

**40 Code of Federal Regulations (CFR)  
Part 58 Technical Systems Audit (TSA)  
of Clean Air Status and Trends Network  
(CASTNET) Program  
Ozone Monitoring Process**

by

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## Summary

This document reports the audit findings made by RTI International (RTI) after conducting a Technical Systems Audit (TSA) on the ozone collection process and ozone data and data management operated by Wood Environment & Infrastructure Solutions, Inc. (Wood E&IS) for the Clean Air Status and Trends Network (CASTNET) program. A TSA is an on-site review and inspection of an air monitoring program to assess its compliance with established regulations governing the collection, analysis, validation, and reporting of ambient air quality data.

RTI prepared questionnaires based on 40 Code of Federal Regulations (CFR) Part 58 and Appendix H of the *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Quality Monitoring Program, January 2017 (QA Handbook)*. Prior to the TSA, two questionnaires (Monitoring Site and Ozone Calibration Laboratory Questionnaire and Data Review and Data Management Questionnaire) were provided to Mr. Kemp Howell, the Project Manager and Mr. Marcus Stewart, the Quality Assurance (QA) Manager for their initial review and submitted later to key Wood E&IS staff and the Georgia Station (GAS153) site operator. The Wood E&IS management and staff provided responses to a majority of the questions on the questionnaires and the RTI auditors completed the questionnaires during the audit process. All responses from the Wood E&IS management and staff and site operator were included in the questionnaires (Appendices A and C).

The RTI audit team consists of Mr. Jeff Nichol and Dr. Prakash Doraiswamy. Mr. Nichol visited the GAS153 monitoring site in Georgia and the Field Calibration Laboratory in Newberry, Florida. He conducted interviews with the Wood E&IS management and staff and the site operator on various aspects of the air monitoring program including the network design, field operations, laboratory operations, data handling, and quality assurance and quality control procedures. Dr. Doraiswamy reviewed the ozone raw data records from the Georgia Station (GAS153) site and compared the data posted to the CASTNET, AIRNow Tech, and Air Quality System (AQS) database. He also performed a review of the overall ozone data management system and QA/QC checks from the site through Wood E&IS to AIRNow Tech and AQS.

The findings listed below were based on a small sample set (one field site visit, a visit the Field Calibration Laboratory, and a remote review of the ozone data streams from the site) overseen by Wood E&IS. The field findings should not be used to characterize the field operations of the CASTNET sites operated by Air Resource Specialists, Inc. (ARS) for the National Park Service (NPS) or Bureau of Land Management - Wyoming State Office (BLM-WSO). Further review of the entire network should be conducted to verify if the findings are an anomaly or consistent throughout the entire CASTNET network.

During the audit of the CASTNET ozone process (EPA-governed field site), Ozone Calibration Laboratory, Field Operations Laboratory, and data management reviews) performed by Wood E&IS, RTI was extremely impressed with several aspects of the program such as:

- The Wood E&IS management structure that oversees the CASTNET program is precise and well organized, the support staff are knowledgeable, cooperative, and supportive to the program, and the verbal supportive communication links between Field Operations Laboratory staff and site operators is advantageous and provides a valuable means of communication and support to the program.
- The increasing use of the iCASTNET software program for data management and data review working has streamlined the data reviewing process to provide staff with error messages faster to resolve problems and issues at the field sites. With the increasing development of the uses for the iCASTNET software, the CASTNET program could become more electronic in nature and reduce the hard copy management of documents such as field logbooks, field notes of site operators, and SSRFs. Moving to a complete electronic platform will improve recordkeeping; data recording, reviewing, and reporting; save on level of effort for data entry from SSRF and secondary data entry review; and overall improvement in communications between field site operators and Field Operations Laboratory.

- The Wood E&IS data management system is impressive. All levels (1, 2, and 3) of data validation are preserved allowing traceability to the raw data if required. It is a well-established system that handles large volumes of data in a seamless manner without interruptions. The levels of QA validation are commendable. The current data reviewing process includes three levels of data validation. The first level is a series of automated screening protocols that assigns flags and screens data sent to a field operations staff on a daily basis. A data analyst monthly reviews the screened data and develops reports to cover missing data. The Level 2 validation archives all data into a single table. The Level 3 validation is a more detailed review of the data (review SSRFs, site operator's logs, recent calibration and verification (Zero-Span-Precision (ZSP) checks) to determine problems and issues. The complete process is tracked electronically and with hard copy forms.
- Older equipment and instrumentation have been replaced out with consistent and current state of the art instrumentation (Thermo 49i, Campbell CR3000, and mass flow controllers). In 2017, a Nafion dryer was added to the ozone sampling train at the GAS153 site to help maintain and control relative humidity disturbances and fluctuations.
- Multiple calibration and verification checks of the measurement system are performed with three levels of NIST-traceable standards (Level II transfer standards, Level III onsite standard, and Level IV site analyzer).
- Supportive QA/QC documentation (QAPP, SOPs, checklist, SSRF, field logbooks) is maintained and the staff are striving to streamline all record management to become more efficient with the use of electronic data recording and management.

### **Overall Findings**

Since the last TSA conducted in 2015, Amec Foster Wheeler has changed its name to Wood Environment & Infrastructure Solutions, Inc. As a global check of all documentation, Wood E&IS management should review the QM, SOPs, and forms to reflect the name change.

However, RTI did have a few findings of deficiencies that should be addressed or clarified. The major deficiencies are listed below and are discussed in detail in this report.

- At the field site, there are no records maintained to show the training of the site operators. (Finding 1, page 6)
- At the field site, there were no records (missing) of the last or any NPAP performance audits or TSAs or PEs conducted by EE&MS. (Finding 2, page 6)
- AQS flags for invalid data should include more detail to represent the actual activity or cause. Currently, all "B" flags in Wood E&IS data are translated to "AN- Machine Malfunction" which would also include periods of ZSP checks, audits, etc. More appropriate AQS flags are recommended to be used. (Finding 3, page 16)

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## Section 1: Introduction

The Wood Environment & Infrastructure Solutions, Inc. (Wood E&IS) office located in Newberry, Florida (FL) has the responsibility of overseeing the sample collection at the monitoring sites for the Clean Air Status and Trends Network (CASTNET) program. At these sites, ozone data is collected based on the requirements stated in 40 Code of Federal Regulations (CFR) Part 58.

RTI performed technical systems audits (TSAs) of the ozone collection process and data and data management operated by Wood E&IS. For this TSA, an RTI auditor visited a monitoring site located in Georgia (GA) and the Field Calibration Laboratory in Newberry, FL. The TSA was based on the procedures and processes used by Wood E&IS management to measure ambient air quality (ozone) and reporting the data and other related information as stated in 40 CFR Part 58. The specific areas of monitoring criteria RTI reviewed and observed were:

1. Quality assurance procedures for monitor operation and data handling
2. Methodology used in monitoring stations
3. Operating schedule
4. Siting parameters for instruments or instrument probes
5. Minimum ambient air quality monitoring network requirements used to make decisions (network design requirements – number of sites and samplers used)
6. Air quality data reporting and requirements involved.

