2018 – 1st Quarter Report

Support for Conducting Systems & Performance Audits of Clean Air Status and Trends Network (CASTNET) Sites and National Atmospheric Deposition Program (NADP) Monitoring Stations - II

EPA Contract No. EP-W-18-005

Prepared for:

U. S. Environmental Protection Agency

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Table of Contents

List of Appendices

List of Tables

List of Acronyms and Abbreviations

% diff	percent difference
A/D	analog to digital converter
ARS	Air Resource Specialist, Inc.
ASTM	American Society for Testing and Materials
CASTNET	Clean Air Status and Trends Network
DAS	data acquisition system
DC	direct current
deg	degree
DVM	digital voltmeter
EEMS	Environmental, Engineering & Measurement Services, Inc.
EPA	U.S. Environmental Protection Agency
ESC	Environmental Systems Corporation
FSAD	Field Site Audit Database
GPS	geographical positioning system
lpm	liters per minute
MLM	Multilayer Model
m/s	meters per second
mv	milivolt
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
QAPP	Quality Assurance Project Plan
SOP	standard operating procedure
TEI	Thermo Environmental Instruments
USNO	United States Naval Observatory
V	volts
WRR	World Radiation Reference

1.0 CASTNET Quarterly Report

1.1 Introduction

The Clean Air Status and Trends Network (CASTNET) is a national air monitoring program developed under mandate of the 1990 Clean Air Act Amendments. Each site in the network measures acidic gases and particles and other forms of atmospheric pollution using a continuous collection filter aggregated over a one week period. Hourly averages of surface ozone concentrations and selected meteorological variables are also measured.

Site measurements are used to estimate deposition rates of the various pollutants with the objective of determining relationships between emissions, air quality, deposition, and ecological effects. In conjunction with other national monitoring networks, CASTNET data are used to determine the effectiveness of national emissions control programs and to assess temporal trends and spatial deposition patterns in atmospheric pollutants. CASTNET data are also used for long-range transport model evaluations and effects research.

CASTNET pollutant flux estimates are calculated as the aggregate product of weekly measured chemical concentrations and model-estimated deposition velocities. Total deposition is assessed using the NADP's Total Deposition Hybrid Method (TDEP; EPA, 2015c; Schwede and Lear, 2014), which combines data from established ambient monitoring networks and chemical-transport models. To estimate dry deposition, ambient measurement data from CASTNET and other networks were merged with dry deposition rates and flux output from the Community Multiscale Air Quality (CMAQ) modeling system.

As of March 2018, the network is comprised of 95 active rural sampling sites across the United States and Canada, cooperatively operated by the Environmental Protection Agency (EPA), the National Park Service (NPS), Environment and Climate Change Canada (ECCC), Bureau of Land Management (BLM) and several independent partners. AMEC-FW is responsible for operating the EPA and ECCC sponsored sites, and Air Resource Specialist, Inc. (ARS) is responsible for operating the NPS and BLM sponsored sites.

1.2 Project Objectives

The objectives of this project are to establish an independent and unbiased program of performance and systems audits for all CASTNET sampling sites. Ongoing Quality Assurance (QA) programs are an essential part of any long-term monitoring network.

Performance audits verify that all evaluated variables are consistent with the accuracy goals as defined in the CASTNET Quality Assurance Project Plan (QAPP). The parameter specific accuracy goals are presented in Table 1. Six EPA sponsored sites that are operated by AMEC-FW continue to operator meteorological sensors. Those sites are BEL116, BVL30, CHE185, IRL141, PAL190, and PND165. Five sites in WY sponsored by EPA and operated by the BLM/ARS also operate meteorological sensors and are BAS601, NEC602, BUF603, FOR604, and SHE604. No sites that operate meteorological sensors were audited during first quarter 2018.

Some or all of the additional monitored variables, NOy, CO, and SO_2 have been added to the EPA sponsored sites BVL130, HWF187, PND165, PNF126, GRS420, MAC426, ROM206, and BEL116. None of those variables were audited during first quarter 2018.

Table 1. Performance Audit Challenge and Acceptance Criteria

Sensor	Parameter	Audit Challenge	Acceptance Criteria
Precipitation	Response	10 manual tips	1 DAS count per tip
Precipitation	Accuracy	2 introductions of known amounts of water	≤ ±10.0% of input amount
Relative Humidity	Accuracy	Compared to reference instrument or standard solution	≤ ±10.0% RH
Solar Radiation	Accuracy	Compared to WRR traceable standard	≤ ±10.0% of daytime average
Surface Wetness	Response	Distilled water spray mist	Positive response
Surface Wetness	Sensitivity	1% decade resistance	N/A
Temperature	Accuracy	Comparison to 3 NIST measured baths (~ 0° C, ambient, ~ full-scale)	≤ ± 0.5° C
Temperature Difference	Accuracy	Comparison to station temperature sensor	≤ ± 0.50° C
Shelter Temperature	Accuracy	Comparison to station temperature sensor	≤ ± 2.0° C
Wind Direction	Orientation Accuracy	Parallel to alignment rod/crossarm, or sighted to distant point	≤ ±5° from degrees true
Wind Direction	Linearity	Eight cardinal points on test fixture	≤ ±5° mean absolute error
Wind Direction	Response Threshold	Starting torque tested with torque gauge	< 10 g-cm Climatronics; < 20 g-cm R.M. Young

