

Wisconsin State Laboratory of Hygiene
NADP Program Office
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NADP AMNet Standard Operating Procedure Site Report A: Each Visit/Weekly Maintenance



National Atmospheric Deposition Program

Wisconsin State Laboratory of Hygiene

NADP Program Office

Revision date: 12/4/2019

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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	Dry Filter Unit
DQO	Data Quality Objectives
GEM	Gaseous Elemental Mercury (expressed in ng/m ³)
GOM	Gaseous Oxidized Mercury (expressed in pg/m ³)
Hg	Mercury, the element (“hydrargyrum”)
LPM	Liters per Minute
LST	Local Standard Time
MDE	Mercury Deposition Event
MDN	Mercury Deposition Network
MSDS	Material Safety and Data Sheets
NADP	National Atmospheric Deposition Program
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NOS	Network Operations Subcommittee
NTN	National Trends Network
OSHA	Office Safety and Health Administration
PBM _{2.5}	Particle-Bound Mercury less than 2.5 µm in diameter (expressed in pg/m ³)
PO	NADP Program Office
QA	Quality Assurance
QAAG	Quality Assurance Advisory Group
QC	Quality Control
QR	Quality Rating
RespFctr	Response Factor
RGM	Reactive Gaseous Mercury (expressed in pg/m ³)
RPF	Regenerable Particulate Filter
SOP	Standard Operating Procedure
SQL	Structured Query Language
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

Introduction

Operational checks are required weekly for each site in the NADP Atmospheric Mercury Network (AMNet). With each visit to the AMNet site, the operator should complete the operational checks described in this Standard Operating Procedure (SOP) document, *Site Report A: Each Visit/Weekly Maintenance*. Though it is not necessary to visit the site on a daily basis or each week, data should be inspected at least twice a week to ensure proper operation of the equipment.

The activities described in this SOP focus on the ambient mercury monitoring system, and ensure that the instrument is free from typical mechanical and operational faults. The SOP and its associated report identify the components that require maintenance, the consumables required as part of the maintenance, and the tools needed to perform the maintenance. Maintenance activities are described in Table 1. Clean, non-talc gloves must be worn when handling the Tekran equipment.

A copy of the each visit/weekly maintenance report is included in the Appendix to this document. The Report requires confirmation that specific tasks and measurements are completed. An “X” in the **Done** column indicates the task was performed. The date and time of the period impacted by each task should be indicated in the report. Users are encouraged to use the electronic version of the Report.

The completed report should be named using the naming scheme *RSSSSYYYYMM.xls*, where R is the report type (e.g., A, B, C, or D – refer to title of the corresponding SOP), SSSS is the 4-character site ID, YYYY is the 4-digit year, and MM is the 2-digit designation for the month. For example, AVT99200912.xls is the each visit/weekly maintenance report that was completed in December 2009 for VT99. A copy of the report should be submitted to the NADP Program Office at the end of each month. The information contained in the report, and in all other reports, is used when validating the data. It is important that all reports are submitted in a timely manner.

This SOP is not intended to be a troubleshooting guide. Additional information is available in the user manuals for the instrumentation, the instrument Tech Notes, and from the AMNet site liaison.

Field Activities

Table 1. Weekly Equipment Maintenance, Field Activities.

Maintenance required	None
Consumables required	None
Tools required	None

Completing the Report

Site, Block 1 - Enter the site name and the site ID. Site names are chosen during the site selection and installation process. The site ID is a four-character code that is assigned by the NADP Program Office.

1. Site	
Name:	ID:

Operator, Block 2 - Enter the name and initials of the person that performed the maintenance, and to whom questions should be directed if there are questions about the report. Three initials should be used, if possible.

2. Operator	
Name:	Initials:

Year/Month, Block 3 - Enter the year and month for the current maintenance period in the form YYYY/MM, where YYYY is the 4-digit year, and MM is the numeric designation for the month.

3. Year/Month (YYYY/MM)

Each Visit Checklist, Block 4

The checklist should be completed each time the AMNet site is visited. Separate boxes are provided for each task. Place an "X" in the box if the specified criterion is met. Tasks in the checklist that are shaded green can be verified both on-site and remotely. Tasks in the checklist that are not shaded can be verified on-site only. Green shaded items must be verified each time the system is inspected.

