

NADP Site Selection and Installation Manual



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I. Introduction

This document, *NADP Site Selection and Installation Manual*, details the rules and guidelines for siting and installing monitoring stations in the National Atmospheric Deposition Program (NADP) networks. Monitoring sites for NADP networks are selected to quantify wet deposition in major physiographic, agricultural, aquatic, and forested areas within states, regions, and ecoregions. Siting criteria were established to meet the goal of having regionally representative measurements, and comparability between network sites. Those criteria are considered in this document.

II. Site Classification

Sites are classified by the population density (based on current census data) within a 15 km radius of the site. The table below indicates the NADP site classifications.

Table 1. NADP Site Classifications.

Site Classification	Population within 15km of the site (people/km ²)
Isolated (I)	< 10
Rural (R)	10 – 99
Suburban (S)	100 – 399
Urban (U)	≥ 400

An additional classification, *Research/Provisional*, has been designated for sites that do not meet NADP siting criteria, but are of scientific interest. A monitoring station on a tower, above a forest canopy is an example of such a site.

III. General Criteria for Site Selection

A site should be accessible year round, and in normal weather conditions. It should be secure against vandalism, and from animals, both wild (e.g., bears) and domestic (e.g., cows). When fences are used to secure a site, the Siting Criteria Rules, as outlined in Section IV B, must be considered. Placement of the NADP instrumentation relative to the fence, in terms of both horizontal and vertical proximity, and the type of fence (e.g., chain link, wood post) are important. In some instances, the fence material may be a concern as well.

Collocation of an NADP site with other long-term monitoring networks is encouraged. Established sites have a data archive that can be evaluated. Such sites have documentation that may be reviewed as well. Data should not be compromised when monitoring sites are collocated. This is true whether multiple NADP networks are collocated, or whether an NADP network is collocated with another network (e.g., CASTNET, IMPROVE). Local site conditions should be evaluated to ensure that there is appropriate space to operate the networks, and that site activities will not impact sample collection or site operations.

IV. Rules

A. Siting Criteria Rules

All new and existing NADP sites must comply with siting criteria that are designated as Rules. These criteria are supported by scientific practices that ensure uniform data quality, and provide a framework for site selection. Sites that do not meet these criteria, but wish to join an NADP network must submit a petition to seek exception. Petitions for exception to siting criteria rules are evaluated by the QA Manager, the NADP Network Operations Subcommittee (NOS) Chair, and the NOS Vice Chair. Note, an exception is not an exemption from the criteria. Depending on the situation, data collected from the site may be qualified. Existing sites that do not meet the Siting Criteria Rules should endeavor to achieve compliance.

The Appendix to this document includes diagrams illustrating the Siting Rules and Guidelines. Siting Rules are indicated in red, and a regular font style in the Rules diagram. Table 2 indicates the siting criteria Rules for the NADP networks.

Table 2. NADP Siting Criteria Rules *

Parameter	Network	Minimum Distance from Collector
Access Road (≤ 10 vehicles/day, ≤ 10 mph, on average)	All	10 m
Unpaved Roads (> 10 vehicles/day, ≤ 50 km/hr, on average)	All	100 m
Paved Roads (> 100 vehicles/day, on average)	All	100 m
Highways (> 4 lanes, > 100 vehicles/hr, on average)	All	500 m
Interstates	All	1 km
Waterways (100 powered vehicles/day, on average)	All	100 m
Harbors and Marinas	All	100 m
Airports (parking area, taxiway, runway)	All	100 m
Large Animal Operations (> 250 beef cattle, > 100 dairy cattle, > 350 pigs, or $> 10,000$ chickens)	NTN, AIRMoN	500 m
Stationary Combustion Sources (excluding fireplaces and residential heating)	All	500 m

* Minimum distances should be considered relative to the collector, or to the sampling instrumentation.

