NADP EC Chair selects individuals to formulate a response and timetable for corrective actions.	NADP EC Chair, Administrative advisors, CSREES National Program Leader
Quality System	External review every 3 years, on-site or remotely	3 member team appointed by NADP EC Chair	Written report to QAAG, EC, subcommittee Chairs documenting: 1) compliance with QMP 2) implementation of QMP procedures 3) compliance of data with DQOs 4) documentation and implementation of the Quality System	QA Manager formulates response and timetable for corrective actions.	NADP EC Chair
Laboratory	On-site, every 3 years, follow-up within one year	Up to 6 reviewers including: Technical systems reviewer(s) Data quality and management reviewer(s) Team leader PO QA Manager as an observer	Written report presented to QA Manager, NADP EC Chair, Program Coordinator, and Lab Director 1) documentation and implementation of QAP and SOPs 2) compliance with QAP and SOPs 3) appropriateness and effectiveness of activities with regard to the SOW 4) data of sufficient quality to meet DQOs and SOW requirements	Lab Director formulates response and timetable for corrective actions. NOS and DMAS approve the response. Final review report and approved response sent to Review Team, Program Coordinator, and EC.	QA Manager, NADP EC Chair
Site Systems and Performance Surveys	Every 3 years, on-site	Survey personnel under contract with U.S. EPA	Written reports to QA Manager and U.S. EPA Program Officer documenting: 1) compliance with siting criteria 2) compliance with field operations manual and SOPs 3) verification of equipment operation	Site Operator and Site Supervisor in coordination with Site Liaison and QA Manager. Document corrective actions that can be made, and when those actions are made.	QA Manager, U.S. EPA Program Officer

Table 3. NADP Assessment Programs - continued.

Type	Frequency	Personnel	Documentation	Response and Corrective Action	Conflict Resolution
Data Quality	As needed (determined by QAAG, EC, Program Coordinator, or DMAS)	QA Manager in coordination with individuals appointed by QAAG or DMAS	Report format determined by Review requester, documenting: 1) data validation and verification processes in QAPs and SOPs. 2) compliance with QAPs and SOPs. 3) data quality sufficient to meet DQOs and SOW requirements	QA Manager proposes corrective actions. DMAS Chair approves corrective actions.	NADP EC Chair
Ad-Hoc Assessment	As needed (determined by QAAG, EC, Program Coordinator, NOS, DMAS, or EROS)	QA Manager in coordination with individuals appointed by QAAG, NOS, DMAS, and EROS	Report format determined by Review requester	QA Manager proposes corrective actions.	NADP EC Chair

2.8 Modeling Guidelines

Modeling is not part of the current NADP mission statement. Should this change, protocols will be established to ensure that the DQOs continue to be met.

3.0 Personnel Qualifications and Training

Appropriate training of NADP Program Office staff, field site operators, and staff at associated laboratories ensures that individuals have sufficient knowledge to perform their duties and meet QA requirements. The QAPs and SOPs specify minimum training requirements for these individuals.

The Program Coordinator is responsible for ensuring adequate resources to support the professional development and training of Program Office personnel. Program Office personnel maintain proficiency in the NADP Quality Management System through annual review of the QMP.

The Program Coordinator ensures that site operator training is available and adequate. Training resources may include: on-site training, NADP-sponsored training courses, training videos, and printed materials (e.g., network operations manuals, and troubleshooting guides). Training materials and programs must be approved by the NOS. A record of attendees at annual NADP-sponsored training programs is maintained at the Program Office.

The Site Liaisons provide the site operators and supervisors with training materials and SOPs. Site Supervisors ensure that site operators have adequate access to training programs. Site operators should maintain proficiency by reviewing the Site Operations Manual and relevant SOPs on an annual basis.

Laboratory Directors are responsible for ensuring adequate resources for the professional development and training of laboratory personnel.

4.0 NADP Management and Organization

As previously discussed, the NADP Governance Handbook describes the mission, structure, management, and operation of the NADP. That document is available from the NADP website.

