

Guidelines for Evaluation and Approval of Equipment for the NADP Wet Deposition Networks



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Acknowledgements

This document was created with guidance from the Quality Assurance Advisory Group (QAAG) and the Network Operations Subcommittee (NOS) of the National Atmospheric Deposition Program (NADP). Their assistance was invaluable.

The authors wish to thank the following individuals for their efforts:

Roger Claybrooke, NADP, Program Office
Tracy Dombek, RTI, formerly with Illinois State Water Survey
Eric Hebert, Environmental Engineering & Measurement Services, Inc.
Maria Jones, Environmental Engineering & Measurement Services, Inc.
Gary Lear, U.S. Environmental Protection Agency
Melissa Puchalski, U.S. Environmental Protection Agency
John Sherwell, Maryland Department of Natural Resources
Marcus Stewart, AMEC Foster Wheeler
Richard Tanabe, Environment Canada
Greg Wetherbee, United States Geological Survey

Document Change History

Version	Description	Effective Date
1.1	Simplified Table 4 Equipment Scoring Include power LED and On/Off switch as minimum requirements for collector Include Event Recorder and Collector Status as minimum requirements for raingage Clarify final decision is documented in meeting minutes rather than the equipment report (Step 5)	05/2016
1.0	Initial document	05/2011

Abbreviations

AIRMoN	Atmospheric Integrated Research Monitoring Network
AMNet	Atmospheric Mercury Network
AMoN	Ammonia Monitoring Network
EC	Executive Committee of the NADP
MDN	Mercury Deposition Network
NADP	National Atmospheric Deposition Program
NOS	Network Operations Subcommittee
NTN	National Trends Network
PO	Program Office
QA	Quality Assurance
QAAG	Quality Assurance Advisory Group
QC	Quality Control
QR	Quality Rating
SOP	Standard Operating Procedure
U.S. EPA	United States Environmental Protection Agency
USGS	United States Geological Survey

Introduction

This document, *Guidelines for Evaluation and Approval of Equipment for the NADP Wet Deposition Networks*, details the criteria for the evaluation and approval of new equipment for use in the National Atmospheric Deposition Program (NADP) wet deposition networks. These networks include: the National Trends Network (NTN), the Mercury Deposition Network (MDN), and the Atmospheric Integrated Research Monitoring Network (AIRMoN).

Candidate equipment for use in the NADP wet deposition networks will be evaluated according to a multi-step process. Those steps are discussed below. Equipment may be submitted for consideration by the manufacturer, or by an advocate associated with the NADP.

Evaluation of Equipment Specifications (Step 1)

First, the manufacturer's specifications for the equipment will be compared with the requirements for network use. Tables 1-3 indicate the minimum requirements for use in NADP wet deposition networks for raingages, wet deposition collectors, and sensors, respectively. Failure to meet one or more of these requirements may eliminate the equipment from further consideration.

Table 1. Minimum Requirements for Raingages in NADP Networks.

Parameter	Value
Capacity	10" of precipitation
Operating Temperature	-30 to 40°C
Accuracy	0.02" of precipitation
Resolution	0.01" of precipitation
Threshold	0.01" of precipitation
Power	12 V DC or 120 V AC
Time Resolution	1 hour
Output	Continuous chart or digital time series
Repeatability	± 0.01
Event Recorder	Mechanism to record collector opening/closing
Collector Status	Mechanism to record whether collector is powered

Table 2. Minimum Requirements for Wet Deposition Collectors in NADP Networks.

Parameter	Value
Capacity	2 L of precipitation
Operating Temperature	-30 to 40°C
Open	Within 15 seconds of sensor signal event
Close	Within 15 seconds of sensor signal event
Power	Switched, and 12 V DC or 120 V AC
Power Indicator	LED on collector housing and part of data signal
Event	Time referenced recording of collector opening and closing
Types of Deposition	Wet deposition only
Types of Precipitation	All
Temperature Control	Option to allow control of sample temperature

Table 3. Minimum Requirements for Sensors in NADP Networks.

Parameter	Value
Trigger	All types of precipitation
Switching on condition	Within 30 seconds of onset of precipitation event
Switching off condition	< 15 minutes after end of precipitation event
Droplet size	≥ 0.2 mm
Measurement area	$\geq 15\text{cm}^2$
Operating Temperature	-30 to 40°C
Power	12 V DC or 24 V DC

Laboratory/Controlled Testing (Step 2)

The second step of the evaluation process is performed under controlled conditions, such as in the laboratory. Tests conducted during this step of the evaluation process are designed to verify the operation of the equipment, and the repeatability of the measurements. Testing may include freezer tests to assess any limitations of the equipment under cold conditions. Failure to meet one or more of the requirements for network use may eliminate the equipment from further consideration.

Testing at the NADP Program Office (PO) is not a requirement. Testing may occur at any NADP affiliated agency (e.g., U.S. EPA, USGS, Eurofins/Frontier Global Sciences). At least one member of the NADP Quality Assurance Advisory Group (QAAG) must be included as part of the testing process. The QAAG member does not need to conduct the tests, but should review results of the tests and provide technical consultation.