Mr. Jeff Nichol conducted the TSAs of the field site GAS153 located near agricultural fields operated by the University of Georgia (UGA) - Griffin campus and the Field Calibration Laboratory located in Newberry, FL. Dr. Prakash Doraiswamy remotely performed the evaluations of the management of the ozone data. The key Wood E&IS staff members involved during the auditing process were:

- Mr. Kemp Howell (Project Manager),
- Mr. Marcus Stewart (Quality Assurance Manager),
- Mr. Chris Rogers (Data Management, Analysis, Interpretation, and Reporting Manager),
- Mr. Kevin Mishoe (Field Operations Manager),
- Mr. Michael Smith (Assistant Field Operations Manager), and
- Ms. Anna Karmazyn (Lead Data Validator).

The site operator that participated in the monitoring site TSA was:

- Mr. Samuel Wright (GAS153).

Sections 2, 3, 4, 5, 6, and 7 of this report discuss the general findings of the Wood E&IS's ozone collection process; network management; field operations at the monitoring site; laboratory operations at the Field Calibration Laboratory; data management and quality assurance/quality control within the ozone collection process, respectively. The appendices are copies of the questionnaires and responses used during the audit and pictures of the GAS153 monitoring site.

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## Section 2: General Program

In 2011, the U.S. EPA upgraded all ozone monitoring equipment at the CASTNET monitoring sites to comply with the requirements stated in 40 CFR Part 58. Each CASTNET site that collects hourly ozone data must meet the additional audit requirements and comply with the data reporting deadlines set forth in the CFR. Wood E&IS is responsible for providing technical support to the site operators (subcontractors); maintaining the operation of all field equipment; collecting, analyzing, and reporting the ozone data; and developing an auditing program to meet the CFR requirements. Wood E&IS submits the real time CASTNET hourly ozone data to [AIRNow](#) (AirNow-Tech) and also submits the data to the CASTNET website daily. In addition, Wood E&IS submits the CASTNET ozone data to the Air Quality System (AQS) database.

During the visits to the field site, the Field Calibration Laboratory visit, and review of the ozone data and data management, the RTI auditors concluded that the requirements in the CFR were being met. The Wood E&IS management and support staff structure at the main laboratory in Newberry, FL is well-organized and documented in the CASTNET Quality Assurance Project Plan (QAPP), Revision 9.1 dated October 2017 and posted at [https://www3.epa.gov/castnet/docs/QAPP\\_v9-1\\_Main\\_body.pdf](https://www3.epa.gov/castnet/docs/QAPP_v9-1_Main_body.pdf) (Revision 9.2 is currently under review). The QA Manager and field support staff were knowledgeable of their job requirements and very cooperative during the audit. There is an established communication chain between management and support staff and a supportive communication link (Call Log) performed weekly (after the Tuesday sample collection and completion of the Site Status Report Form (SSRF) documentation) between the staff at the Field Operations Laboratory and the site operators.

Prior to the TSA, the QA Manager provided the location (<http://java.epa.gov/castnet/documents.do>) of the documentation used for the CASTNET quality management system (QMS). At this website, the auditors found the current QAPP, supportive Standard Operating Procedures (SOPs), and quarterly QA reports. The QAPP was written in accordance with U.S. EPA Guidance Documents, “*EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5)*” (EPA, reissued May 2006), and “*EPA Guidance for Quality Assurance Project Plans (EPA QA/G-5)*” (EPA, December 2002) and contains all (some need updating) of the necessary elements for an EPA-approved QAPP. The current QAPP contains information regarding the CASTNET project organization with U.S. EPA Clean Air Markets Division (CAMD), Wood E&IS, NPS, and BLM-WSO. The QAPP integrates all technical and quality aspects of a project, including planning, implementation, and assessment, and documents the quality assurance and quality control that are applied to an environmental data operation to assure the results obtained are of the type and quality needed and expected. The SOPs are written in accordance with U.S. EPA Guidance Documents, “*EPA Guidance for Preparing Standard Operating Procedures (SOPs) (EPA QA/G-6)*” (EPA, reissued April 2007). Both QAPP and SOPs are reviewed and updated annually.

Wood E&IS has developed a Quality Management Plan (QMP) that is Revision 4, dated June 1, 2018. The QMP was written in accordance with U.S. EPA Guidance Documents, “*EPA Requirements for Quality Management Plans (EPA QA/R-2)*” (EPA, March 2001). All pertinent elements of the QMP regulations and guidance are addressed in this document. The document is proprietary and will not be posted on the CASTNET website. The document has been signed and dated by the Director of Quality Assurance (Ms. Ann Bernhardt), the Associate Quality Assurance Manager (Ms. Anne Glubis), and the Chief Executive Officer of Wood E&IS (Ms. Ann Massey).

### Findings

Since the last TSA conducted in 2015, Amec Foster Wheeler has changed its names to Wood Environment & Infrastructure Solutions, Inc. Wood E&IS management should conduct a global check of all documentation, including QA documents such as the QAPP, SOPs, and forms used for the CASTNET program to reflect the name change.

The RTI auditors discussed the overall quality management program for CASTNET (ozone collection) with the Wood E&IS management and staff (including site operator). The QA documentations used were the QAPP

(Revision 9.1 dated October 2017) and SOPs on the CASTNET website and any forms associated with the program. The RTI auditor found a few concerns (**Findings 1 and 2**) regarding the maintaining records for the CASTNET program at the field sites.

### **FINDING 1:**

There were no records maintained at the field site to demonstrate the training of the site operators

#### **Discussion:**

##### **Field Site:**

When the RTI auditor visited the field site, he could not find any evidence of training records (electronic or hard copies) demonstrating the site operator was capable of performing his job. Mr. Wright stated he was trained by the previous site operator and has taken over the site operator role in 2015. The RTI auditor checked the site's laptop computer for training records and also reviewed the site's logbook. He could not find any training files on the laptop desktop. He also checked and reviewed the entries for the January and July 2018 6-month calibration in the Calibration Folder for documentation of any training. No training notes stood out. He reviewed the site's logbook for training records during the 6-month calibration entries, but much of the writing was too difficult to read (illegible). In observing the site operator during the visit, the RTI auditor is totally convinced the site operator has full capability to perform his functions at the site for ozone collection.

