

Wisconsin State Laboratory of Hygiene
NADP Program Office
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Atmospheric Mercury Network Site Performance and Systems Survey



National Atmospheric Deposition Program

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Document Change History

Version	Description	Effective Date
2.0	Updated contact information to Wisconsin State Laboratory of Hygiene.	12/2019
1.5	Field usable forms added as an appendix.	10/2016
1.4	Removed requirement for site sketch – no longer required as part of wet-deposition site surveys as well Added units to measurement parameters for clarity Added target values for clarity	05/2014
1.2	Initial document	10/2012

Abbreviations

AIRMoN	Atmospheric Integrated Research Monitoring Network
AMNet	Atmospheric Mercury Network
AMoN	Ammonia Monitoring Network
CAMD	Clean Air Markets Division
CAMNet	Canadian Atmospheric Mercury Network
CASTNET	Clean Air Status and Trends Network
CVAFS	Cold Vapor Atomic Fluorescence Spectroscopy
DFU	Disposable Filter Unit
DQO	Data Quality Objective
GEM	Gaseous Elemental Mercury (expressed in ng/m ³)
GOM	Gaseous Oxidized Mercury (expressed in pg/m ³)
Hg	Mercury
MDE	Mercury Deposition Event
MDN	Mercury Deposition Network
MSDS	Material Safety Data Sheet
NADP	National Atmospheric Deposition Program
NED	Network Equipment Depot
NIST	National Institute of Standards and Technology
NTN	National Trends Network
NYSDEC	New York State Department of Environmental Conservation
PBM _{2.5}	Particulate-Bound Mercury less than 2.5 µm in diameter (expressed in pg/m ³)
PO	Program Office
QA	Quality Assurance
QAAG	Quality Assurance Advisory Group
QC	Quality Control
RF	Response Factor
RGM	Reactive Gaseous Mercury (expressed in pg/m ³)
SAES	State Agricultural Experiment Stations
SOP	Standard Operating Procedures
TGM	Total Gaseous Mercury
UHP	Ultra-High Purity
U.S. EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WSLH	Wisconsin State Laboratory of Hygiene

Units and Conversion Factors

°	degrees
°C	degrees Celcius
cm	centimeters
L	liters
lpm	liters per minute
mm	millimeters (1 mm = 10 ⁻³ m)
ng	nanograms (1 ng = 10 ⁻⁹ g)
ng/m ³	nanograms per cubic meter
pg	picograms (1 pg = 10 ⁻¹² g)
pg/m ³	picograms per cubic meter
psi	pounds per square inch
µm	micrometer (1 µm = 10 ⁻⁶ m)
V	volts

Introduction

This document, *Site Performance and Systems Survey*, describes the activities associated with the site surveys for the National Atmospheric Deposition Program's Atmospheric Mercury Network (NADP/AMNet). Each AMNet site will be surveyed at least once every two years. At present, site surveys will be conducted by the AMNet Site Liaison. Figure 1 illustrates the components of a site performance and systems survey. The goals of the survey are as follows:

- verify contact information and site coordinates,
- verify proper operation of the Tekran instrumentation,
- document conditions at the site relative to AMNet siting criteria,
- verify operator access to current SOPs and manuals,
- answer operator questions, and
- provide a training opportunity for site personnel