Sensor	Parameter	Audit Challenge	Acceptance Criteria
Wind Speed	Accuracy	Shaft rotational speed generated and measured with certified synchronous motor	≤ ±0.5 mps below 5.0 mps input; ≤ ±5.0% of input at or above 5.0 mps
Wind Speed	Starting Threshold	Starting torque tested with torque gauge	< 0.5 g-cm
Mass Flow Controller	Flow Rate	Comparison with Primary Standard	≤ ± 5.0% of designated rate
Ozone	Slope	Linear regression of multi-point test gas concentration as measured with a certified transfer standard	0.9000 ≤ m ≤ 1.1000
Ozone	Intercept		-5.0 ppb ≤ b ≤ 5.0 ppb
Ozone	Correlation Coefficient		0.9950 ≤ r
Ozone	Percent Difference	Comparison with Level 2 standard concentration	≤ ±15.1% of test gas concentration
DAS	Accuracy	Comparison with certified standard	≤ ± 0.003 VDC

Performance audits are conducted using standards that are traceable to the National Institute of Standards and Technology (NIST), or another authoritative organization, and certified as current.

Site systems audits are intended to provide a qualitative appraisal of the total measurement system. Site planning, organization, and operation are evaluated to ensure that good Quality Assurance/Quality Control (QA/QC) practices are being applied. At a minimum the following audit issues were addressed at each site systems audit:

- Site locations and configurations match those provided in the CASTNET QAPP.
- Meteorological instruments are in good physical and operational condition and are sited to meet EPA ambient monitoring guidelines (EPA-600/4-82-060).
- Sites are accessible, orderly, and if applicable, compliant with OSHA safety standards.
- Sampling lines are free of leaks, kinks, visible contamination, weathering, and moisture.
- Site shelters provide adequate temperature control.
- All ambient air quality instruments are functional, being operated in the appropriate range, and the zero air supply desiccant is unsaturated.
- All instruments are in current calibration.
- Site documentation (maintenance schedules, on-site SOPs, etc.) is current and log book records are complete.
- All maintenance and on-site SOPs are performed on schedule.

- Corrective actions are documented and appropriate for required maintenance/repair activity.
- Site operators demonstrate an adequate knowledge and ability to perform required site activities, including documentation and maintenance activities.

1.3 CASTNET Sites Visited First Quarter 2018

This report consists of the systems and performance and other audit results from the CASTNET sites visited during the first quarter (January through March) of 2018. The locations and dates of the site visits for complete audits are presented in Table 2.

Table 2. Site Audit Visits

Side ID	Audit Type	Sponsor	Site Visit Date	Station Name
GRB411	FSA+Flow+Ozone	NPS	3/26/2018	Great Basin National Park

In addition to the sites listed in Table 2 that were visited for complete audits, the sites listed in Table 3 were visited to conduct Through-The-Probe (TTP) pollutant Performance Evaluations (PE).

Table 3. TTP Pollutant PE Visits

Side ID	PE Audit Type	Sponsor	Site Visit Date	Station Name
PAL190	Ozone	EPA	3/9/2018	Palo Duro

1.4 Audit Results

The observations and results of the systems and performance audits are included in Appendix A, *CASTNET Audit Report Forms* by site, arranged by audit date. Photographs of site conditions are included within each systems report where necessary. Copies of the spot reports that were sent immediately following the audit of each site are included as Appendix B, *CASTNET Site Spot Report Forms*. The Ozone PE results and observations are included in Appendix C, *CASTNET Ozone Performance Evaluation Forms.*

2.0 NADP Quarterly Report

2.1 Introduction

The National Atmospheric Deposition Program (NADP) operates three precipitation chemistry networks and two atmospheric concentration networks. The National Trends Network (NTN) has been measuring acidic precipitation since 1978. The network currently has more than 250 sites. The Atmospheric Integrated Research Monitoring Network (AIRMoN) began operation in 1992 and currently measures event based precipitation events at 6 sites. The Mercury Deposition Network (MDN) measures total mercury in precipitation samples from more than 120 stations. The MDN began operation in 1996 and includes sites throughout the US and Canada. The Atmospheric Mercury Network (AMNet) and the Ammonia Monitoring Network (AMoN) measure ambient concentrations of mercury and ammonia, respectively.

The NADP and other long-term monitoring networks provide critical information to the EPA regarding evaluating the effectiveness of emission reduction control programs from the power industry.

The NADP Program Office (PO) operates and administers the three precipitation chemistry networks (NTN, MDN and AIRMoN), two atmospheric concentration networks (AMNet and AMoN), two analytical laboratories (the Central Analytical Laboratory (CAL) located at the University of Illinois/Illinois State Water Survey and the Mercury Analytical Laboratory (HAL) located at Frontier Global Sciences), and the network equipment depot (NED).

As of March 2018 the PO and NED have moved to the Wisconsin State Lab of Hygiene (WSLH) located at the University of Wisconsin in Madison WI. The CAL is scheduled to move to WSLH during the summer of 2018.

2.2 Project Objectives

The objective of this project is to perform independent and unbiased evaluations of the sites along with its operations. These evaluations provide quality assurance pertaining to siting, sample collection and handling, equipment operation and maintenance, record keeping and field laboratory procedures.

More specifically, the surveys determine and report findings based on an established methodology consisting of completing a site questionnaire, testing the equipment and documenting with photographs the location, siting criteria, existing equipment, and any issues encountered that require such documentation.

2.3 NADP Sites Visited First Quarter 2018

This report covers the results from the NADP sites surveyed during the first quarter (January through March) of 2018. The station names and dates of the audits are presented in Table 4.