B. Site Installation Rules

Table 3 indicates the installation Rules for sites in an NADP network. These Rules are indicated in red (and a regular font style) in the Rules diagram in the Appendix to this document. All heights are measured relative to the base of the instrumentation (e.g., collector, raingage). Angles of projection are measured from the top of the instrumentation. For an angle of 45° from horizontal, the object must be a distance equal to the object's height away from the instrument. For an angle of 30° from horizontal, the object must be a distance equal to twice the object's height away from the instrumentation. Local siting criteria are based on a 30 meter radius from the collector. That is the typical footprint of an NADP site.

Table 3. NADP Site Installation Rules.

Parameter	Network	Description
Collector orientation	All	wet side bucket $\pm 45^\circ$ of magnetic west
Sensor orientation	All	to the north
Distance between collector and raingage	All	≥ 5 m, < 30 m
Vertical distance between collector orifice and raingage orifice	All	≤ 0.3 m
Vegetation height	All	≤ 0.6 m within 5 m of instrument base
Fertilizer usage	All	> 20 m from collector
Cultivated agricultural fields	All	> 20 m from collector
Pasture land	All	> 20 m from collector
Vertical objects (Includes towers, wires, fences), angle of projection from instrumentation	All	$\leq 45^\circ$ from top of instrument
Trees, angle of projection from instrumentation	All	$\leq 45^\circ$ from top of instrument
Buildings, angle of projection from instrumentation	All	$\leq 30^\circ$ from top of instrument
Objects, > 1 m tall, > 5 cm in width or depth	All	≥ 5 m from instrument
$> 20\%$ annual precipitation is frozen	All	wind shield present on raingage
Wind shield, pivot axis	All	same height as raingage orifice
Rooftop installation	All	urban sites only
Rooftop installation, equipment separation from potential emission sources (sewer vents, HVAC systems)	All	maximize separation
Rooftop installation, objects, angle of projection	All	$\leq 30^\circ$ from top of instrument

V. Guidelines

A. Siting Criteria Guidelines

It is beneficial, but not required, for all new and existing NADP sites to comply with siting criteria that are designated as Guidelines. These criteria are recommendations based on scientific judgment. Due to practical siting considerations and research goals, it may not be possible for sites to meet one or more of these criteria. Failure to meet these criteria will not prohibit a site from either joining, or remaining in an NADP network. The extent of the departure from these criteria may designate the site as *Research/Provisional*. This decision will be made by the NADP Program Office with input from the site.

The Appendix to this document includes diagrams illustrating the Siting Rules and Guidelines. Siting Guidelines are indicated in blue, and an *italicized* font style in the Guidelines diagram. Table 4 indicates the Siting Criteria Guidelines for sites in the NADP network.

Table 4. NADP Siting Criteria Guidelines.

Parameter	Network	Minimum Distance from Collector
Electric Utilities (≥ 25 MW)	All	20km
Chemical Manufacturing	All	20km
Mining Operations	All	20km
Metal Fabrication	All	20km
Incinerators	All	20km
Mercury emitting sources, > 10 kg/year	MDN	20km
Abattoir	All	20km
Other Industrial Operations	All	20km
Parking Lots/Maintenance Areas (> 6 vehicles/day)	All	100m
Parking Lots/Maintenance Areas (≤ 6 vehicles/day)	All	30m
Storage areas (fertilizer, manure, road salt)	All	100m
Metal Working (welding)	MDN	100m

B. Site Installation Guidelines

Table 5 indicates the installation Guidelines for sites in an NADP network. These Guidelines are indicated in blue (and an *italicized* font style) in the Guidelines diagram in the Appendix to this document.

Table 5. NADP Site Installation Guidelines.

Parameter	Network	Description
Groundcover	All	natural/typical within 30 m radius of instrumentation
Ground slope	All	≤ 15% within 30 m of instrumentation
Trees, angle of projection from instrumentation	All	≤ 30° from top of instrument
Platform	All	matches footprint of instrumentation
Platform, height, snow depth ≤ 0.5 m/year	All	≤ 0.6 m
Platform, height, snow depth > 0.5 m/year	All	≤ height of maximum anticipated snow depth
Treated wood	MDN (Trace metal sites only)	exposed surface > 5 m from collector
Galvanized metal	MDN	exposed surface > 5 m from collector
Snow roof on collector	All	present year round
> 20% annual precipitation is frozen	All	snow roof on collector
Site altitude > 1000 m	All	wind shield present on raingage
Herbicide usage	All	≤ 20m from collector, minimal use

VI. Site Re-location

In the event that a site needs to be re-located from its original, approved location, please consult the Site Liaison. Depending on the extent of the move, documentation required for the move will differ. See Table 6 for details. If possible, new coordinates (latitude, longitude, and elevation) should be provided to the Program Office for the proposed collector location. Note, moving the site more than 10 km from its original location will require a new SiteID.