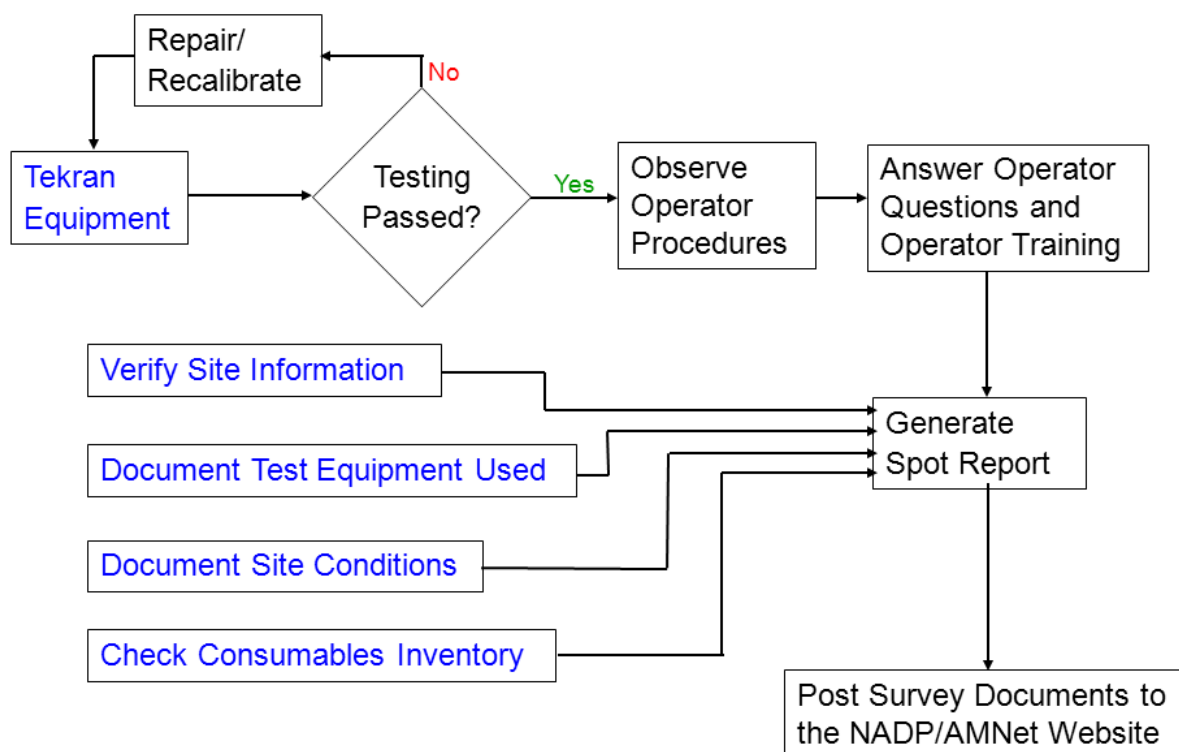


Figure 1. Components of a Site Performance and Systems Survey.

Procedures for verifying proper operation of the Tekran equipment are documented in separate Standard Operating Procedure (SOP) documents. Those documents are posted on the NADP website (<http://nadp.slh.wisc.edu>).

Documentation from the site surveys will be made available on the NADP website (<http://nadp.slh.wisc.edu>). Conditions as documented during the site surveys will be maintained in a database. A copy of the site survey database will be provided to the NADP Quality Assurance (QA) Manager at least quarterly. The AMNet Site Liaison will present results from the Site Performance and Systems Surveys to the NADP Technical Subcommittees at each NADP meeting.

Qualifications

The technical nature of the Tekran instrumentation limits the individuals who are qualified to perform the site survey. The Site Liaison must maintain expertise with the Tekran instrumentation to perform this work. This includes keeping up to date with documentation from the instrument manufacturers, and continued hands-on experience with the instrumentation.

Performance and Systems Survey

Parameters to be tested and information to be verified as part of the site performance and systems survey are considered in Tables 1 - 7. Tables 1 - 3 identify contact information for the site, as well as conditions at the site relative to the AMNet siting criteria. Tables 4 - 5 consider identification and field verification of the Tekran. Table 6 identifies the equipment used during the tests. Table 7 lists the minimum recommended consumables for uninterrupted operation of the AMNet site. Field usable forms containing the same information from these tables are included in the Appendix to this document.

Table 1. Contact Information and Coordinates for an AMNet Site.

Parameter	Value
Site Name	
Site ID	
Survey Arrival Date and Time	
Survey Departure Date and Time	
Operator Name	
Operator Phone Number, Office	
Operator Phone Number, Cell	
Operator Email Address	
Operator Mailing Address	
Operator Shipping Address	
Backup Operator Name	
Backup Operator Phone Number, Office	
Backup Operator Phone Number, Cell	
Backup Operator Email Address	
Backup Operator Mailing Address	
Backup Operator Shipping Address	
Supervisor Name	
Supervisor Phone Number, Office	
Supervisor Phone Number, Cell	
Supervisor Email Address	
Supervisor Mailing Address	
Supervisor Shipping Address	
Site Latitude (decimal degrees)	
Site Longitude (decimal degrees)	
Site Elevation (m)	

Table 3. Changes at AMNet Site Since Previous Site Performance and Systems Survey.