In addition to the requirements in that document, all NADP personnel must:

- Be familiar with and comply with all QA and QC practices within their job duties as outlined in QAPs, and task-specific SOPs.
- Report deviations from the approved QAPs and SOPs to supervisory staff, and take the necessary corrective actions.

Position specific responsibilities are listed below.

4.1 Program Coordinator

The Program Coordinator is the principal investigator of the NADP. The Program Coordinator is responsible for ensuring that the scientific, technical, and administrative work is in accordance with the terms and conditions of the grants, contracts, and cooperative agreements that fund the NADP. Responsibilities of the Program Coordinator under this QMP include:

- Developing and implementing the NADP QMP in cooperation with the QA Manager.
- Developing and implementing policies, programs, and activities approved by the EC.
- Ensuring that the Program Office is staffed with professionals who can carry out the administrative activities and responsibilities specified in the Program Office SOW
- Ensuring adequate resources are available for NADP QA programs and activities.
- Overseeing network and laboratory operations as detailed in the corresponding QAPs and SOWs.
- Participating in NADP management and operations assessments.
- Coordinating annual planning activities
- Approving SOWs for the analytical laboratories.
- Approving network SOPs.
- Coordinating NADP training programs.
- Presenting budgetary requests, including QA activities, for consideration by the Budget Advisory Committee (BAC) and the Executive Committee.

4.2 Assistant Coordinator

The Assistant Coordinator reports to the Program Coordinator and has the following responsibilities under this QMP:

- Implementing the NADP QMP in cooperation with the QA Manager.
- Implementing policies, programs, and activities approved by the EC.
- Implementing network SOPs.
- Participating in NADP management and operations assessments.
- Coordinating NADP Training programs.

4.3 Quality Assurance (QA) Manager

The QA Manager reports to the Program Coordinator and Executive Committee. He/she is organizationally independent of other NADP personnel involved with the generation and reporting of environmental data. The QA Manager has the following responsibilities in implementing the NADP Quality Management System:

- Developing and implementing the NADP QMP in cooperation with the Program Coordinator with guidance from the Executive Committee and QAAG.
- Developing and implementing activity-specific QAPs for current and future NADP

networks with guidance from the EC and the QAAG.
- Ensuring that QAPs and SOPs are developed and implemented by QA staff of the analytical laboratories.
- Coordinating the QAAG.
- Challenging, and thus ensuring, the overall quality of NADP data-collection, management, and presentation processes.
- Coordinating periodic NADP surveys, audits, reviews, and assessments for the NADP networks and associated laboratories.

4.4 Analytical Laboratory Quality Assurance (QA) Staff

Each NADP affiliated analytical laboratory maintains separate QA staff. These individuals are independent of all personnel involved with the generation and reporting of environmental data. Laboratory QA staff report to the Director of the analytical laboratory. The QA staff have the following responsibilities in implementing the NADP Quality System:

- Implementing the NADP QMP with guidance from the QA Manager and the QAAG.
- Developing and implementing activity-specific QAPs for laboratory operations.
- Developing and approving SOPs for laboratory operations and QA activities.
- Participating in NADP management and operations assessments.

4.5 Network Equipment Depot (NED)

The Program Office maintains a supply of replacement parts through the Network Equipment Depot (NED). Replacement parts include motor boxes, sensors, and event recorders for the NADP wet deposition collectors, and clocks and mechanisms for the Belfort recording precipitation gage. Replacement parts are shipped to sites within 7 days of notification. Replaced parts are returned to the NED for repair.

Equipment repair and calibration are performed at the NED in accordance with SOPs. Equipment is tested to ensure that it meets specifications as documented in network QAPs and SOPs.

5.0 Procurement of Items and Services

Specifications for approved field equipment are documented in the network QAPs. Changes to equipment specifications or equipment types must be approved by the Executive Committee with recommendation by NOS. Supplies used for field operations must comply with specifications outlined in the field operations manuals. Supplies provided by the analytical laboratories for site use must meet specifications stated in the laboratory SOW.