##### **Ozone Calibration Laboratory:**

The RTI auditor discussed the training program with the QA Officer. The training program for new site operators is generally conducted during a 6-month calibration. The calibrator completes a Site Operator Evaluation Questionnaire and follows up on subsequent 6-month calibration visits. The questionnaire is maintained on the Wood E&IS network server. Mr. Michael Smith completed a questionnaire for Mr. Wright (site operator) on May 8, 2016. The QA Officer reviews statistics (data capture and accuracy checks) pulled from database entries and logbooks of the site operator's performance to determine if further training is needed. The training is also reinforced through the 6-month calibrations and through telephone communications.

### **RECOMMENDATION:**

It is possible that all field TSAs will not include a visit to the Ozone Calibration Laboratory. Wood E&IS appears to have a training program designed for their site operators and the documentation demonstrating the steps are maintained at the Newberry facility, but documentation of this training program should extend to records at the field site. These records then would be assessable to any auditor that visits the site. Wood E&IS should extend their current training protocol for accessing, reviewing, and maintain training records for the site operators to include placing those records on the site's laptop computer. This possibly can be set up at the Newberry facility through their network server and then placed on the site's computer desktop by the QA Officer after a 6-month calibration. ARS that oversees the NPS CASTNET field sites has developed a Site Visitation Checklist that is a simple form to track activities during the 6-month calibrations. This form has 10 sections (included a training tracking section) that the field staff calibrator checks while conducting the calibration. It is part of the 6-month check and can be electronically placed in a folder on the site's laptop computer desktop at the completion of the 6-month calibration. This form along with your current Site Operator Evaluation Questionnaire will help supplement training records for the site operator at the site.

### **FINDING 2:**

There were missing or no records of the last or any NPAP performance audits or TSAs or PEs conducted by EE&MS

## Discussion:

### Field Site:

At the field site, there were no records or missing records of any NPAP performance audits or TSAs or PEs conducted by EE&MS. There is a folder on the site's laptop computer desktop for the 6-month calibration performed over the last four years, but this folder does not contain any information of NPAP or EE&MS audits. In reviewing the 6-month calibrations for 2018 (July) at this site, the RTI auditor was not able to locate PDF copies of the Excel files for components calibrated such as shelter temperature or sample (ozone) temperature. The site calibrator should develop PDFs for all of the components calibrated or verified during the 6-month calibration.

### Ozone Calibration Laboratory:

The RTI auditor discussed the lack (missing) of assessment reports for PEs and TSAs at the field site with the QA Officer. Mr. Stewart was able to provide the copies of the PE audit conducted by the State of Georgia on May 10, 2018, the last TSA and annual PE conducted by EE&MS on May 10, 2018, and the last NPAP audit conducted by EPA Region 3 on August 14, 2018. A Wood E&IS staffer later informed the RTI auditor that NPAPs may be out of their hands depending on EPA decisions on what their auditors leave onsite. The introduction of the EPA Performance Evaluation Audit Tool (PEAT) at least initially meant that there was no official document available to leave onsite. Data went directly into the interface program to be loaded automatically into AQS. What has received since the PEAT program development; has been provided by the individual auditor from their personal record of the audit.

NOTE: PEAT is a tool that assists auditors in performing NPAP audits for sites. Audits can be scheduled, performed and the results uploaded immediately to AQS. All data is verified against AQS data and business rules to ensure the submitted data will be accepted by AQS.

During discussions with the Field Operations Manager, it was explained that the calibrator is supposed to place the PDF forms on the site's laptop computer desktop in the Calibration Folder. The calibrator also places an Excel spreadsheet with data from the calibrations for all components in this folder. In this instance, he believes the calibrator just forgot to place the shelter and sample (ozone) temperature sensor forms in the folder as a PDF file. He showed the RTI auditor the Excel spreadsheet for the July 2018 calibration and there were worksheets for the shelter temperature and sample temperature sensor calibrations.

## RECOMMENDATION:

All assessments (audits) conducted at the field site should have a record of the audit maintained at the site. Wood E&IS should develop an assessment folder for the site's computer desktop to maintain records for internal and external assessments of the ozone collection program. If the NPAP audits are directly loaded to EPA AQS database through PEAT, Wood E&IS management should be pulling the results to confirm the site is within NPAP acceptance limits for ozone. These results should then be posted to the site's laptop computer as site records.

Currently, there is a folder for the site's 6-month calibrations, but other external audits, PEs, and TSAs should also be placed in a folder on the site's computer. Be consistent in these folders from one site to another throughout the CASTNET program. For 6-month calibrations, be sure the calibrator places all forms in the folder for that audit. It would also be recommended to place the summary form so the auditor would have an understanding of the devices and parameters audited/calibrated.