VII. Site Changes/Modifications

Changes or modifications to NADP sites must be coordinated with the Site Liaison. Contact information for the Site Liaison is included in the Contact List section of this document. This includes: equipment modifications, equipment replacement, installation of additional equipment at the site, installation/removal of equipment platforms, long-term storage of equipment and/or materials which may violate siting criteria, construction activities, and as previously discussed, site re-locations. Changes within 30m of the collector and/or the raingage are of particular concern. Land-use changes in the area around the site should be documented and discussed with the Site Liaison. Such changes may impact data quality. The introduction of livestock, and changes to agricultural practices may impact sample chemistry.

Table 6. Requirements for Re-location of an NADP Network Site.

Distance from Original Location	Network	Required Action
≤ 30 m	All	<ul style="list-style-type: none"> - notify Site Liaison of date and purpose for move - submit new site sketch - submit new site photos
> 30 m and ≤ 10 km	All	<ul style="list-style-type: none"> - notify Site Liaison of date and purpose of move - submit new site sketch - submit new site photos - submit new Site Information Worksheet (SIW)
> 10 km	All	<ul style="list-style-type: none"> - notify Site Liaison of date and purpose of move - submit new site sketch - submit new site photos - submit new Site Information Worksheet (SIW) - new SiteID will be assigned

VIII. New Sites

A Site Information Worksheet (SIW) and site sketch are required for all sites applying to one of the NADP networks. Both the SIW and the template for the site sketch are available on the NADP website (<http://nadp.isws.illinois.edu>). Completed SIWs and site sketches should be sent to the address listed below. Alternatively, documentation may be submitted via email at relay@illinois.edu.

Roger Claybrooke
 NADP Program Office
 Illinois State Water Survey
 University of Illinois at Urbana-Champaign
 2204 Griffith Drive
 Champaign, Illinois 61820-7495

SiteIDs are assigned by the NADP Program Office. The SiteID is based on the County where the station is located. Sites located at National Parks have a separate code. The U.S. Environmental Protection Agency’s Office of Air Quality Planning and Standards’ (U.S. EPA, OAQPS) AEROS Manual of Code is used to determine the code.

IX. Power Requirements

A. AC Operation, 110V

110 V AC power is the preferred method for powering an NADP site. For those sites located in areas where power is interrupted frequently, a trickle charged battery backup is recommended. Configuration of the trickle charger is important. It should not interrupt AC power to the collector as illustrated in Figure 1 below.

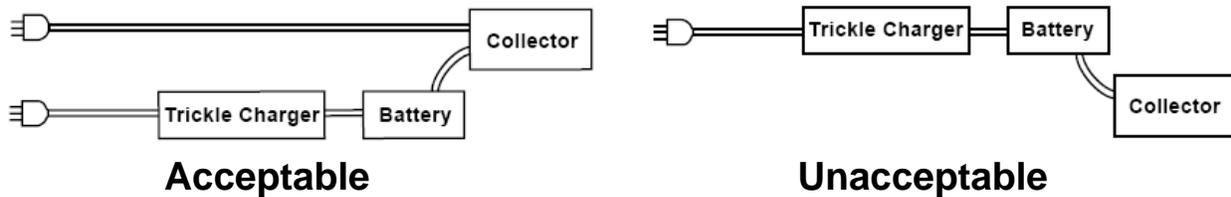


Figure 1. Trickle Charger Configuration in AC Power Line.

If a battery failure occurred with the configuration on the right, AC power would not reach the collector, and the trickle charge would be the sole source of power to the collector.