Equipment repaired under outside contract must meet tolerance and performance criteria stated in the contract, and comply with specifications documented in the network QAPs and SOPs. The NED tests and verifies vendor and subcontractor repairs to ensure that they meet NADP specifications.

Analytical laboratory services provided for the NADP must meet the specifications stated in SOWs and laboratory QAP. The Program Coordinator reviews and approves the SOWs to ensure that changes to NADP policies and procedures are reflected. Laboratories must provide QC information to assess the quality of reported results for comparison to stated performance criteria. Supplies procured for laboratory NADP use must meet the specifications stated in the laboratory QAPs and SOPs.

Items and services procured by the Program Office must meet the specifications stated in the purchase request and be of acceptable quality to meet NADP objectives. Items on bid should include adequate detail, including the quality and performance expectations of the acquired items. Certifications of calibration, performance, quality, and warranty information that accompany goods and services must be maintained in a secure location under the control of designated personnel. External laboratory services must provide adequate QC information (e.g., compliance with accreditation requirements, QAPs, QMPs, and SOPs) to assess the bias and precision of the reported results.

6.0 Documentation and Records

Accurate and complete documentation is an important resource for data users. It allows data users to evaluate data from NADP networks. This section considers required NADP documentation, its preparation, approval, and maintenance. Documentation may include both printed and digital material, including video.

All NADP network and associated laboratory operations must prepare and maintain documents specified in this document. A consistent format should be used to allow tracking of documentation and records, and revisions to documents. Header information should appear on each page and should include the title of the document and its effective date. Page numbering should be used for multi-page documents. Table 4 lists the required documents, and the individuals responsible for preparing, maintaining, and reviewing the documents.

Documents and records at the Program Office and the analytical laboratories should be maintained in a secure location with adequate temperature, light, static, and moisture control to ensure their integrity.

Electronic records are archived on write-protected, secure electronic media following accepted data management practices. Metadata should accompany data archives. Metadata should include the data format, data fields with associated units, and other information intended to inform the data user about the nature of the data, their quality, or their use. These records must be stored permanently. Data archives must be updated at least annually. A duplicate copy of the data archive should be stored in a secure, off-site location

Provisional and raw data will not be made available for general distribution.

Table 4. Management of NADP Documentation

	Quality Management Plan (QMP)	*Quality Assurance Plans (QAPs)*		*Standard Operating Procedures (SOPs)**		*Other Documents*
		Network	*Laboratory*	*Network*	*Laboratory*	
Format/standard	ANSI/ASQC E4-2004 (or as designated by QAAG/EC)	ANSI/ASQC E4-2004 (or as designated by QAAG/EC)	ANSI/ASQC E4-2004	defined by NOS	defined by laboratory	designated by EC or Program Coordinator
Responsibility	Program Coordinator, QA Manager	Program Coordinator, QA Manager	Laboratory Director, Laboratory QA Staff	Program Coordinator, QA Manager, Site Liaison	Laboratory Director, Laboratory QA Staff	
Review Time	2-mo. review by QAAG, then 2-mo. review by EC			3-mo. review by NOS and DMAS	1 mo. by QA Manager (inform only)	
Approval Personnel	NADP EC Chair	NADP EC Chair, Subcommittee Chairs	Program Coordinator, QA Manager	NOS Chair, DMAS Chair	Laboratory Director, Laboratory QA Staff	
Acknowledgement Personnel	QA Manager	Program Coordinator, QA Manager	Laboratory Director, Laboratory QA Staff	Program Coordinator, QA Manager, Site Liaison	Designated Laboratory Staff	
Effective Date	Effective from date of approval for a maximum period of five years unless specified otherwise.					
Distribution	NADP website				Laboratory Personnel, QA Manager	designated by EC or Program Coordinator
Revision Schedule	annually or as needed; status and changes reported to EC and Subcommittees. Document revised/reissued at least every 3 years.					
Retention Times	permanently at Program Office (unless specified otherwise)					

* Operations manuals and training videos are considered SOPs.