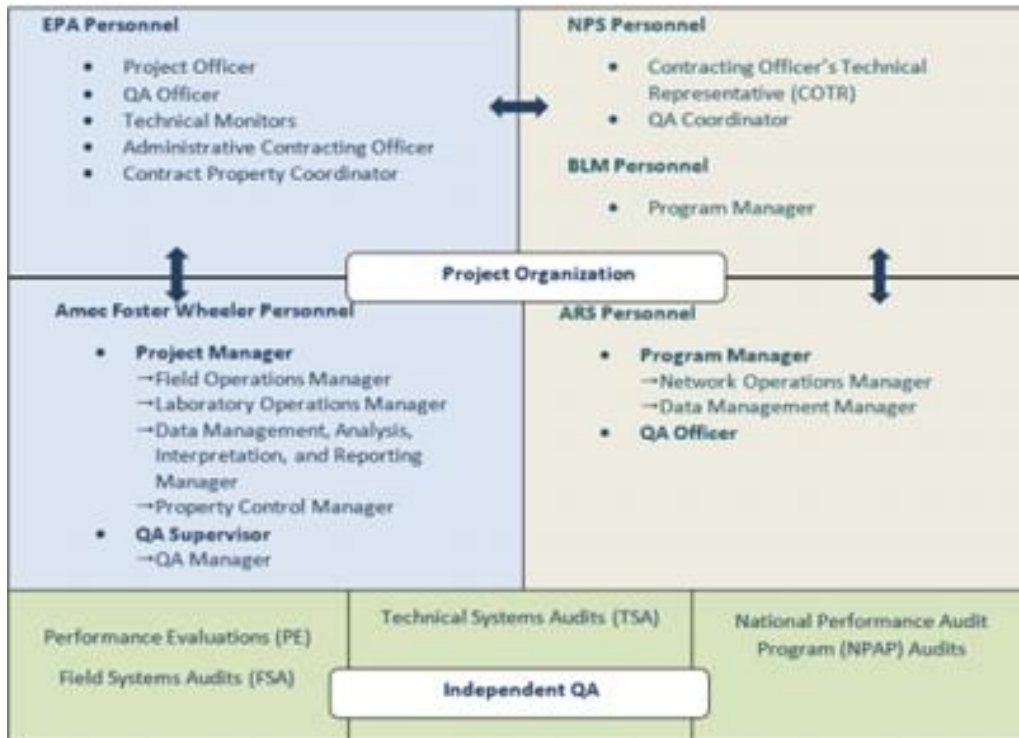
## Section 3: Network Management

Wood E&IS along with Air Resource Specialists, Inc. (ARS) operate and maintain the ozone collection network for the CASTNET program. ARS is primarily responsible for overseeing the NPS and BLM-WSO sites and reporting validated data from those sites to Wood E&IS. Wood E&IS oversees the EPA sites, but Wood E&IS is ultimately responsible for the data collection, management, and reporting of the ozone data from all CASTNET monitoring sites. The network consists of 83 monitoring sites. The most recent network assessment was the “CASTNET 2018 Annual Network Plan”, dated June 29, 2018 and the annual network plan can be found at [https://www.epa.gov/sites/production/files/2018-06/documents/castnet\\_plan\\_2018\\_final\\_0.pdf](https://www.epa.gov/sites/production/files/2018-06/documents/castnet_plan_2018_final_0.pdf). Mr. Tim Sharac of U.S. EPA CAMD in Washington D.C. Office has custody of the network plan and the plan is maintained on the CASTNET website (<http://epa.gov/castnet/javaweb/index.html>).

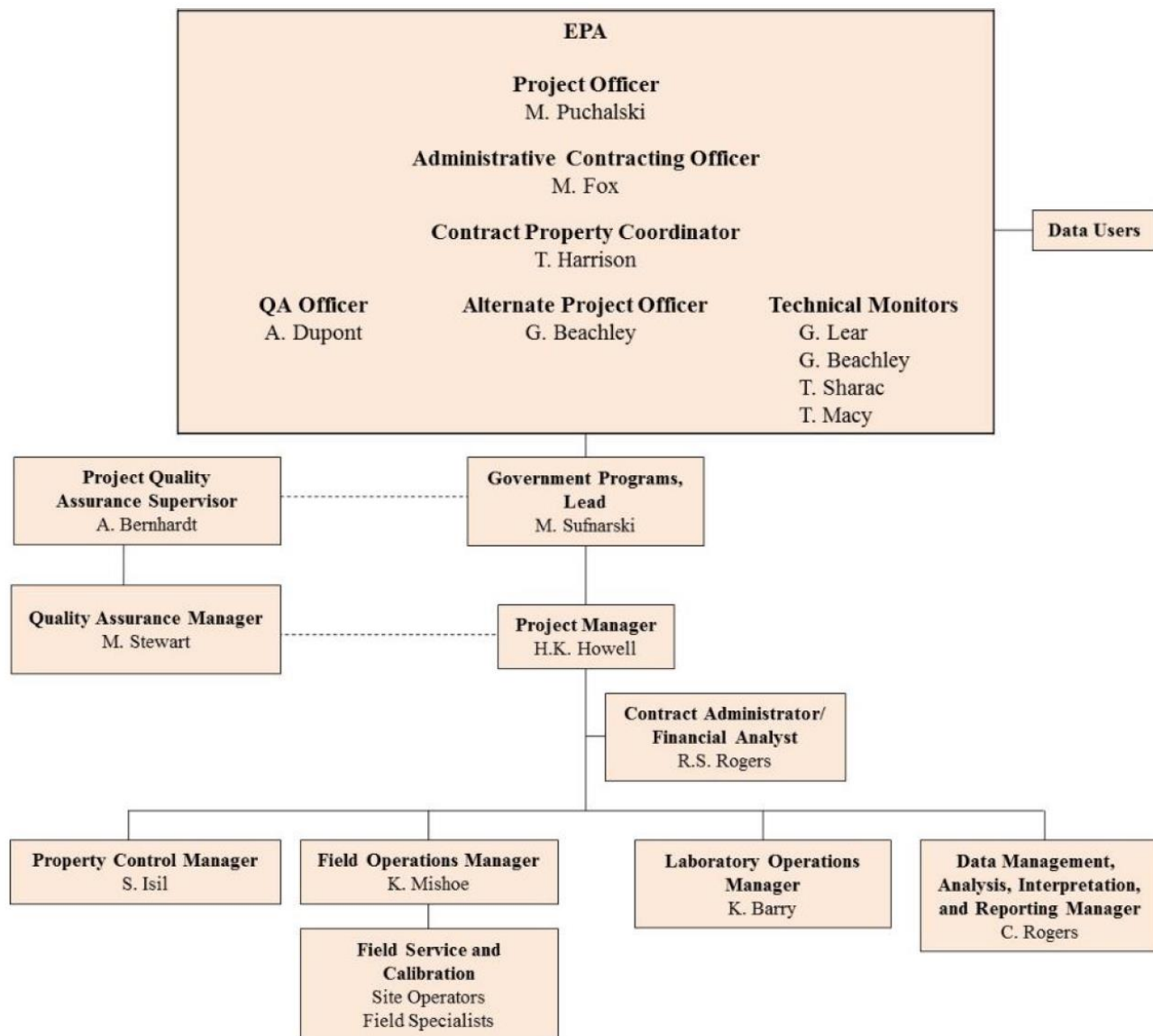
During this TSA, RTI visited the GAS153 located near agricultural fields operated by the University of Georgia (UGA) - Griffin campus. Based on 40 CFR Part 58, the site is within siting criteria requirements and has not requested or received any waivers. The distance from roadways, obstructions, trees were all within the EPA criteria. The inlet heights were all within the required range in 40 CFR 58, Appendix E. The site is outfitted with a datalogger and data is backed up on the computer and a server database.

**Exhibit 1** displays the current organizational chart for the CASTNET Project Organization working on the CASTNET program and **Exhibit 2** provides the organizational chart for Wood E&IS working on the CASTNET program.

**Exhibit 1. CASTNET Project Organization**



## Exhibit 2. EPA-Wood E&IS Project Organization



## FINDINGS

No problems or issues base on the review of the visited site and discussions with the Wood E&IS management and QA Manager.

## Section 4: Field Operations

Wood E&IS oversees the EPA-governed CASTNET monitoring sites. During this TSA, RTI visited the GAS153 field site located near agricultural fields operated by the University of Georgia (Griffin campus) in Georgia. Below is a table of information regarding the site location, site and backup operators, equipment for each site, GPS coordinates, and site elevation. The GPS coordinates and site elevation were measured by the RTI auditor and confirmed against the data for the sites on the CASTNET website.