4. Each Visit Checklist									
	Operator initials:								
		Date	1	2	3	4	5	6	7
			X	X	X	X	X	X	X
A00	Checks performed remotely								
A01	2537 date time correct								
A02	Peak status = OK, OKF, or NP								
A03	Sample volume 5.0 L (adjustable)								
A04	Baseline voltage 0.100-0.250 V								
A05	Baseline deviations < 0.100 V								
A06	Calibration zero = 0.000								
A07	SPAN RespFctr $\geq 6 \times 10^6$								
A08	Span difference A vs B $\leq 5\%$								
A09	Desorbition blank C = 0.000 pg/m ³								
A10	PBM _{2.5} clear peak								
A11	GOM clear peak								
A12	Argon tank ≥ 200 psi								
A13	Regulator ≥ 30 psi								
A14	2537 Lamp light off								
A15	2537 Perm light blinking								
A16	1130/1135 switches to auto								
A17	1130 pump switch on								
A18	1130 pump flow switch to auto								
A19	1102 warm to touch								
A20	1102 drierite blue								

Operator Initials - Place your initials above the day the AMNet equipment was inspected. The presence of initials in this field will indicate that an operator was at the field site, and that at least one task was performed.

Checks Performed Remotely – Place an “X” in the appropriate box if the checks are performed from a remote location rather than at the field site. This indicates to the Site Liaison that some parameters cannot be verified. Fields that are shaded green must be completed.

2537 Date Time Correct - With the 2537 running, use the left or right arrows to access the RUN:TIME screen. If the 2537 clock is within 10 seconds of NIST time (<http://www.nist.time.gov/>) based on local standard time, place an “X” in the appropriate box. Refer to the Tekran user manual for instructions to reset the date and time. Include a comment in the **Notes** field if the instrument clock is adjusted.

Peak Status = OK, OKF, or NP - Observe the assigned flags below the STAT header, see column E in Table 1. Place an “X” in the appropriate box if the flags are *OK*, *OKF* or *NP*. If this condition is not met, contact the AMNet Site Liaison for guidance with the peak status, and include a comment in the **Notes** field.

Table 2. Example Tekran 2537 time screen.

A	B	C	D	E	F	G	H	I	J	K	L	M
Date	Time	Typ	C	Stat		AdTim	Vol	Bl	BlDev	MaxV	Area	ng/m3
8/15/2009	10:38:41	CLN	A	NP	0	0	0	0.158	0.054	0	0	0
8/15/2009	10:42:16	CLN	B	NP	1	216	3.66	0.158	0.057	0	0	0
8/15/2009	10:45:01	CONT	A	OKF	1	300	5	0.158	0.057	0.159	1459	0.226
8/15/2009	10:50:01	CONT	B	OK	0	300	5	0.158	0.076	0.169	34242	1.188
8/15/2009	10:55:01	CONT	A	OK	0	300	5	0.158	0.07	0.167	31578	1.176
8/15/2009	11:00:01	CONT	B	OK	0	300	5.01	0.158	0.068	0.169	36015	1.247

Sample Volume 5.0 L - The typical flow rate for the 2537 is 1 liter per minute (lpm). A collection period of five minutes yields a target volume of 5.0 L. Different flow rates will yield different target volumes. The measured volume, see column H in Table 2, should be within 2 percent of the target volume. If the measured volume is within 2% of the target volume place an “X” in the appropriate box. If the condition is not met, contact the AMNet Site Liaison for guidance with the sample volume, and include a comment in the **Notes** field.

Baseline Voltage 0.100 – 0.250V – The baseline voltage, column I in Table 2, should be between 0.100 and 0.250V. Place an “X” in the appropriate box if the baseline voltage is within this range. Refer to the user manual to adjust the baseline voltage.