Table 4. Sites Surveyed – First Quarter 2018

Side ID	Network	Visit Date	Station Name
NV05	NTN	3/27/2018	Great Basin National Park-Lehman Cavern
UT98	NTN	3/28/2018	Green River

2.4 Survey Results

Site survey results are entered into a relational database. The database in turn generates Site Spot Reports which are distributed among the interested parties as soon as all the site data has been entered. Database tables with all the data collected and reviewed are then sent to the NADP Program Office and to the U.S. EPA Project Officers.

Other items gathered during the surveys (i.e., photographs, Belfort charts, etc.) are uploaded to EEMS' server where the NADP PO and the U.S. EPA POs can access them and download them as needed by login into the server site.

Given the volume of data generated, and the fact that data is distributed and/or is available through EEMS' server, no survey results are included in this report.

APPENDIX A

CASTNET Audit Report Forms

Field Systems Data Form

F-02058-1500-S1-rev002

Site ID	GRB411	**Technician**	Martin Valvur	**Site Visit Date**	03/26/2018

Site Sponsor (agency)	NPS	**USGS Map**	Lehman Caves
Operating Group	NPS	**Map Scale**	
AQS #	32-033-0101	**Map Date**	
Meteorological Type	Climatronics		
Air Pollutant Analyzer	Ozone, IMPROVE	**QAPP Latitude**	39.0053
Deposition Measurement	dry, wet	**QAPP Longitude**	-114.2158
Land Use	woodland - evergreen	**QAPP Elevation Meters**	2060
Terrain	complex (dessert basin and mountain)	**QAPP Declination**	
Conforms to MLM	No	**QAPP Declination Date**	
Site Telephone	(775) 234-7104	**Audit Latitude**	39.005121
Site Address 1	Great Basin Nat. Park	**Audit Longitude**	-114.215932
Site Address 2	Hwy 488	**Audit Elevation**	2058
County	White Pine	**Audit Declination**	12.5
City, State	Baker, NV		
Zip Code	89311	**Fire Extinguisher**	☑ Present
Time Zone	Pacific	**First Aid Kit**	☑
Primary Operator		**Safety Glasses**	☐
Primary Op. Phone #		**Safety Hard Hat**	☐
Primary Op. E-mail		**Climbing Belt**	☐
Backup Operator		**Security Fence**	☐
Backup Op. Phone #		**Secure Shelter**	☑
Backup Op. E-mail		**Stable Entry Step**	☑

Shelter Working Room ☑ **Make** Ekto **Model** 8810 (s/n 2652-1) **Shelter Size** 640 cuft

Shelter Clean ☑ **Notes** The shelter is in fair condition, The shelter floor has missing and crumbled tiles.

Site OK ☑ **Notes**

Driving Directions From Las Vegas travel north on Interstate 15 to exit 109 in Beaver, Utah. Travel west on 21 to Garrison, Nevada and turn left on route 487 and continue to Baker. Turn left on 488 in Baker and follow the signs to Great Basin National Park. The site is on the left of the road to the residential and office area.

Field Systems Data Form

F-02058-1500-S2-rev002

Site ID GRB411 **Technician** Martin Valvur **Site Visit Date** 03/26/2018

Potential Interferent	Minimum Distance From Measurement Apparatus	Distance	Pass = Checked
Large Point Source of SO2 or NOx	20 to 40 km		☑
Major industrial complex	10 to 20 km	mines to west	☐
City > 50,000 population	40 km		☑
City 10,000 to 50,000 population	10 km		☑
City 1,000 to 10,000 population	5 km		☑
Major highway, airport or rail yard	2 km		☑
Secondary road, heavily traveled	500 m		☑
Secondary road, lightly traveled	200 m		☑
Feedlot operations	500 m		☑
Intensive agricultural ops (including aerial spraying)	500 m		☑
Limited agricultural operations	200 m		☑
Large parking lot	200 m		☑
Small parking lot	100 m		☑
Tree line	50 m		☑
Obstacles to wind	10 times obstacle height		☑

Siting Distances OK ☑

Siting Criteria Comment

Field Systems Data Form

F-02058-1500-S3-rev002

Site ID	GRB411	Technician	Martin Valvur	Site Visit Date	03/26/2018

1	Are wind speed and direction sensors sited so as to avoid being influenced by obstructions?	☑	N/A
2	Are wind sensors mounted so as to minimize tower effects? (i.e. wind sensors should be mounted atop the tower or on a horizontally extended boom >2x the max diameter of the tower into the prevailing wind)	☑	N/A
3	Are the tower and sensors plumb?	☑	N/A
4	Are the temperature shields pointed north or positioned to avoid radiated heat sources such as buildings, walls, etc?	☑	
5	Are temperature and RH sensors sited to avoid unnatural conditions? (i.e. ground below sensors should be natural surface and not steeply sloped. Ridges, hollows, and areas of standing water should be avoided)	☑	
6	Is the solar radiation sensor plumb?	☑	N/A
7	Is it sited to avoid shading, or any artificial or reflected light?	☑	N/A
8	Is the rain gauge plumb?	☑	N/A
9	Is it sited to avoid sheltering effects from buildings, trees, towers, etc?	☑	N/A
10	Is the surface wetness sensor sited with the grid surface facing north?	☑	N/A
11	Is it inclined approximately 30 degrees?	☑	N/A

Provide any additional explanation (photograph or sketch if necessary) regarding conditions listed above, or any other features, natural or man-made, that may affect the monitoring parameters:

Field Systems Data Form

F-02058-1500-S4-rev002

Site ID	GRB411	Technician	Martin Valvur	Site Visit Date	03/26/2018

1	Do all the meterological sensors appear to be intact, in good condition, and well maintained?	☑	Temperature only
2	Are all the meteorological sensors operational online, and reporting data?	☑	Temperature only
3	Are the shields for the temperature and RH sensors clean?	☑	
4	Are the aspirated motors working?	☑	
5	Is the solar radiation sensor's lens clean and free of scratches?	☑	N/A
6	Is the surface wetness sensor grid clean and undamaged?	☑	N/A
7	Are the sensor signal and power cables intact, in good condition, and well maintained?	☑	
8	Are the sensor signal and power cable connections protected from the elements and well maintained?	☑	

Provide any additional explanation (photograph or sketch if necessary) regarding conditions listed above, or any other features, natural or man-made, that may affect the monitoring parameters:

Field Systems Data Form

F-02058-1500-S5-rev002

Site ID	GRB411	Technician	Martin Valvur	Site Visit Date	03/26/2018

Siting Criteria: Are the pollutant analyzers and deposition equipment sited in accordance with 40 CFR 58, Appendix E

1	Do the sample inlets have at least a 270 degree arc of unrestricted airflow?	☑	
2	Are the sample inlets 3 - 15 meters above the ground?	☑	
3	Are the sample inlets > 1 meter from any major obstruction, and 20 meters from trees?	☑	

Pollutant analyzers and deposition equipment operations and maintenance

1	Do the analyzers and equipment appear to be in good condition and well maintained?	☑	
2	Are the analyzers and monitors operational, on-line, and reporting data?	☑	
3	Describe ozone sample tube.		1/4 teflon by 12 meters
4	Describe dry dep sample tube.		3/8 teflon by 12 meters
5	Are in-line filters used in the ozone sample line? (if yes indicate location)	☑	At inlet only
6	Are sample lines clean, free of kinks, moisture, and obstructions?	☑	
7	Is the zero air supply desiccant unsaturated?	☐	Saturated with moisture
8	Are there moisture traps in the sample lines?	☑	Flow line only
9	Is there a rotometer in the dry deposition filter line, and is it clean?	☑	Clean and dry

Provide any additional explanation (photograph or sketch if necessary) regarding conditions listed above, or any other features, natural or man-made, that may affect the monitoring parameters:

The zero air desiccant is saturated.

Field Systems Data Form

F-02058-1500-S6-rev002

Site ID GRB411 **Technician** Martin Valvur **Site Visit Date** 03/26/2018

DAS, sensor translators, and peripheral equipment operations and maintenance

1	Do the DAS instruments appear to be in good condition and well maintained?	☐	LCD display difficault to read
2	Are all the components of the DAS operational? (printers, modem, backup, etc)	☑	
3	Do the analyzer and sensor signal leads pass through lightning protection circuitry?	☑	Met sensors only
4	Are the signal connections protected from the weather and well maintained?	☑	
5	Are the signal leads connected to the correct DAS channel?	☑	
6	Are the DAS, sensor translators, and shelter properly grounded?	☑	
7	Does the instrument shelter have a stable power source?	☑	
8	Is the instrument shelter temperature controlled?	☑	

		Stable	Grounded
9	Is the met tower stable and grounded?	☑	☑
10	Is the sample tower stable and grounded?	☑	☑
11	Tower comments?		

Provide any additional explanation (photograph or sketch if necessary) regarding conditions listed above, or any other features, natural or man-made, that may affect the monitoring parameters:

The DAS LCD display is damaged and difficult to read.

Field Systems Data Form

F-02058-1500-S7-rev002

Site ID GRB411 **Technician** Martin Valvur **Site Visit Date** 03/26/2018

Documentation

Does the site have the required instrument and equipment manuals?

	Yes	No	N/A		Yes	No	N/A
Wind speed sensor	☐	☐	☑	Data logger	☑	☐	☐
Wind direction sensor	☐	☐	☑	Data logger	☐	☐	☑
Temperature sensor	☐	☑	☐	Strip chart recorder	☐	☐	☑
Relative humidity sensor	☐	☐	☑	Computer	☑	☐	☐
Solar radiation sensor	☐	☐	☑	Modem	☐	☐	☑
Surface wetness sensor	☐	☐	☑	Printer	☐	☐	☑
Wind sensor translator	☐	☐	☑	Zero air pump	☐	☑	☐
Temperature translator	☐	☐	☑	Filter flow pump	☐	☑	☐
Humidity sensor translator	☐	☐	☑	Surge protector	☐	☐	☑
Solar radiation translator	☐	☐	☑	UPS	☐	☐	☑
Tipping bucket rain gauge	☐	☐	☑	Lightning protection device	☐	☑	☐
Ozone analyzer	☐	☑	☐	Shelter heater	☐	☑	☐
Filter pack flow controller	☐	☑	☐	Shelter air conditioner	☑	☐	☐
Filter pack MFC power supply	☐	☑	☐				

Does the site have the required and most recent QC documents and report forms?