	<b>GAS153</b>
Site Location Address (Deliveries)	University of Georgia Station Department of Biology & Ag Engineering Griffin, GA 30223-1797
AQS Number	132319991
Site Operator Contact Information	Samuel Wright <a href="mailto:sw021683@uga.edu">sw021683@uga.edu</a>
Backup Site Operator Contact Information	Daniel M. Evans <a href="mailto:dmevans@griffin.uga.edu">dmevans@griffin.uga.edu</a>
Site Ozone Analyzer (Manufacturer, S/N, EPA Decal)	Thermo 49i S/N: 103244807 EPA Decal: 000705
Transfer Standard Site Ozone Analyzer (Manufacturer, S/N, EPA Decal)	Thermo 49i S/N: 0726124692 EPA Decal: 000371
GPS Coordinates	N 33.1812° W 84.4101°
Elevation	267 ft. (81.38 m)

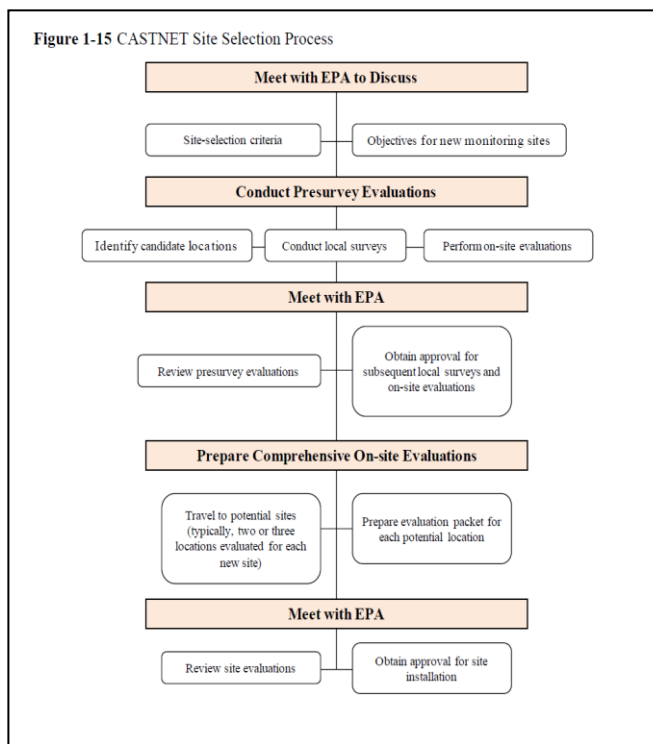
The CASTNET Field Operations Team oversees the field activities for the EPA-governed sites. The site operators (subcontractors) collect the field samples and complete the SSRFs based on procedures listed in CASTNET QAPP Appendix 1 Standard Operating Procedures, but Mr. Mishoe and Mr. Smith complete most of the operational oversight either remotely or onsite. Mr. Mishoe is responsible for the development of the sites and works with Mr. Smith to train site operators; oversee the operation, calibration, and maintenance of the equipment; and maintenance of the monitoring sites conducted by the field staff, subcontractors, and site operators. Mr. Smith remotely coordinates the field operations and provides logistical support of the field operations with assistance from Ms. Heidi Schwing from his office in Newberry, FL. Ms. Anna Karmazyn performs the data validation of the daily electronic data from the site's data loggers and reviews routine sampler data and quality control data. The QA Manager (Mr. Stewart) reviews and authorizes her decisions. Mr. Mishoe and Mr. Smith provide insight for results of the ZSP checks. Ms. Selma Isil is the CASTNET Property Control Manager and reviews completed calibration forms. Ms. Elaine Valcourt, Mr. Richard Humes, and Ms. Ruby Wyrosdick review the SSRFs when they arrive at the Newberry laboratory.

At the EPA-governed sites, two forms (hard copy and electronic) of data streams are used for ozone collection process, but primarily only the electronic data is submitted to AIRNow-Tech and AQS. The site operator does enter some data from the CR3000 data logger program on the SSRF such as: noise check, sample frequency, cell pressure, cell temperature, sampler flow rate, offset/background, span/coefficient, and the results of the last audit calibration as well as recording site activities in a site logbook. The CR3000 data logger program also is designed to complete a zero, span, and precision (ZSP) check every day at 1:46 am (takes approximately 20 minutes) and a weekly multi-point verification check on Sunday. All electronic data is saved on the data logger and transmitted to the Wood E&IS server. The procedure for conducting the QA checks (Sunday multi-point verification and ZSP checks) is documented in the CASTNET QAPP Appendix 1 Field SOP Section 3A-5.

All sites installation is prepared by an Installation Team and Station Initiation Team (generally the same Wood E&IS staff). The GAS153 site was selected in 1988 for the National Dry Deposition Network (NDDN) and was later absorbed into CASTNET program in 1998. Specific site selection documents from 1988 are not available. In October 2009, ozone collection was initiated using an ozone generator as the site transfer standard. In January 2011, the site transfer standard was updated to a Level 2 standard to meet the requirements of 40 CFR Part 58. In July 2017, a Nafion dryer was added to the ozone collection system to assist in mitigating relative humidity in the sample line.

For future site installations, the staff will use the CASTNET Site Selection Process (see Figure 1-15 from CASTNET QAPP displayed below). EPA approval is acquired prior to installation and all initial certifications of equipment are maintained in the Calibration Folder on the site’s laptop. Initial training is provided to the site operator by the Installation Team.

The site operators visit the site every Tuesday as stated in the Field SOPs. In some cases the site operator might visit more frequently if they are responsible for other networks at that monitoring site. Site operators report the filter pack flow rates indicated by the PC200W software of the sampler’s mass flow controllers. At the time of the TSA, the site operator does not conduct flow rate or leak checks. The site operator performs a noise check every week and replaces the inlet filter every two weeks. After collecting their filter packs and verifying the ozone collection process is working properly, the site operator calls the Wood E&IS Laboratory by telephone and discusses the weekly sampling event with the Field Operations Manager or other Wood E&IS staff and then submits sampled filter pack and SSRF to the Wood E&IS Laboratory. The site operators do not send any ozone data to the Wood E&IS Laboratory. This is all performed electronically through the data acquisition system (DAS).



## FINDINGS

No problems or issues based on the review of the visited site and discussions with the Wood E&IS management and QA Manager.

### 4.1 GAS153 Field Site

On November 6, 2018, Mr. Nichol met Mr. Samuel Wright (site operator) at his office on the University of Georgia (UGA) - Griffin campus. The GAS153 site is located south of the Griffin campus near agricultural fields operated by UGA staff. GAS153 was initially established as a NDDN site for acid rain deposition and currently is a National Atmospheric Deposition Program (NADP) National Trends Network (NTN) and Ammonia Monitoring Network (AMoN) site. During the drive to the site, Mr. Nichol discussed the overall scope of the field TSA with Mr. Wright and Mr. Wright elaborated on the field activities that he conducted every Tuesday. These activities included reviewing the ozone collection operation and collecting the filter pack sample; data review, collection, and transfer; housekeeping needs at the site; and confirming field operations are operating properly.