7.0 Computer Hardware and Software

Requirements of the DQOs should be considered when selecting computer hardware and software for use in the NADP. Table 5 considers the hardware and software requirements of the NADP Program Office, the associated laboratories, and the field locations. Each location has specific needs and requirements that must be addressed. Software includes design, data handling, data analysis, modeling, data acquisition, geographic information system scripts, and database programs.

Table 5. NADP hardware and software requirements.

Item	Location	Selection Criteria	Notes
Hardware	Field Operations	- NOS approved - meets specifications as stated in the QAP and SOPs	
	Program Office	- sufficient to meet SOW data deliverables - support long-term data storage - compatible with existing NADP hardware - website and database servers should meet current industry norms for speed, retrieval, and processing.	- at least weekly backup - at least 3 backup media used in rotation - off site storage of 1 set of backup media - off site storage of data archive updated at least once annually
	Laboratory	- meets specifications in the laboratory QAP - sufficient to meet SOW data deliverables	- at least weekly backup - at least 2 backup media used in rotation - off site storage of 1 set of backup media
Software	Field Operations	- NOS approved - meets specifications as stated in the QAP and SOPs	
	Program Office	- compatible with existing NADP software - sufficient to meet SOW data deliverables	- formulae and algorithms for mathematical and computational software required - source code required if needed to customize the software - specify roundoff/truncation protocols if commercial software is to be used
	Laboratory	- meets specifications in the laboratory QAP - sufficient to meet SOW data deliverables	

Internally developed software should contain adequate documentation clearly stating the purpose, program limitations, and applications for which the software was developed. The author(s) of the software should be identified. Whenever practicable, a complete listing of the source code should be available to users. All mathematical algorithms used in the software should be described in a narrative description accompanying the source code. Prior to use, newly developed software should be tested rigorously using predetermined acceptance criteria. When feasible, manual calculations should be conducted on test data sets and databases to confirm the software reliability prior to routine use.

NADP data and associated reports are maintained in an on-line repository. Access to that site is not restricted. The site may be accessed at http://nadp.isws.illinois.edu. DMAS approves data formats that are available on-line. These formats are compatible with industry standards. Data may be made available in an alternate format or via alternate means by special request.

Data integrity can be compromised during data entry, electronic capture from automated instruments, or when transferred between different data logging devices (e.g., datalogger, PDA), different computers or databases. Written procedures for ensuring the accuracy and reliability of computerized data products should be described in individual QAPs. Data verification SOPs may be available which would explain these procedures in more detail. Data verification methods may include double entry, manual checking of a fixed percent of data, and computer-automated checking of the entire data record.

8.0 Network Expansion

When a site proposes to join a NADP network several steps must occur. This helps ensure continued integrity of the NADP, and that the mission of the NADP is preserved. Those steps are:

1. The Proposer reviews the *NADP Site Selection and Installation Manual* (NADP, 2009) to verify the appropriateness of the site based on NADP siting criteria.

2. The Proposer submits a completed *Site Information Worksheet* (SIW) to the Program Office requesting admission to a NADP network.

3. The Proposer submits a site sketch and photos of the proposed location to the Program Office.

4. The Site Liaison and QA Manager review the submitted documentation.

5. The Site Liaison works with Site Sponsor(s) and other site personnel to resolve any problems at the proposed site.

6. For cases where siting rules and guidelines cannot be met completely, supporting documentation is reviewed by the QA Manager, NOS Chair, and NOS Vice Chair for possible inclusion in the network with exception. Note, an exception is not an exemption. Depending on the situation, data collected from the site may be qualified and/or censored from selected reports and products.

7. Once a decision is made, the Site Liaison notifies Site Sponsors and other site personnel of approval or rejection. When a site is approved, the Site Liaison requests that the site be sent start-up supplies from the network's analytical laboratory.

8. The Program Coordinator will ensure that appropriate agreements are in place for site sponsorship.

9. The Site Liaison enters site information into the site information database and creates an archive for all relevant documentation from the site.