Some trickle charges may overcharge the battery, and damage it. Both the Aerochem Metrics and the N-CON collectors have trickle chargers which operate in parallel to direct line AC power, as illustrated in the configuration on the left in Figure 1.

B. DC Operation

For networks that do not require AC power, a 12 VDC source may be used if AC power is not available at the site. The 12 VDC power source may be maintained by swapping batteries periodically, or by using a solar panel and trickle charger. Please contact the site liaison for assistance when selecting the appropriate sized solar panel.

Deep cycle marine batteries should be used as the 12 VDC source. Ordinary automotive batteries, though cheaper, are not designed to be drawn down and recharged. Deep cycle marine batteries are rated for 2,000 cycles. Gel batteries have a couple of advantages over lead-acid batteries. Gel batteries weigh less than lead acid batteries for an equal capacity, and gel batteries do not freeze at low temperatures when not fully charged.

X. Equipment Installation

The most current information regarding the installation of equipment can be found on the NADP website (<http://nadp.isws.illinois.edu>). The site liaison for the network may be contacted as well.

When installing the collector and the raingage, please consult the installation manuals that accompany each device. All instrumentation should be level and secure. The collector should be installed with the wet-side bucket to the west and the sensor facing north.

The collector has a large cross-section and is light in weight. As such, the collector is susceptible to being blown over in high wind. The collector must be secure to prevent this from happening.

After installing the equipment, it is important that the station be tested to determine whether it is operating properly. The collector lid should fit snugly, and be centered over the wet-side bucket/sample train. The sensor should trigger with a drop of water (grid type sensor), or by breaking the optical path repeatedly within 20 seconds (optical sensor). Triggering the sensor should cause the collector to open, and the Event Recorder to log the event.

XI. Site Performance and Systems Surveys

Each site in an NADP network will be surveyed once every 3-4 years by an independent contractor as part of the quality assurance program. During the survey the following items will be verified:

- calibration, condition, and correct operation of instrumentation
- site contact information
- site condition
- power
- NADP siting criteria
- operating procedures
- supplies

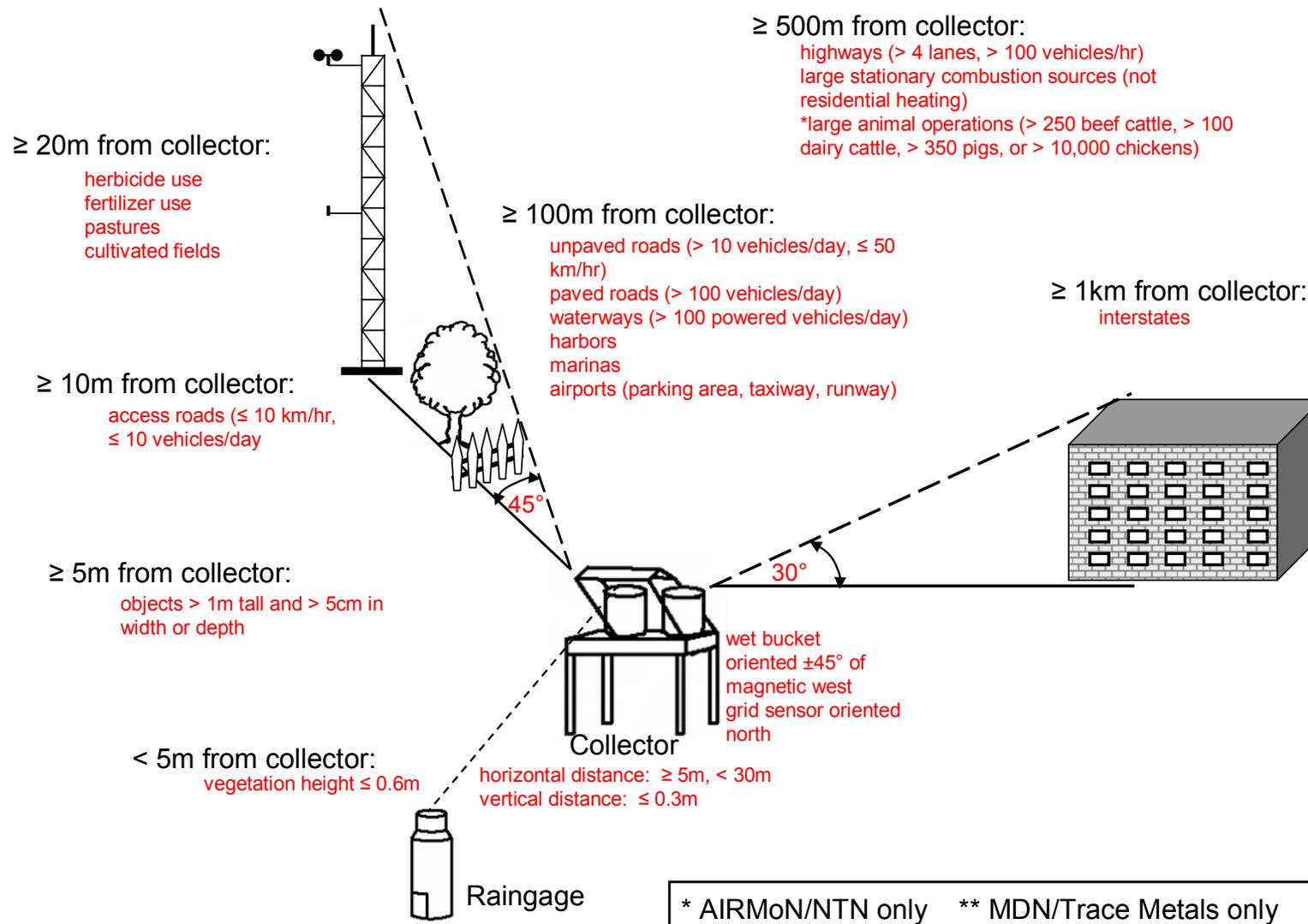
Conditions at the site will be documented with photographs, and the site sketch will be updated. The survey team will also answer questions regarding the operation and maintenance of the site with regard to NADP procedures and policies. The Site Liaison and the NADP Program Office will follow-up regarding any issues discovered during the site survey. Information from the site survey is available on the NADP website for each monitoring site.