Field Testing (Step 3)

The third step in the evaluation process is performed in the field, with the equipment installed at one or more existing monitoring sites. This allows the candidate equipment to be evaluated side by side against currently approved equipment. Field testing should include a range of meteorological conditions: snow, freezing rain, rain, and wind. Collection efficiency, durability, mean-time between equipment failure, ease of operation, and ease of support may be used to evaluate the performance of the candidate equipment.

Equipment Scoring (Step 4)

In step four of the evaluation process the candidate equipment is scored. Equipment is scored as Pass/Fail with regard to the criteria listed in Table 4. A “Pass” means the equipment meets the criterion unconditionally. Each of the criteria must receive a “Pass” to proceed to final approval. Conditional approval can be assigned if only minor changes to the equipment are required, and the equipment manufacturer has agreed to those changes.

Table 4. Equipment Scoring.

Criterion	Items to Consider	Notes	Pass/Fail
Target Specifications	Minimum requirements for the candidate equipment		
Controlled Testing	Data are within 5% of target values Data from testing multiple units are within 5% of one another		
Field Testing	Data are within 5% of (or superior to) values from approved equipment based on collocated testing Collection efficiency \geq approved equipment for all precipitation types Response of candidate equipment to environmental conditions Reliability of candidate equipment Durability and ruggedness of candidate equipment		
Usability	Ease of installation Equipment footprint Ease of use (hardware and software), based on skills of typical operator Compatibility with existing NADP equipment Ease of incorporating data stream Ease of troubleshooting Ease of re-starting equipment following critical failure Power requirements, particularly for solar powered sites Availability of spare parts Cost (parts and labor) to maintain and repair vulnerable components (e.g., load cell, motorbox, sensor) Projected long-term stability of manufacturer and/or vendor (\geq 5 years) Ability of manufacturer and/or vendor to meet delivery requirements Warranty and terms of support (\geq 1 year)		

Final Approval and Required Documentation (Step 5)

The final step of the evaluation process is the presentation of the results from the equipment evaluation to the Network Operations Subcommittee (NOS) of the NADP. NOS will vote whether to recommend acceptance of the candidate equipment in the wet deposition network. This recommendation is presented to the Joint Subcommittees, and to the NADP Executive Committee (EC). Final approval for network acceptance is given by the EC.

NOS and the EC meet twice a year, once in the spring and then again in the fall. Testing of candidate equipment should be scheduled to allow sufficient time for completion of the multi-step process prior to those meetings. The testing process and the results of the testing, regardless of approval for use in the network, should be documented in a written report. That report should be archived with the NADP PO for future reference. At a minimum, the report should include the following:

- Comparison with NADP minimum requirements (sample tables included in the Appendix to this document)
- When the testing occurred
- Where the testing occurred
- What tests were conducted
- Who conducted the tests
- Test results
- Equipment scoring (Table 4)
- Recommendation made to NOS

Presentations to NOS, and the written report are the responsibility of the individual(s) responsible for testing the candidate equipment. Final approval for network use is made by the NADP EC and is documented in meeting minutes.

Appendix

Comparison of Candidate Raingages Parameters with NADP Minimum Requirements.

Parameter	NADP Minimum Requirement	Candidate Raingage
Capacity	10" of precipitation	
Operating Temperature	-30 to 40°C	
Accuracy	0.02" of precipitation	
Resolution	0.01" of precipitation	
Threshold	0.01" of precipitation	
Power	12 V DC or 120 V AC	
Time Resolution	1 hour	
Output	Continuous chart or digital time series	
Repeatability	± 0.01	
Event Recorder	Mechanism to record collector opening/closing	
Collector Status	Mechanism to record whether the collector is powered	

Comparison of Candidate Wet Deposition Collector Parameters with NADP Minimum Requirements.

Parameter	NADP Minimum Requirement	Candidate Wet Deposition Collector
Capacity	2 L of precipitation	
Operating Temperature	-30 to 40°C	
Open	Within 15 seconds of sensor signal event	
Close	Within 15 seconds of sensor signal event	
Power	Switched, and 12 V DC or 120 V AC	
Power Indicator	LED on collector housing and part of data signal	
Event	Time referenced recording of collector opening and closing	
Types of Deposition	Wet deposition only	
Types of Precipitation	All	
Temperature Control	Option to allow control of sample temperature	

Comparison of Candidate Sensor Parameters with NADP Minimum Requirements.

Parameter	NADP Minimum Requirement	Candidate Sensor
Trigger	All types of precipitation	
Switching on condition	Within 30 seconds of onset of precipitation event	
Switching off condition	< 15 minutes after end of precipitation event	
Droplet size	≥ 0.2 mm	
Measurement area	≥ 15 cm ²	
Operating Temperature	-30 to 40°C	
Power	12 V DC or 24 V DC	