10. Site information is posted on the NADP website by the Program Office Database Manager.

9.0 New Networks and Special Studies

Proposals for new NADP initiatives must address, at a minimum, the items outlined in the document *Guide for New NADP Initiatives*. This document is available from the NADP website. Proposals are submitted to the NADP EC via the Program Office. A QAP outlining DQOs and required QA activities must be submitted to the QAAG within 5 months of when the network begins operation.

Periodically, the NADP conducts special studies to evaluate new methods, new equipment, or to evaluate existing protocols. Compliance with the NADP QMS is recommended, but is not required for special studies. As such, complete QA documentation and programs need not be written for these studies. Special studies conducted under the auspices of the NADP will not compromise the QMS for the NADP or any other network at a participating site.
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10.0 Deliverables and Schedules

Table 6 lists the deliverables, the responsible agency, and the schedule for those items. The Program Office is responsible for the quality and timeliness of all deliverables, regardless of their origin.

11.0 Quality Improvement

The QAAG is responsible for continued quality improvement in the NADP. The QAAG takes the lead in identifying DQOs. Assessment programs ensure that DQOs are achieved and meet the needs of data users. NADP Subcommittees advise the QAAG.

Quality improvement programs focus both on field and laboratory operations. All individuals involved in NADP activities should seek continued quality improvement of the DQIs. Prompt identification of problems is essential. Once the nature and extent of a problem has been determined, corrective measures may be implemented.

The structure of the NADP promotes the free exchange of information. All individuals are encouraged to participate in efforts to improve the networks and enhance their scientific relevance of the NADP.

Table 6. NADP deliverables and schedules.

Deliverable	Action	Responsible Party	Schedule
field supplies for sample collection	oral report to the NADP Subcommittees	Analytical Laboratory	sufficient for uninterrupted operation
validated data, including data corrections	submit to Program Office	Analytical Laboratory	90 days from collection
laboratory report	oral report to the NADP Subcommittees	Analytical Laboratory	at bi-annual NADP Subcommittee meetings
QA Report and revisions	submit to Program Office for review	Analytical Laboratory	final version by 01 October for previous calendar year's data
QAP and revisions	submit to Program Office for review and approval	Analytical Laboratory	at least every 3 years
SOPs and revisions	submit to Program Office	Analytical Laboratory	annual
network status report (e.g., site problems, equipment and personnel changes, site closures, site relocation)	submit to Program Office	Analytical Laboratory	monthly
validated data	post to NADP website	Program Office	30 days from receipt by PO
site reports	site specific reports to site personnel	Program Office	annual, by 01 July for previous calendar year's data
data summary	NADP data summary report to data users, may include isopleth maps for concentration and deposition, and other figures	Program Office	annual, by 01 October for previous calendar year's data
Program Office Report	oral and written reports to the NADP Subcommittees and EC	Program Office	oral reports at bi-annual NADP meetings, written report to EC at Spring meeting
SAES Report	oral and written report to the SAES Regional Research Committees and National Information Management and Support System	Program Office	annual, end of federal year
USDA Report	oral and written report to the USDA Current Research Information System	Program Office	annual, end of federal year
QAP	submit to QAAG for review, submit to NADP Subcommittees and EC for approval	Program Office	at least every 3 years
QMP	submit to QAAG for review, submit to NADP Subcommittees and EC for approval	Program Office	at least every 3 years
Governance Handbook	submit to NADP Subcommittees and EC for approval	Program Office	at least every 3 years

Appendix A: Terms

accuracy – exactness, correctness with deviation from a standard within limits.

acidic compound – a chemical compound capable of transferring a hydrogen ion in solution.

acidic precipitation – precipitation with **pH** below approximately 5.0.