XII. Contact List

NADP Personnel		
Contact	Phone Number	email address
AIRMoN Site Liaison	800-952-7353	airmon@isws.illinois.edu
MDN Site Liaison	877-622-6960	hal@frontiergeosciences.com
Network Equipment Depot	217-244-1913	tleon@illinois.edu
NTN Site Liaison	800-952-7353	ntn@isws.illinois.edu
Site Performance and Systems Survey Program	217-244-6413	rhodes1@illinois.edu

Appendix

NADP Siting Criteria Rules – Wet Deposition



NADP Siting Criteria Guidelines – Wet Deposition

≥ 100m from collector:

- parking lots (> 6 vehicles/day)*
- maintenance areas (> 6 vehicles/day)*
- storage areas (fertilizer, manure, road salt)*
- **metal working (welding)*

≥ 20km from collector:

- electric utilities*
- chemical manufacturing*
- mining operations*
- metal fabrication*
- incinerators*
- abattoir*
- other industrial operations*
- **Hg emitting sources (> 10 kg/yr)*

≥ 30m from collector:

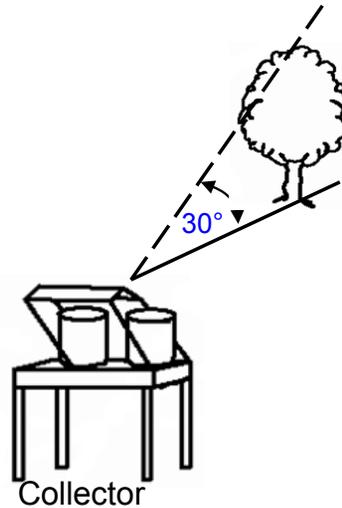
- parking lots (≤ 6 vehicles/day)*
- maintenance areas (≤ 6 vehicles/day)*

≥ 5m from collector:

- treated wood*
- **galvanized metal*

< 5m from collector:

- ground slope ≤ 15%*
- groundcover typical of area*



* AIRMoN/NTN only ** MDN/Trace Metals only