Field operations performed by the site operator follows the CASTNET field SOPs provided by the QA Manager. These SOPs (dated October 2017) were installed on the site's laptop computer desktop prior to the site visit by the RTI auditor. The site operator (Mr. Wright) has been the site operator since 2015 and a Site Evaluation Questionnaire was completed by Mr. Smith on May 8, 2016 discussing Mr. Wright's operational performance. During the site visit, Mr. Wright seemed very knowledgeable of the field operations for the ozone sample collection process. He stated he was trained by the previous site operator and does attend the 6-month calibrations, but could not provide documentation showing the dates and what training was received.

Mr. Wright maintains a field logbook (2-3 carbonless paper) and sends the white page to the Field Operations Laboratory upon completion. Copies of completed SSRFs are maintained a 3-ring binder and there were no obsolete documents (SOPs) present. The inside of the shed was maintained and clean. The auditor could sense that maintenance was routinely performed inside the shed and the surroundings of the site.

Maintenance and repair work on instruments is performed at the monitoring site if possible through the direction of Mr. Mishoe or Mr. Smith. When repairs are not possible onsite, equipment is sent back to the Wood E&IS Field Operations Laboratory, which serves as the centralized maintenance and repair facility.

*Site Description*

The site is used to collect CASTNET, NADP NTN, and AMoN field samples. It is a secure location and only UGA staff has access. The agricultural fields are located south of the CASTNET and NADP/NTN sites. A minimum 100-ft. circle extending around the ozone collection-CASTNET filter pack sampling tower is native grass. The NADP/NTN site is approximately 500 feet (152 m) to the south of the CASTNET site. The shelter is roughly 8-ft tall with a 10-m (ozone collection-CASTNET filter pack sampling) tower located slightly to the west at approximately 2.2 meter distance. There is a second shelter (trailer) approximately 18.2 meters to the east of the 10-meter tower (ozone collection). A satellite dish is located next to the second shelter approximately 22.3 meters from the ozone collection-CASTNET tower. An AMoN sampler is 12.4 meters to the west of the ozone collection-CASTNET tower. Pictures of the 8 cardinal directions were taken and are provided in Appendix B. All items (equipment, towers, and shed) at the site are listed in the table below. Natural grass covers the ground within the 30 meter circle from the shed that houses the ozone analyzers. Beyond the 30 meter circle are agricultural fields in all directions.

Georgia Station Field Site (GAS153) Measurements (11/6/2018)

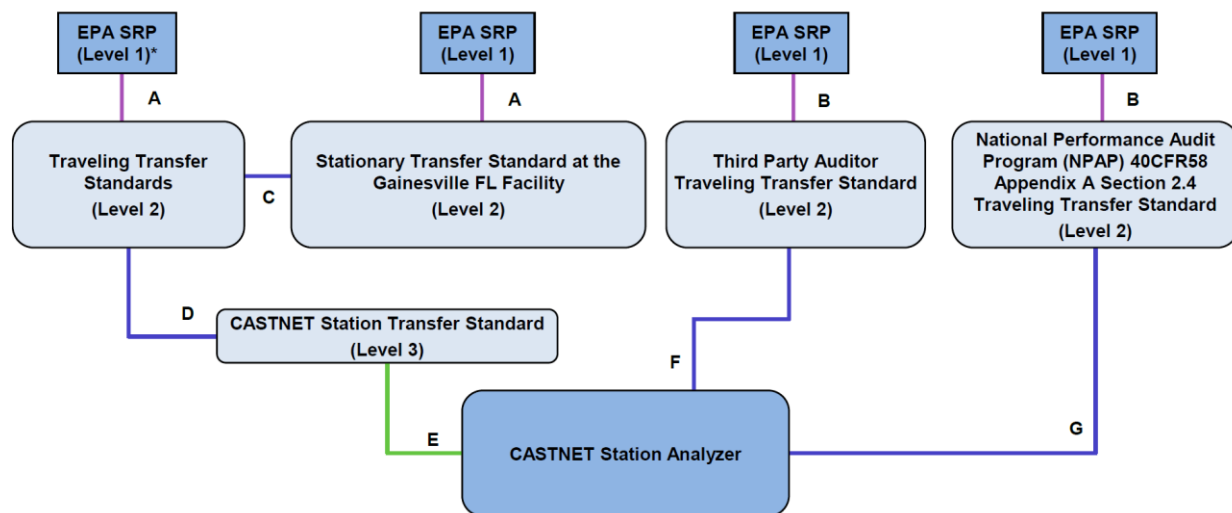
(Distance measurements and compass directions are from the ozone inlet on the 10-m tall tower)

Items	Compass Degrees	Distance (m)	Height (m)
A. CASTNET ozone tower	-	-	10
B. CASTNET shed	30	2.2	2.8
C. AMoN sampler	260	12.4	2.4
D. Satellite dish	110	22.3	2.7
E. Shed	90	18.2	2.8
F. NADP/NTN site	190	~152	1.2

## Section 5: Laboratory Operations (Field Calibration Laboratory)

The Field Calibration Laboratory is staffed by experts in ambient ozone measurements. The laboratory consists of a central laboratory for providing maintenance, repairs, testing, and verifying the equipment used in the ozone collection process. There also is a shipping room for sending equipment (onsite Level III transfer standards, Level IV site analyzer, tubing, pumps, etc.) to the site operators by FedEx. The Field Calibration Laboratory also ships and receives the Level II transfer standards used by the field technicians during the 6-month calibration checks.

Staff at the Wood E&IS Laboratory maintains and controls all NIST-traceable certifications of their standards in filing cabinets outside their offices. The Level II standards are certified by NIST or EPA Regional Office and the Level III site analyzers are certified by Wood E&IS with Level II ozone analyzers. The Level II transfer standards used for the 6-month calibration check and the laboratory-controlled standards are listed on the CASTNET website with the most recent certification date. The figure below is from the CASTNET QAPP that illustrates the different levels of ozone standards verifications used in the CASTNET program.