ANSI/ASQC E4-1994 – American National Standards Institue/American Society for Quality Control - "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs."

assessment – the evaluation process to measure the performance or effectiveness of a system and its elements; this all-inclusive term denotes evaluations, audits, or reviews.

atmospheric deposition – removal of solid, aqueous, or gaseous materials from the atmosphere via fallout or precipitation.

audit – a systematic and independent examination to determine whether practices comply with documented **QAPs** and **SOPs**, and that these practices are implemented effectively and are suitable to achieve stated objectives.

base cations – chemical compounds capable of accepting a hydrogen ion in solution; for the purposes of the NADP, compounds of calcium, magnesium, potassium, and sodium.

bias – systematic or persistent distortion of a measurement process that causes errors in one direction (i.e., the expected sample measurement is different than the sample's true value), see also: **accuracy.**

comparability – a measure of the confidence with which one data set can be compared to another.

completeness – a measure of the amount of valid data obtained from a measurement system compared to the amount that was possible given that **SOPs** are followed.

conductance – a measure of a solution's capacity to conduct an electrical charge

data quality assessment – scientific and statistical evaluations of validated data to determine if they are of the right type, quality, and quantity to support their intended use.

Data Quality Indicator (DQI) – quantitative statistics and qualitative descriptors used to interpret the degree of acceptability or utility of data to the user: principally **bias**/**accuracy**, **precision**, **comparability**, **completeness**, and **representativeness**.

Data Quality Objective (DQO) – qualitative and quantitative statements that specify the technical characteristics of data that are required to support the intended purposes and uses of the data. May include tolerances on the **Data Quality Indicators.**

deposition – see **atmospheric deposition**.

ecoregion – a regional classification based on climate and terrain; defined by Robert G. Bailey, **USDA**, see www.fs.fed.us/institute/ecoregions/ecoreg1_home.html.

emissions – release of pollutants from natural and human sources.

environmental data – any measurements or information that describe environmental processes, location, or conditions; ecological or health effects and consequences; or the performance of environmental technology. Environmental data include information collected directly from measurements, produced from models, and compiled from other sources such as databases or the literature.

free acidity – free hydrogen ions in solution not bound in other chemical compounds.

metadata – data and other information about another data set.

nutrient – chemical compounds that enhance the growth of organisms.

peer review – a critical review of a specific scientific and/or technical product to corroborate scientific defensibility, which may include an in-depth assessment of assumptions, calculations, extrapolations, alternative interpretations, methodology, acceptance criteria, and conclusions pertaining to the specific scientific and/or technical products and of the supporting documentation.

performance evaluation – a quantitative test to determine whether a measurement system can obtain results that meet tolerance limits.

pH – a measure of free hydrogen ion in solution on a logarithmic scale.

precipitation –water that falls from the atmosphere, generally snow, rain, and ice, but not fog.

precipitation chemistry – chemical changes occurring in a liquid state in the atmosphere.

precision – a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions, expressed generally in terms of the standard deviation.

Quality Assurance (QA) – an integrated system of management activities involving planning, implementation, documentation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the necessary type and quality expected by the client; generally implemented after an activity has occurred.

Quality Assurance Plan (QAP) – a formal document describing in comprehensive detail the necessary QA, QC, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy stated performance criteria.

Quality Control (QC) – the overall system of technical activities to measure the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and

activities that are used to fulfill requirements for quality; generally implemented while activities are being performed.

quality improvement – a management program to improve the quality of operations using a formal mechanism to encourage worker recommendations, timely management evaluation, and feedback or implementation.

Quality Management Plan (QMP) – a document that describes the quality system in terms of the organizational structure, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, and assessing all activities conducted.

Quality Management System (QMS) – the overall management system of the organization that determines and implements the quality policy. Includes strategic planning, allocation of resources, and other systematic activities (e.g., planning, implementation, documentation, and assessment) pertaining to the quality system.

receptor – location where pollutants are deposited or ingested.

record – a completed document that provides objective evidence of an item or process. Records may include photographs, drawings, magnetic tape, and other data recording media.

representativeness – a measure of the degree to which data accurately and precisely represent the characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

specifications – a document stating requirements and that refers to or includes drawings or other relevant documents. They should indicate the means and criteria for determining conformance.

Standard Operating Procedure (SOP) – a written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps. The officially approved method for performing certain routine or repetitive tasks.

Statement of Work (SOW) – a written document detailing the procedures and deliverables required to meet contract obligations.

wet deposition – removal of solid, aqueous, and gaseous materials from the atmosphere via precipitation.

Appendix B: References

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