	Present		Current
Station Log	☑	Dataview	☐
SSRF	☑		☑
Site Ops Manual	☑	Oct 2015	☑
HASP	☐		☐
Field Ops Manual	☐		☐
Calibration Reports	☑		☐
Ozone z/s/p Control Charts	☐		☐
Preventive maintenance schedul	☐		☐

1	Is the station log properly completed during every site visit?	☑	Dataview
2	Are the Site Status Report Forms being completed and current?	☑	
3	Are the chain-of-custody forms properly used to document sample transfer to and from lab?	☑	
4	Are ozone z/s/p control charts properly completed and current?	☐	Control charts not used

Provide any additional explanation (photograph or sketch if necessary) regarding conditions listed above, or any other features, natural or man-made, that may affect the monitoring parameters:

The station logbook system (Dataview) and the station maintenance reports are not current.

Field Systems Data Form

F-02058-1500-S8-rev002

Site ID	GRB411	Technician	Martin Valvur	Site Visit Date	03/26/2018

Site operation procedures

1	Has the site operator attended a formal CASTNET training course? If yes, when and who instructed?	☐	
2	Has the backup operator attended a formal CASTNET training course? If yes, when and who instructed?	☐	
3	Is the site visited regularly on the required Tuesday schedule?	☑	
4	Are the standard CASTNET operational procedures being flollowed by the site operator?	☑	
5	Is the site operator(s) knowledgeable of, and able to perform the required site activities? (including documentation)	☑	

Are regular operational QA/QC checks performed on meteorological instruments?

QC Check Performed		Frequency	Compliant
Multipoint Calibrations	☑	Semiannually	☑
Visual Inspections	☑	Weekly	☑
Translator Zero/Span Tests (climatronics)	☑	N/A	☑
Manual Rain Gauge Test	☑	N/A	☑
Confirm Reasonableness of Current Values	☑	Weekly	☑
Test Surface Wetness Response	☑	N/A	☑

Are regular operational QA/QC checks performed on the ozone analyzer?

QC Check Performed		Frequency	Compliant
Multi-point Calibrations	☑	Semiannually	☑
Automatic Zero/Span Tests	☑	Daily	☑
Manual Zero/Span Tests	☑	Monthly	☑
Automatic Precision Level Tests	☑	Daily	☑
Manual Precision Level Test	☐		☑
Analyzer Diagnostics Tests	☑	Alarm values only	☑
In-line Filter Replacement (at inlet)	☑	Every 2 weeks	☑
In-line Filter Replacement (at analyze	☐	N/A	☑
Sample Line Check for Dirt/Water	☐		☐
Zero Air Desiccant Check	☑	As needed	☑

1	Do multi-point calibration gases go through the complete sample train including all filters?	☑	Unknown
2	Do automatic and manual z/s/p gasses go through the complete sample train including all filters?	☑	
3	Are the automatic and manual z/s/p checks monitored and reported? If yes, how?	☑	Dataview

Provide any additional explanation (photograph or sketch if necessary) regarding conditions listed above, or any other features, natural or man-made, that may affect the monitoring parameters:

Field Systems Data Form

F-02058-1500-S9-rev002

Site ID GRB411 **Technician** Martin Valvur **Site Visit Date** 03/26/2018

Site operation procedures

1	Is the filter pack being changed every Tuesday as scheduled?	☑	Filter changed morinings
2	Are the Site Status Report Forms being completed and filed correctly?	☑	Flow & observation sections
3	Are data downloads and backups being performed as scheduled?	☐	No longer required
4	Are general observations being made and recorded? How?	☑	SSRF
5	Are site supplies on-hand and replenished in a timely fashion?	☑	
6	Are sample flow rates recorded? How?	☑	SSRF
7	Are samples sent to the lab on a regular schedule in a timely fashion?	☑	
8	Are filters protected from contamination during handling and shipping? How?	☑	Clean gloves on and off
9	Are the site conditions reported regularly to the field operations manager or staff?	☐	

QC Check Performed		Frequency	Compliant
Multi-point MFC Calibrations	☑	Semiannually	☑
Flow System Leak Checks	☑	Weekly	☐
Filter Pack Inspection	☐		☐
Flow Rate Setting Checks	☑	Weekly	☑
Visual Check of Flow Rate Rotometer	☑	Weekly	☑
In-line Filter Inspection/Replacement	☑	As needed	☑
Sample Line Check for Dirt/Water	☐		☐

Provide any additional explanation (photograph or sketch if necessary) regarding conditions listed above, or any other features, natural or man-made, that may affect the monitoring parameters:

Field Systems Data Form F-02058-1500-S10-rev002

Site ID GRB411 **Technician** Martin Valvur **Site Visit Date** 03/26/2018

Site Visit Sensors

Parameter	Manufacturer	Model	S/N	Client ID
Computer	Hewlett Packard	ProBook	5CB22906VO	none
DAS	Environmental Sys Corp	8816	2507	90635
Elevation	Elevation	1	None	None
Filter pack flow pump	Thomas	107CA14	0000109-84D	none
flow rate	Tylan	FC280AV	AW9403026	03387
Infrastructure	Infrastructure	none	none	none
Met tower	Climatronics	18 inch taper	none	01358
MFC power supply	Tylan	RO-32	FP9404004	03681
Ozone	ThermoElectron Inc	49C	49C-59285-322	90565
Ozone Standard	ThermoElectron Inc	49C	0330302753	none
Sample Tower	Aluma Tower	B	AT-5381-F9-2	none
Shelter Temperature	ARS	none	80	none
Siting Criteria	Siting Criteria	1	None	None
Temperature2meter	RM Young	41342	018532	none
Zero air pump	Werther International	TT70/4E	507782	90722