Distance from Tekran 2537 Inlet	Parameter	No	Yes	Notes
within 5m	New* HVAC units			
	New* inlet obstructions			
	New* objects (> 1m in height and > 5cm in width or depth)			
	Vegetation > 0.6m in height			
within 10m	New* access roads (≤ 10 vehicles/day, ≤ 10 km/hr)			
	New* instrument exhaust			
within 20m	New* cultivated fields			
	New* herbicide use			
	New* pastures			
within 50m	New* areas of dense forest			
	New* fertilizer use			
	New* parking lots or maintenance areas (≤ 6 vehicles/day)			
within 100m	New* parking lots or maintenance areas (> 6 vehicles/day)			
	New* small sources of mercury (e.g., municipal waste containers, fluorescent light storage, mercury thermometer, mercury barometer)			
within 10km	New* industrial complexes or large stationary emission sources			

* “New” means within the past year, or since the last checklist was completed.

Table 4. Parameters Tested as Part of Field Verification of Tekran Instrumentation.

Instrument	Parameter	Test condition	Value
1130	Inlet height (m)	From ground	
		From mounting surface	
	Sample line (m)	Length	
	Temperature (°C)	Denuder, sampling	
		Inlet boot, sampling	
		Denuder, desorption	
		Inlet boot, desorption	
		Case	
	Sample line		
Flow rate (lpm)	Inlet, while sampling (accuracy: ±1 lpm)		
1135	Temperature (°C)	Pyrolyzer, sampling	
		Regenerable Particulate Filter, sampling	
		Pyrolyzer, desorption	
		Regenerable Particulate Filter, desorption	
		Case	

Notes:

Table 4. Parameters Tested as Part of Field Verification of Tekran Instrumentation – continued.

Instrument	Parameter	Test condition	Value
2537	Leak check A (lpm)	Instrument	
	Leak check B (lpm)	(target: < 0.03 lpm)	
	Flow rate (lpm)	Inlet, while sampling (accuracy: ±3%)	
	Lamp voltage (V)	Instrument (target: 7.0-12.5 V)	
	Calibration, Cartridge A (mean percent recovery)	Low level injection (accuracy: ±5%)	
		High level injection (accuracy: ±5%)	
		Ambient air injection (accuracy: ±10%)	
		Response Factor (2537A&B: > 6x10 ⁶ counts, 2537X: > 1x10 ⁷ counts)	
		Baseline Deviation (2537A&B: < 0.100, 2537X: < 100)	
	Calibration, Cartridge B (mean percent recovery)	Low level injection (accuracy: ±5%)	
		High level injection (accuracy: ±5%)	
		Ambient air injection (accuracy: ±10%)	
		Response Factor (2537A&B: > 6x10 ⁶ counts, 2537X: > 1x10 ⁷ counts)	
		Baseline Deviation (2537A&B: < 0.100, 2537X: < 100)	

Notes:

Table 5. Identification of Field Equipment at AMNet Site.

Instrument	Manufacturer	Model Number	Serial Number	Calibration Date
Air Dryer	Tekran	1102		
Oxidized Mercury Speciation Module, Pump Module	Tekran	1130		
Oxidized Mercury Speciation Module, Sampling Head	Tekran	1130		
Particulate Mercury Module	Tekran	1135		
Continous Mercury Vapor Analyzer	Tekran	2537		
Mercury Vapor Calibration Unit	Tekran	2505		
Syringe				
Flow Meter (medium)				
Flow Meter (high)				
Datalogger				

Notes:

Table 6. Test Equipment used During the Site Performance and Systems Survey.

Instrument	Parameter Tested	Manufacturer	Model Number	Serial Number	Calibration Date
Mercury Vapour Calibration Unit	Concentration	Tekran	2505		
Syringe	Liquid volume	Hamilton	1702 RN		
Flow Meter (medium)	2537 flow rate	Bios	Definer 220M		
Flow Meter (high)	Inlet flow rate	Bios	Definer 220H		
Digital Multimeter	Voltage	Fluke	70 Series		
Global Positioning System Receiver	Latitude/Longitude	Garmin	Map76S		
Digital Camera	Conditions at site	Canon	A590		

Notes:

Table 7. Minimum Recommended Consumables for Operation of an AMNet Site.