Baseline Deviation < 0.100V - If the baseline deviation (column J in Table 2) is less than 0.100V, place an “X” in the appropriate box. If the baseline deviation is greater than 0.100V on a consistent basis, corrective action should be taken. Contact the AMNet Site Liaison for guidance with the baseline deviation, and include a comment in the **Notes** field.

```

CALIBRATION: S/N:0236 H/W: 2.21 S/W: 1.04 06-02-07 19:50:41
-
ZERO: A
Sample : 300 sec | BIArea : 0
Volume : 5.001 | BICorr : 0/1
Baseline: .084 V | PkMax : .000 V
B1 StDev: .04 mv | PkWid : .0 sec
Start : 06-02-07 19:32:08
-
ZERO: B
Sample : 300 sec | BIArea : 0
Volume : 5.001 | BICorr : 0/1
Baseline: .083 V | PkMax : .000 V
B1 StDev: .03 mv | PkWid : .0 sec
Start : 06-02-07 19:37:08
-
SPAN: A SOURCE
Sample : 300 sec | Area : 588238
Volume : 5.001 | AdjArea : 588238 *
HgAmt : 127.2pg | RespFctr:4624509
Baseline: .083 V | PkMax : 0.261 V
B1 StDev: .03 mv | PkWid : 16.7 sec
Start : 06-02-07 19:42:08
-
SPAN: B SOURCE
Sample : 300 sec | Area : 584465
Volume : 5.001 | AdjArea : 584465 *
HgAmt : 127.2pg | RespFctr:4594851
Baseline: .083 V | PkMax : 0.262 V
B1 StDev: .04 mv | PkWid : 17.5 sec
Start : 06-02-07 19:47:08
  
```

Figure 1. Post-calibration instrument output.

Calibration ZERO = 0.000 - Review values from the last calibration. If the value for BIArea (Figure 1), for both cartridge A and B is equal to 0.000, place an “X” in the appropriate box. If the condition is not met, contact the AMNet Site Liaison for guidance with the calibration zero, and include a comment in the **Notes** field.

SPAN RespFctr $\geq 6 \times 10^6$ – Review values for the last calibration summary. If the value for the calibration response factor (RespFctr in Figure 1) for both cartridge A and B is greater than 6 million counts, place an “X” in the appropriate box. If the condition is not met, contact the AMNet Site Liaison for guidance with the calibration response factor, and include a comment in the **Notes** field.

SPAN Difference A vs B $\leq 5\%$ - Compare the RespFctr values for cartridges A and B. If the RespFctr difference is less than 5%, place an “X” in the appropriate box. If the condition is not met, contact the AMNet Site Liaison for guidance with the calibration response factor, and include a comment in the **Notes** field.

Desorption Blank C = 0.000 pg/m³ – Review values from the last desorption cycle. The Area parameter associated with the third 1 flag should have a value of 0.000. If this is true, place an “X” in the appropriate box. Desorption cycles are discussed in greater detail in the Data Management SOP. Refer to the user manual or call the AMNet Site Liaison for assistance correcting problems with the desorption cycle, and include a comment in the **Notes** field.

PBM_{2.5} Clear Peak – Greater than 70% of the total peak should be represented in the first 5 minute particulate cycle. In addition, the second particulate cycle should be less than 20% of the total peak, and the third particulate cycle less than 10% of the total peak. Place an “X” in the appropriate box if these conditions are met. Refer to the user manual or call the AMNet Site Liaison for assistance correcting problems with the PBM_{2.5} peak, and include a comment in the **Notes** field.

GOM Clear Peak - Greater than 70% of the total peak should be represented in the first 5 minute GOM cycle. In addition, the second GOM cycle should be less than 20% of the total peak, and the third GOM cycle less than 10% of the total peak. If these conditions are met, place an “X” in the appropriate box. Refer to the user manual or call the AMNet Site Liaison for assistance correcting problems with the GOM peak, and include a comment in the **Notes** field.

Argon Tank ≥ 200 psi – Tank pressure for the argon tank should be greater than or equal to 200 psi. Place an “X” in the appropriate box if this condition is met. Replace the argon tank if this condition is not met, and document the change in the **Notes** field.

Regulator ≥ 30 psi - 2 stage regulators and line pressure greater than or equal to 30 psi is recommended. Place an “X” in the appropriate box if this condition is met. Adjust the regulator if the condition is not met, and document the change in the **Notes** field.

2537 Lamp Light Off - The Lamp indicator of the front panel of the 2537 should be off. If this condition is met, place an “X” in the appropriate box. If the Lamp indicator is on, adjust the lamp voltage according to the Tekran user manual and Tekran Tech Note TN 2537-013: *Lamp Driver Modification Kit Installation*. Document the change in the **Notes** field.