Site Inventory by Site Visit

Site Visit Date	*Parameter*	*Mfg*	*Owner ID*	*Model Number*	*Serial Number*
GRB411-Martin Valvur-03/26/2018					
1 3/26/2018	Computer	Hewlett Packard	none	ProBook	5CB22906VO
2 3/26/2018	DAS	Environmental Sys Corp	90635	8816	2507
3 3/26/2018	Elevation	Elevation	None	1	None
4 3/26/2018	Filter pack flow pump	Thomas	none	107CA14	0000109-84D
5 3/26/2018	flow rate	Tylan	03387	FC280AV	AW9403026
6 3/26/2018	Infrastructure	Infrastructure	none	none	none
7 3/26/2018	Met tower	Climatronics	01358	18 inch taper	none
8 3/26/2018	MFC power supply	Tylan	03681	RO-32	FP9404004
9 3/26/2018	Ozone	ThermoElectron Inc	90565	49C	49C-59285-322
10 3/26/2018	Ozone Standard	ThermoElectron Inc	none	49C	0330302753
11 3/26/2018	Sample Tower	Aluma Tower	none	B	AT-5381-F9-2
12 3/26/2018	Shelter Temperature	ARS	none	none	80
13 3/26/2018	Siting Criteria	Siting Criteria	None	1	None
14 3/26/2018	Temperature2meter	RM Young	none	41342	018532
15 3/26/2018	Zero air pump	Werther International	90722	TT70/4E	507782

DAS Data Form

DAS Time Max Error: 1.38

Mfg	Serial Number	Site	Technician	Site Visit Date	Parameter	Use Desc.
Environmental Sys	2507	GRB411	Martin Valvur	03/26/2018	DAS	Primary

Das Date: 3 /26/2018
Das Time: 8:41:17
Das Day: 85

Audit Date 3 /26/2018
Audit Time 8:42:40
Audit Day 85

Low Channel:		High Channel:	
Avg Diff:	**Max Diff:**	**Avg Diff:**	**Max Diff:**
0.0003	0.0003	0.0003	0.0003

Mfg	HY	**Parameter**	DAS
Serial Number	12010039329	**Tfer Desc.**	Source generator (D
Tfer ID	01322		
Slope	1.00000	**Intercept**	0.00000
Cert Date	6/15/2014	**CorrCoff**	1.00000

Mfg	Fluke	**Parameter**	DAS
Serial Number	95740243	**Tfer Desc.**	DVM
Tfer ID	01312		
Slope	1.00000	**Intercept**	0.00000
Cert Date	2/14/2018	**CorrCoff**	1.00000

Channel	Input	DVM Output	DAS Output	InputUnit	OutputUnit	Difference
10	0.0000	-0.0003	-0.0006	V	V	-0.0003

Flow Data Form

Mfg	Serial Number Ta	Site	Technician	Site Visit Date	Parameter	Owner ID
Tylan	AW9403026	GRB411	Martin Valvur	03/26/2018	flow rate	03387

Mfg	Tylan
SN/Owner ID	FP9404004 / 03681
Parameter	MFC power supply

Mfg	BIOS	**Parameter**	Flow Rate
Serial Number	148613	**Tfer Desc.**	BIOS 220-H
Tfer ID	01421		
Slope	0.98450	**Intercept**	0.10300
Cert Date	3/1/2018	**CorrCoff**	1.00000

DAS 1:		DAS 2:			
A Avg % Diff:	**A Max % Di**	**A Avg %Dif**	**A Max % Di**	**Cal Factor Zero**	0.339
0.33%	0.66%			**Cal Factor Full Scale**	5.798
				Rotometer Reading:	3.2

Desc.	Test type	Input l/m	Input Corr_	MfcDisp.	OutputSignal	Output S E	InputUnit	OutputSignalI	PctDifference
primary	pump off	0.000	0.000	-0.29	0.000	0.06	l/m	l/m	
primary	leak check	0.000	0.000	-0.28	0.000	0.06	l/m	l/m	
primary	test pt 1	3.070	3.010	2.43	0.000	3.00	l/m	l/m	-0.33%
primary	test pt 2	3.080	3.020	2.43	0.000	3.00	l/m	l/m	-0.66%
primary	test pt 3	3.060	3.000	2.43	0.000	3.00	l/m	l/m	0.00%

Sensor Component	Condition	Status
Leak Test		pass
Tubing Condition	Good	pass
Filter Position	Poor	Fail
Rotometer Condition	Clean and dry	pass
Moisture Present	No moisture present	pass
Filter Distance	5.5 cm	pass
Filter Depth	-2.0 cm	Fail
Filter Azimuth	190 deg	pass
System Memo	See comments	pass

Ozone Data Form

Mfg	Serial Number Ta	Site	Technician	Site Visit Date	Parameter	Owner ID
ThermoElectron Inc	49C-59285-322	GRB411	Martin Valvur	03/26/2018	Ozone	90565

Slope:	1.00068	**Slope:**	0.00000
Intercept	-1.01085	**Intercept**	0.00000
CorrCoff	0.99992	**CorrCoff**	0.00000

Mfg	ThermoElectron Inc	**Parameter**	ozone
Serial Number	49CPS-70008-364	**Tfer Desc.**	Ozone primary stan
Tfer ID	01110		
Slope	1.00801	**Intercept**	-0.05199
Cert Date	9/11/2017	**CorrCoff**	1.00000

DAS 1:		DAS 2:	
A Avg % Diff:	**A Max % Di**	**A Avg %Dif**	**A Max % Di**
3.7%	8.1%		