Description	Part Name	Recommended Quantity*	Quantity On-Hand
For operation of the Tekran 2537A	UV analytical lamp, 1"	1	
	Gold cartridge, matched pair	1	
	Zero air canister	1	
	Disposable filter unit	1	
	Particulate filter, pore size 0.2 µm, diameter 47 mm	10	
	Injection port septum	10	
	Cartridge heater, pair	1	
	Pump diaphragm and brushes	1	
	V2 valve	1	
	Soda lime cartridge	1	
	¼" Teflon ferrules	2	
For operation of the Tekran 1130	Impactor disks	10	
	Particulate filter, borosilicate glass, pore size 1.0 µm , diameter 47 mm	10	
	Zero air canister	2	
	Disposable filter unit	2	
	Impactor inlet assembly	1	
	Pump diaphragm and brushes	1	
	Quartz denuder (body only)	2	
For operation of the Tekran 1135	Quartz filter disks for regenerable particulate filter, pore size 0.1 µm, diameter 21 mm	10	
	Quartz wool regenerable particulate filter fill material	1	
	GL14-GL18 union	1	
	Teflon 90 reducing union ⅜" – ¼" elbow	1	
	Quartz regenerable particulate filter assembly	2	

* Recommended number of parts, in addition to those in use.

Survey Products

A Spot Report will be generated at the conclusion of each site survey and performance review. A copy of this report will be provided to the Site Supervisor, the Site Operator, and the NADP Quality Assurance Manager within 48 hours of completion of the survey. The report will include the following items:

- a list of supplies that are needed at the site
- a list of site conditions relative to NADP siting criteria

- a summary of the results from each piece of equipment tested, and
- a list of items requiring additional consideration/attention

Photos will be completed as part of the site survey. Photos will include:

- each of the cardinal directions (i.e., north, east, south, and west) from the Tekran 2537 inlet,
- view of the equipment mounting,
- overview images of the site, and
- photographs documenting equipment problems.

Copies of the survey reports, and photos will be made available on the NADP website (<http://nadp.slh.wisc.edu>) and will be maintained indefinitely. Full survey results will be maintained in a database to facilitate comparison of conditions between successive site surveys.

Appendix - Survey Form

<u>Site Name</u> _____	<u>MDN ID</u> _____	<u>Date</u> _____
<u>Coordinates</u> N _____		<u>Arrival / Departure Time</u> _____ / _____
W _____	<u>Elevation</u> _____	
<u>Site Address</u> <input type="checkbox"/> on file _____	<u>Operator</u> _____	<u>Email</u> _____
_____	<u>Phone</u> _____	<u>Cell Phone</u> _____

<u>Shipping Address</u> _____	<u>Second Operator</u> _____	<u>Email</u> _____
_____	<u>Phone</u> _____	<u>Cell Phone</u> _____
_____	<u>Supervisor</u> _____	<u>Email</u> _____
Serial Numbers		
2537 SN _____	1130 SN _____	1102 SN _____
1130 P SN _____	1135 SN _____	<u>Sample Line Length</u> _____
<u>Inlet Ht Ground / Surface</u> _____ / _____ m	2505 SN _____	<u>Syringe SN</u> _____
<u>Flow meter type</u> _____	<u>Meter cert date</u> _____	<u>Syringe Cert Date</u> _____
<u>Flow meter SN</u> _____		
External Temps		
1135 Pyro _____	Sample	Desorb
1135 Part _____		
1135 Case _____		
		<u>Lamp Voltage</u> _____
		<u>BLDev range</u> _____
1130 Denuder _____		<u>2537 Leak Check</u> A _____ lpm B _____ lpm
1130 Boot _____		_____
1130 Case _____		_____
<u>Sample Line</u> _____		_____

Flows		
	<u>Initial</u>	<u>Adjusted</u>
<u>Inlet while Sampling</u> _____		10 lpm
2537 _____		1 lpm
		<u>Adjustments</u> _____

Calibration		
	<u>Trap A</u>	<u>Trap B</u>
<u>Perm Source RF</u> _____		> 6 M
<u>Low Level Injections</u> _____	%	%
<u>High Level Injections</u> _____	%	%
<u>Ambient Air Injections</u> _____	%	%
		<u>Ambient Air Conc</u> _____
		100 pg _____
		100 pg _____

Perm Source Calibration		
	<u>Time / Trap</u>	<u>Recovery</u>
100 pg _____		150 pg
100 pg _____		150 pg
100 pg _____		150 pg
100 pg _____		150 pg
100 pg _____		150 pg
100 pg _____		150 pg
100 pg _____		150 pg
100 pg _____		150 pg
100 pg _____		150 pg
	Average	
		11.6 ul open
		_____ pg
		11.6 ul close
		_____ pg
		17.4 ul open
		_____ pg
		17.4 ul close
		_____ pg