2537 Perm Light Blinking - The Perm light on the front of the 2537 should be blinking. If this condition is met, place an “X” in the appropriate box. Contact the AMNet Site Liaison for guidance if the Perm light is not blinking and include a comment in the **Notes** field.

1130/1135 Switches to Auto – There are eight switches to the left of the 1130 pump module, four switches for the 1130 and four for the 1135. All of the switches should all be set to AUTO. If this condition is met, place an “X” in the appropriate box. If the condition is not met, set all switches to the AUTO position and include a comment in the **Notes** field to indicate which switch(es) was/were corrected.

1130 Pump Switch On - The power switch for the 1130 pump is located on the front of the 1130 pump module. The switch should be in the ON position. If this condition is met, place an “X” in

the appropriate box. If the condition is not met, set the switch to ON and include a comment in the **Notes** field.

1130 Pump Flow Switch to Auto - The pump flow switch for the 1130 pump is located on the front panel of the 1130 pump module. The switch should be in the AUTO position. If this condition is met, place an “X” in the appropriate box. If the condition is not met, set the switch to AUTO and include a comment in the **Notes** field.

1102 Warm to Touch - The 1102 air drier removes moisture from the zero air. The drier should be warm to the touch. This is an indication that the air drier is working properly. If the condition is met (i.e., the air drier is warm), place an “X” in the appropriate box. **IMPORTANT:** Use caution when verifying this as the air drier may be hot. If the condition is not met, contact the AMNet Site Liaison for guidance and include a comment in the **Notes** field.

1102 Drierite Blue - The 1102 requires an upgrade (Tekran part number: 80-1102MOD-KIT) and should include an external drying canister. The canister should be filled with indicating Drierite. This material changes from blue to rose-red as it absorbs moisture. If the Drierite is blue, place an “X” in the appropriate box. Otherwise, replace the material and include a comment in the **Notes** field.

1130 unit								
A21	Denuder temperature (sample) 50 °C							
A22	Denuder temperature (desorb) 500 °C							
A23	Elutriator heater temperature (sample) 50 °C							
A24	Elutriator heater temperature (desorb) 75 °C							
A25	1130 Case temperature 35-41 °C							
A26	Sample line temperature 50 °C							
1135 unit								
A27	Pyro temperature (sample) 50 °C							
A28	Pyro temperature (desorb) 800 °C							
A29	Part temperature (sample) 50 °C							
A30	Part temperature (desorb) 800 °C							
A31	1135 Case temperature 35-41 °C							

1130 Denuder Unit

Denuder Temperature (sample) 50°C - The temperature of the denuder should be 50°C during the sampling cycle. The measurement is made from the denuder PID on the 1130. If this condition is met, place an “X” in the appropriate box. If the denuder temperature is less than 50°C, contact the AMNet Site Liaison for guidance and include a comment in the **Notes** field.

Denuder Temperature (desorb) 500°C - Forty-five minutes into the desorption cycle the denuder temperature should be 500°C. If this condition is met, place an “X” in the appropriate box. If the temperature is less than 500°C, contact the AMNet Site Liaison for guidance and include a comment in the **Notes** field.

Elutriator Heater Temperature (sample) 50°C - The elutriator temperature should be 50°C during the sampling cycle. If this condition is met, place an “X” in the appropriate box. If the elutriator temperature is less than 45°C, contact the AMNet Site Liaison for guidance and include a comment in the **Notes** field.

Elutriator Heater Temperature (desorb) 75°C - 5 minutes into the desorption cycle, the elutriator heater should be 75°C. If this condition is met, place an “X” in the appropriate box. If the elutriator heater temperature is not 75°C, contact the AMNet Site Liaison for guidance and include a comment in the **Notes** field.

1130 Case Temperature 35 - 41°C - The set point temperature for the case of the 1130 is typically 38°C. Except under conditions of severe weather, the unit should be able to maintain a temperature between 35°C and 41°C. The measurement is made from the case temperature PID on the 1130. If this condition is met, place an “X” in the appropriate box. If the case temperature is outside the expected range, contact the AMNet Site Liaison for guidance and include a comment in the **Notes** field.