UseDescription	ConcGroup	Tfer Raw	Tfer Corr	Site	Site Unit	PctDifference
primary	1	0.05	0.10	-0.17	ppb	
primary	2	15.92	15.84	14.56	ppb	-8.08%
primary	3	36.42	36.18	34.63	ppb	-4.28%
primary	4	66.62	66.14	64.86	ppb	-1.94%
primary	5	110.05	109.22	108.70	ppb	-0.48%

Sensor Component	Condition	Status
Sample Train	Good	pass
22.5 degree rule		pass
Inlet Filter Condition	Clean	pass
Battery Backup	N/A	pass
Offset	0.000	pass
Span	1.003	pass
Zero Voltage	-0.1213	pass
Fullscale Voltage	9.992	pass
Cell A Freq.	83.2 kHz	pass
Cell A Noise	0.5 ppb	pass
Cell A Flow	0.75 lpm	pass
Cell A Pressure	575.3 mmHg	pass
Cell A Tmp.	42.5 C	pass
Cell B Freq.	70.8 kHz	pass
Cell B Noise	0.7 ppb	pass
Cell B Flow	0.67 lpm	pass
Cell B Pressure	574.9 mmHg	pass
Cell B Tmp.		pass
Line Loss	Not tested	pass
System Memo		pass

2 Meter Temperature Data Form

Calc. Difference

Mfg	Serial Number Ta	Site	Technician	Site Visit Date	Parameter	Owner ID
RM Young	018532	GRB411	Martin Valvur	03/26/2018	Temperature2meter	none

Mfg	Fluke	**Parameter**	Temperature
Serial Number	3275143	**Tfer Desc.**	RTD
Tfer ID	01229		
Slope	0.99986	**Intercept**	-0.01977
Cert Date	1/24/2018	**CorrCoff**	1.00000

DAS 1:		DAS 2:	
Abs Avg Err	**Abs Max Er**	**Abs Avg Err**	**Abs Max Er**
0.01	0.02		

UseDescription	Test type	InputTmpRaw	InputTmpCorrected	OutputTmpSignal	OutputSignalEng	OSE Unit	Difference
primary	Temp Low Rang	0.00	0.02	0.000	0.02	C	0
primary	Temp Mid Rang	24.45	24.47	0.000	24.49	C	0.02
primary	Temp High Rang	48.23	48.26	0.000	48.25	C	-0.01

Sensor Component	Properly Sited	**Condition**	Properly sited	**Status**	pass
Sensor Component	Shield	**Condition**	Clean	**Status**	pass
Sensor Component	Blower	**Condition**	Functioning	**Status**	pass
Sensor Component	Blower Status Switch	**Condition**	N/A	**Status**	pass
Sensor Component	System Memo	**Condition**		**Status**	pass

Shelter Temperature Data For

Mfg	Serial Number Ta	Site	Technician	Site Visit Date	Parameter	Owner ID
ARS	80	GRB411	Martin Valvur	03/26/2018	Shelter Temperature	none

DAS 1:		DAS 2:	
Abs Avg Err	Abs Max Er	Abs Avg Err	Abs Max Er
0.14	0.19		

Mfg	Fluke	Parameter	Shelter Temperatur
Serial Number	3275143	Tfer Desc.	RTD
Tfer ID	01229		
Slope	0.99986	Intercept	-0.01977
Cert Date	1/24/2018	CorrCoff	1.00000

UseDesc.	Test type	InputTmpRaw	InputTmpCorr.	OutputTmpSignal	OutputSignalEng	OSE Unit	Difference
primary	Temp Mid Range	24.51	24.53	0.000	24.6	C	0.06
primary	Temp Mid Range	24.41	24.43	0.000	24.6	C	0.19
primary	Temp Mid Range	23.57	23.59	0.000	23.4	C	-0.16

Sensor Component	System Memo	Condition		Status	pass

Infrastructure Data For

Site ID	GRB411	Technician	Martin Valvur	Site Visit Date	03/26/2018

Shelter Make	Shelter Model	Shelter Size
Ekto	8810 (s/n 2652-1)	640 cuft

Sensor Component		Condition		Status	
Sensor Component	Sample Tower Type	Condition	Type B	Status	pass
Sensor Component	Conduit	Condition	Good	Status	pass
Sensor Component	Met Tower	Condition	Good	Status	pass
Sensor Component	Moisture Trap	Condition	Installed	Status	pass
Sensor Component	Power Cables	Condition	Good	Status	pass
Sensor Component	Shelter Temp Control	Condition	Functioning	Status	pass
Sensor Component	Rotometer	Condition	Installed	Status	pass
Sensor Component	Sample Tower	Condition	Good	Status	pass
Sensor Component	Shelter Condition	Condition	Fair	Status	pass
Sensor Component	Shelter Door	Condition	Good	Status	pass
Sensor Component	Shelter Roof	Condition	Good	Status	pass
Sensor Component	Shelter Floor	Condition	Poor	Status	Fail
Sensor Component	Signal Cable	Condition	Good	Status	pass
Sensor Component	Tubing Type	Condition	3/8 teflon	Status	pass
Sensor Component	Sample Train	Condition	Good	Status	pass

Site Visit Comments

Parameter	Site	Technician	S.V. Date	Component	Mfg	Serial No.	Hazard	Problem
Flow Rate	GRB411	Martin Valvur	03/26/2018	Filter Position	Tylan	698	☐	☑

The filter attachment plate is mounted too low in the enclosure resulting in the filter being exposed to wind-driven rain and in the standard geometric orientation.