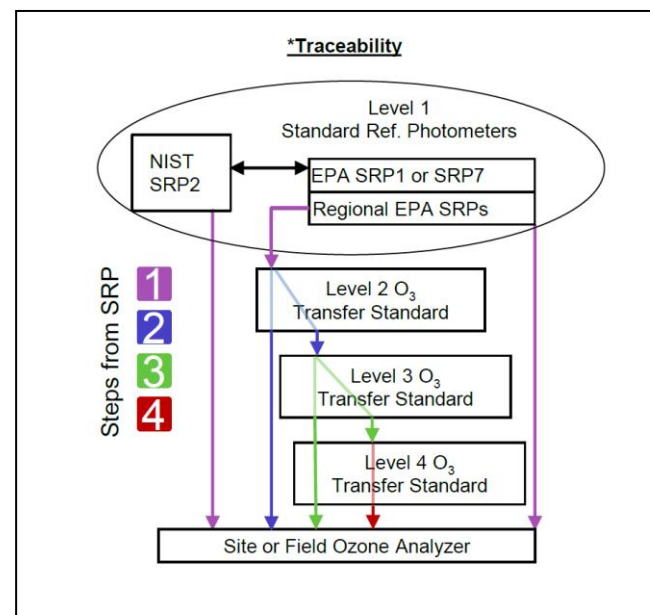


### Legend

- A = Annual Reverification
- B = Quarterly Reverification
- C = Audited ~1/6 weeks
- D = Reverification 1/6 months
- E = Zero, Span and single Point QC check daily
- F = Audited Annually
- G = Audited 1/5 years

Currently, there are five transfer standards (4 of the 5 are within certification) and two laboratory-controlled standards (both are within certification) that have been used in the CASTNET ozone collection process and are listed in the table below. The Thermo 49i ozone analyzer transfer standard (S/N: S/N: 1105347330; EPA Decal: 000747) is out of certification and Mr. Mishoe will make arrangements to have the analyzer sent to EPA for recertification.

Ms. Heidi Schwing maintains a spreadsheet (Certification Schedule) that list all standards that require annual recertifications and also maintains the database of certifications on the Wood E&IS server. Besides the ozone



analyzers, the Field Calibration Laboratory also uses and tracks 6 flow meters (all currently within certification), 2 temperature sensors with current certifications, 1 barometric pressure sensor with current certification, and 6 voltage units (all with current certifications).

		<b>Manufacturer S/N and EPA Decal Number</b>	<b>Last Certification Date</b>
<b>Level II Transfer Standards</b>			
1	Thermo 49i	S/N: 1105347329 EPA Decal: 000736	March 1, 2018
2	Thermo 49i	S/N: 1030244811 EPA Decal: 000691	July 19, 2018
3	Thermo 49i	S/N: 1030244810 EPA Decal: 000679	February 7, 2018
4	Thermo 49i	S/N: 1030244813 EPA Decal: 000677	February 7, 2018
5	Thermo 49i	S/N: 1105347330 EPA Decal: 000747	Last calibrated on August 21, 2017 and Mr. Mishoe will make arrangements to send the analyzer to EPA for recertification.
<b>Laboratory-Controlled Standards</b>			
1	Thermo 49i-PS	S/N: 1022143674 EPA Decal: 000636	January 23, 2018
2	Thermo 49i-PS	S/N: 801827200 EPA Decal: 000380	December 8, 2017

A primary responsibility of the staff in the Field Calibration Laboratory is to provide technical support to the site operators that operated the CASTNET monitoring sites. The staff can be reached by telephone or by e-mail. All telephone calls relating to issues at the monitoring sites are documented into a Call Log. All records are electronically backed up and the QA Manager conducts internal reviews of the complete process.

During the TSA of the Field Calibration Laboratory, the RTI auditor could not find any discrepancies in the operations as stated in the CASTNET QAPP or the Field SOPs (Appendix 1 of the QAPP).

## **FINDINGS**

No problems or issues were cited as deficiencies based on the visit to the Field Calibration Laboratory and discussions with Wood E&IS staff. It should be noted that one Level II analyzer (Thermo 49i (S/N: 105347330; EPA Decal: 000747) is due for recertification by EPA. Wood E&IS management (Field Operations Manager and QC Officer) should track the EPA recertification. One laboratory controlled standard (Thermo 49i-PS (S/N: 801827200; EPA Decal: 000380) is also due for recertification on December 8, 2018.

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## Section 6: Data Review and Data Management

### Introduction

The evaluation of the data management system for ozone data was divided between the on-site portion performed by Mr. Nichol and an off-site data evaluation performed by Dr. Doraiswamy. The overall quantity and quality of CASTNET's project documentation was impressive, and the Wood E&IS personnel who assisted with the audit were knowledgeable and helpful. The data management audit looked at several aspects of the operation as well as verifying and comparing selected data, including calculated ozone concentrations, validity flags and status codes, and date/times. Data were compared at the following points in the process:

- "raw" data from site data logger (records were supplied by Wood E&IS after they had been polled)
- data extracted from the in-house database

In addition, data were extracted from external EPA databases after it had been uploaded from the contractor's database.

- The EPA/CAMD "CASTNET" website, <https://www.epa.gov/castnet> – this site allows ad hoc downloading of data from all CASTNET sites. Hourly ozone data are available for download within 24 hours of the sampling date. Because of this quick turnaround, the most recent data are not fully validated. Other types of data are also available from this site. Procedures used for transferring data are contained in the CASTNET SOP "Data Deliverables" Revision 8, May 2018 in Appendix 6 of the CASTNET QAPP.
- EPA AQS system – This is the final repository of fully validated data for compliance and reporting purposes. Wood E&IS uploads data to AQS as described in CASTNET SOP "Data Deliverables", Appendix A.

### Information Gathering:

1. Downloaded relevant sections of the CASTNET QAPP and SOPs from the CASTNET website. <https://www.epa.gov/castnet>. The following documents were obtained as part of the data management audit.
  - a. Clean Air Status and Trends Network (CASTNET) Quality Assurance Project Plan (QAPP), Rev. 9.1, October, 2017.
  - b. QAPP Appendix 6: CASTNET Data Operations Standard Operating Procedures, October 2017.
  - c. CASTNET Quality Assurance Reports
    - Fourth Quarter 2017
    - First Quarter 2018
    - Second Quarter 2018
    - Third Quarter 2018

The QAPP and the data operations SOP were reviewed closely in the preparation of the audit questionnaire and to assist with the onsite as well remote data review and data management audit. The QA reports were skimmed through to cross-check QAPP update revision date and information presented in the annual report, as well as to familiarize with information presented, the QA statistics and the calibration schedule for the GAS153 site.

2. Prepared and evaluated data management checklist based in part on QA Handbook, Vol 2, Appendix H. Completed checklist attached.



3. Collected the following datasets for the GAS153 site to establish data traceability and to verify data flags:
  - a. Raw data
    - 1-minute and hourly ozone data and related data for the GAS153 site that had been acquired via the LoggerNet system were downloaded and provided to RTI by the Wood E&IS QA officer for the time period of the onsite audit in November 2018. The hourly data had been averaged by the data logger.
    - Raw hourly ozone data, ozone flag, temperature and temperature flag for the GAS153 site were provided by Mr. Marcus Stewart (QA Officer) on 11/7/2018 for the four time periods identified in the data management questionnaire.
  - b. Data were downloaded from AQS for the GAS153 site for the following time periods:
    - 8/13/2018 - 8/16/2018
    - 7/9/2018 – 7/12/2018
    - 1/7/2018-1/8/2018
    - Data for September and later were not posted to AQS at the time of this audit.
  - c. Data downloaded from EPA's CASTNET site, operated by EPA/CAMD. These are hourly data, typically available within one day. Start at <https://www.epa.gov/castnet>
    - -> Download Data
    - -> CASTNET Data
    - -> Measurement (Raw Data)
    - -> Ozone-Hourly
    - -> "Continue"
    - -> Indicate time range
    - -> "Continue"
    - -> Select site
    - Download data.