Sample Line Temperature 50°C - The temperature of the sample line should be 50°C during sampling and desorption cycles. If this condition is met, place an “X” in the appropriate box. If the sample line is not 50°C, contact the AMNet Site Liaison for guidance and include a comment in the **Notes** field.

1135 Particulate Unit

Pyro Temperature (sample) 50°C - The pyrolyzer temperature should be 50°C during the sampling cycle. The measurement is made from the pyrolyzer PID on the 1135. If this condition is met, place an “X” in the appropriate box. If the pyrolyzer temperature is less than 50°C, contact the AMNet Site Liaison for guidance and include a comment in the **Notes** field.

Pyro Temperature (desorb) 800°C - Twenty five minutes into the desorption cycle, the pyrolyzer should be 800°C. If this condition is met, place an “X” in the appropriate box. If the unit has not reached this temperature after 25 minutes, contact the AMNet Site Liaison for guidance and include a comment in the **Notes** field.

Part Temperature (sample) 50°C - The particulate temperature should be 50°C during the sampling cycle. The measurement is made from the particulate PID on the 1135. If this condition is met, place an “X” in the appropriate box. If the particulate temperature is less than 50°C, contact the AMNet Site Liaison for guidance and include a comment in the **Notes** field.

Part Temperature (desorb) 800°C - Thirty five minutes into the desorption cycle, the particulate temperature should be approximately 800°C. If this condition is met, place an “X” in the appropriate box. If the heater has not reached this temperature after 35 minutes, contact the AMNet Site Liaison for guidance and include a comment in the **Notes** field.

1135 Case Temperature 35 – 41°C - The set point temperature for the case of the 1135 is typically 38°C. Except under conditions of severe weather, the unit should be able to maintain a temperature between 35°C and 41°C. The measurement is made from the case temperature PID on the 1135. If this condition is met, place an “X” in the appropriate box. If the case temperature is outside the expected range, contact the AMNet Site Liaison for guidance and include a comment in the **Notes** field.

Remarks, Block 6 - Enter any additional comments or explanation regarding the maintenance activities in this block. Please be concise and clear.

6. Remarks

Appendix

National Atmospheric Deposition Program Atmospheric Mercury Network (AMNet) Site Report A		No. of Site Visits	
1. Site		2. Operator	3. Year/Month (YYYY/MM)
Name	ID:	Station	Latitude
4. Each Visit Checklist		5. Notes	
Operator Initials	Date	1	2
	3	4	5
	6	7	8
	9	10	11
	12	13	14
	15	16	17
	18	19	20
	21	22	23
	24	25	26
	27	28	29
	30	31	31
A00	Check performed correctly		
A01	25.11 dial test passed		
A02	Break status - OK, ODS, or 70"		
A03	Sample volume 0.01 (if applicable)		
A04	Sample voltage < 0.00-0.010 V		
A05	Sample stream flow < 0.00 V		
A06	Calibration zero < 0.000		
A07	Spillover height < 0.000"		
A08	Span difference A < 0.000%		
A09	Excitation blank C < 0.000 pg/m ³		
A10	Blank 1 clear peak		
A11	Blank 2 clear peak		
A12	Regulator > 2.00 psi		
A13	Regulator > 0.00 psi		
A14	25.11 lamp light off		
A15	25.11 power light blinking		
A16	11.00 11.55 switch to auto		
A17	11.00 pump switch to on		
A18	11.00 pump flow switch to auto		
A19	11.00 warm to touch		
A20	11.00 dial with blue		
1100 unit			
A21	Desiccant temperature (sample) 50 °C		
A22	Desiccant temperature (blow) 50 °C		
A23	Substrate heater temperature (sample) 50 °C		
A24	Substrate heater temperature (blow) 75 °C		
A25	11.00 Case Temperature 55-61 °C		
A26	Sample bottle temperature 50 °C		
1105 unit			
A27	Flow temperature (sample) 50 °C		
A28	Flow temperature (blow) 800 °C		
A29	Flow temperature (sample) 50 °C		
A30	Flow temperature (blow) 800 °C		
A31	11.00 Case Temperature 55-61 °C		
6. Remarks			

At the end of the month, please upload the completed form to: <http://nadp.wvu.edu/upload/am> Problems? Contact Mark Olsen at 801-335-4232