Field Systems Comments

1 **Parameter:** DasComments

The DAS LCD display is damaged and difficult to read.

2 **Parameter:** DocumentationCo

The station logbook system (Dataview) and the station maintenance reports are not current.

3 **Parameter:** ShelterCleanNotes

The shelter is in fair condition, The shelter floor has missing and crumbled tiles.

4 **Parameter:** PollAnalyzerCom

The zero air desiccant is saturated.

APPENDIX B

CASTNET Site Spot Report Forms

EEMS Spot Report

Data Compiled: 4/17/2018 2:47:33 PM

SiteVisitDate	Site	Technician
03/26/2018	GRB411	Martin Valvur

Records with valid pass/fail criteria

Line	Audited Parameter	DAS	Ch. #	Criteria +/-	Counts	QaResult	Units	Pass/Fail
1	Temperature2meter average error	P	5	0.5	3	0.01	c	**P**
2	Temperature2meter max error	P	5	0.5	3	0.02	c	**P**
3	Ozone Slope	P	0	1.1	4	1.00068	unitless	**P**
4	Ozone Intercept	P	0	5	4	-1.01085	ppb	**P**
5	Ozone correlation	P	0	0.995	4	0.99992	unitless	**P**
6	Ozone % difference avg	P	7	10	4	3.7	%	**P**
7	Ozone % difference max	P	7	10	4	8.1	%	**P**
8	Flow Rate average % difference	P	10	5	10	0.33	%	**P**
9	Flow Rate max % difference	P	10	5	10	0.66	%	**P**
10	DAS Voltage average error	P	10	0.003	10	0.0003	V	**P**
11	Shelter Temperature average error	P	5	2	18	0.14	c	**P**
12	Shelter Temperature max error	P	5	2	18	0.19	c	**P**

SiteVisitDate	Site	Technician
03/26/2018	GRB411	Martin Valvur

Field Performance Comments

1 **Parameter:** Flow Rate **SensorComponent:** Filter Position **CommentCode** 71

The filter attachment plate is mounted too low in the enclosure resulting in the filter being exposed to wind-driven rain and in the standard geometric orientation.

Field Systems Comments

1 **Parameter:** DasComments

The DAS LCD display is damaged and difficult to read.

2 **Parameter:** DocumentationCo

The station logbook system (Dataview) and the station maintenance reports are not current.

3 **Parameter:** ShelterCleanNotes

The shelter is in fair condition, The shelter floor has missing and crumbled tiles.

4 **Parameter:** PollAnalyzerCom

The zero air desiccant is saturated.

EEMS Spot Report

Data Compiled: 4/17/2018 2:45:54 PM

SiteVisitDate	Site	Technician
03/09/2018	PAL190	Martin Valvur

Records with valid pass/fail criteria

Line	Audited Parameter	DAS	Ch. #	Criteria +/-	Counts	QaResult	Units	Pass/Fail
1	Ozone Slope	P	0	1.1	4	0.99943	unitless	**P**
2	Ozone Intercept	P	0	5	4	0.50033	ppb	**P**
3	Ozone correlation	P	0	0.995	4	0.99998	unitless	**P**
4	Ozone % difference avg	P	7	10	4	0.9	%	**P**
5	Ozone % difference max	P	7	10	4	2.1	%	**P**

APPENDIX C

CASTNET Ozone Performance Evaluation Forms

Ozone Data Form

Mfg	Serial Number Ta	Site	Technician	Site Visit Date	Parameter	Owner ID
ThermoElectron Inc	1105347322	PAL190	Martin Valvur	03/09/2018	Ozone	000733

Slope:	0.99943	**Slope:**	0.00000
Intercept	0.50033	**Intercept**	0.00000
CorrCoff	0.99998	**CorrCoff**	0.00000

Mfg	ThermoElectron Inc	**Parameter**	ozone
Serial Number	49CPS-70008-364	**Tfer Desc.**	Ozone primary stan
Tfer ID	01110		
Slope	1.00801	**Intercept**	-0.05199
Cert Date	9/11/2017	**CorrCoff**	1.00000

DAS 1:		DAS 2:	
A Avg % Diff:	**A Max % Di**	**A Avg %Dif**	**A Max % Di**
0.9%	2.1%		

UseDescription	ConcGroup	Tfer Raw	Tfer Corr	Site	Site Unit	PctDifference
primary	1	0.08	0.13	1.03	ppb	
primary	2	13.63	13.57	13.86	ppb	2.14%
primary	3	37.39	37.14	37.29	ppb	0.40%
primary	4	67.96	67.47	67.93	ppb	0.68%
primary	5	113.28	112.43	113.00	ppb	0.51%

Sensor Component	Condition	Status
Sample Train	Good	pass
22.5 degree rule		pass
Inlet Filter Condition	Clean	pass
Battery Backup	N/A	pass
Offset	-0.6	pass
Span	1.013	pass
Zero Voltage	N/A	pass
Fullscale Voltage	N/A	pass
Cell A Freq.	85.5 kHz	pass
Cell A Noise	0.6 ppb	pass
Cell A Flow	0.72 lpm	pass
Cell A Pressure	648.1 mmHg	pass
Cell A Tmp.	31.4 C	pass
Cell B Freq.	95.7 kHz	pass
Cell B Noise	0.6 ppb	pass
Cell B Flow	0.61 lpm	pass
Cell B Pressure	647.5 mmHg	pass
Cell B Tmp.		pass
Line Loss	Not tested	pass
System Memo		pass