Available variables include Site ID, Date/Time, Ozone Conc., QA code, and Update Date. Downloaded data on 11/26/2018.

## **Data Evaluation Activities:**

1. Data were requested and obtained for the GAS153 site for four time periods: 10/14/2018-10/15/2018, 8/13/2018 - 8/16/2018, 7/9/2018 – 7/12/2018, 1/7/2018-1/8/2018. In addition, data were obtained for 11/4/2018-11/6/2018 to cover the onsite audit time period. Data reduction was evaluated by tracing data from the 1-minute to the hourly average. Hourly average concentrations were compared between the different data sources against one another and against the calculated hourly averages. These include the raw 1-minute and hourly average data obtained from Wood E&IS, the hourly average data posted to the EPA CASTNET website, and the hourly average data posted to the AQS website. Hourly ozone concentrations from AQS, CASTNET website and data from Wood E&IS all agreed perfectly for available data sources after truncating the Wood E&IS data in ppb to a whole number. AQS data was not available for the October and November time periods. Periods of invalidations also agreed between the hourly datasets.
2. Data reports from the EPA/CAMD CASTNET site contained two fields, the QA code and the Update date which reflected the incremental stages in the data validation process, since there were parallel updates to the QA codes, which ranged from 1 to 3. Updates provided by the CASTNET staff appear to be happening regularly. The data on the CASTNET website is censored and does not include the validation flags associated with the invalid data. It might be useful to also include the data validation flags in the dataset uploaded to the CASTNET website for the benefit of the users who download data directly from the CASTNET website.

3. For the time periods inspected, the 2:00 A.M. data in the files from EPA/CAMD and AQS were invalidated with an associated flag. These are associated with the daily automated zero/span/precision (ZSP) checks. In some instances, these checks stretched into the next hour resulting in data for 3:00 AM also being invalidated. Mr. Chris Rogers noted that if the ZSP check fails because of moisture interference in the measurement and a delay in stabilization, they adjust the ZSP to run longer. The data logger will run a second ZSP automatically if the first one fails. If they both fail because of the stabilization problem, field staff may go in and lengthen the run to allow sufficient time for readings to stabilize.
4. Flags in the raw hourly data file provided by Wood E&IS for the above time periods were examined in detail. Many "<" flags appeared for the hour adjacent to the 2:00 AM observations, as expected because regular zero/span/precision checks are programmed to run at this time.
5. Raw data were also obtained from the GAS153 site during the onsite audit. The 1-minute data were converted to hourly averages to compare against the AQS data and that obtained from the CASTNET website. After converting to an hourly average, the data had to be offset by an hour to account for the assignment of the value to the beginning of the hour (as required by the regulation) from the end of the hour (as recorded by the data logger). All data matched except for the following period (beginning of hour): 11/6/2018 9:00:00 AM to 11/6/2018 10:00:00 AM. The CASTNET data has missing data for that time period with a QA code of "1".

## FINDINGS

The RTI auditors worked with the Wood E&IS management team through telephone conversations, e-mail transmittals, and face-to-face discussions. RTI received GAS513 ozone sampling data from the CASTNET QA Officer and also downloaded data streams from the CASTNET website, EPA AQS website, and AIRNow-Tech website for review and comparisons. All data agreed between the different data sets. No major discrepancies in data were identified upon comparing data. The data from the CASTNET website is censored to not include flags associated with invalid data. It might be beneficial to add the data status flags in the dataset posted on the CASTNET website as well, so that data users are aware of the reason for the data invalidation since not all users may have access to the data in AQS. The CASTNET website offers a quicker access to data and therefore users would benefit more from including data flags in the CASTNET dataset as well.

**Finding 3** is discussed below regarding the data review and data management review of the CASTNET program (in particular field site GAS153).

### **FINDING 3:**

When generating the AQS formatted file, the current approach applies a universal "AN – Machine Malfunction" flag for all records with a "B" flag in the Wood E&IS database. As a result, data invalidated during ZSP checks get flagged as "AN" in AQS. Likewise, data invalidation due to an audit also received a "AN" flag. A universal "AN" flag does not provide useful information to a data user.

#### **Discussion:**

During the data review, the RTI off-site auditor found that the hourly data agreed perfectly between CASTNET, AQS, and the data provided by Wood E&IS. Null data also agreed between the databases. However, when comparing the individual flags, the auditor noticed that the data flags in the AQS database for invalidated data, had the "AN – Machine Malfunction" flag for events corresponding to the daily automated ZSP checks in the morning, and the time period corresponding to the NPAP audit on 8/14/2018. These events get a "B" flag in the Wood E&IS database. Discussions with Mr. Rogers indicated that all "B" flags in the Wood E&IS database are universally translated to the "AN – Machine Malfunction" data flag in AQS. The auditor feels that use of appropriate data flags in AQS is important as it will benefit the data users when they use the data for their analysis. As of now, the data users are led to believe that there are quite frequent instances of machine malfunction leading to invalid data (e.g., daily at 2 or 3 am for ZSP), when in fact those are not instances of

problems with the machine but rather QC processes to ensure data quality. Use of a more relevant flag in AQS such as “AY- QC Control Points (Zero/Span)” or “BF – Precision/Zero/Span” will provide more information to the data users on the robustness of the dataset and the QC checks performed. Chris agrees that more details to the hourly flagging would enhance the value of the data.

**RECOMMENDATION:**

It is recommended that Wood E&IS choose appropriate flags in AQS to represent the specific reason for invalidation, which will enhance the hourly flagging by provided more relevant and specific detail for a data user.

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## Section 7: Quality Control and Quality Assurance

### Quality Management Documentation

The QMS consists of the CASTNET QAPP and several attached appendices for SOPs used in the program. Within the QMS is a controlled document network that consists of SSRFs; Call Log; site and laboratory logbooks; results from internal and external audit and assessments; databases and back-up copies on Wood E&IS servers; and records of e-mail transmittals.

The current CASTNET QAPP and supplementary SOPs are Revision 9.1 and dated October 2017. The QAPP is titled “Clean Air Status and Trends Network (CASTNET) Quality Assurance Project Plan (QAPP)” is written in accordance with EPA Guidance Document “*EPA Requirements for Quality Assurance Project Plans EPA QA/R-5*” and “*EPA Requirements for Quality Assurance Project Plans EPA QA/G-5*,” and contains all necessary elements for an EPA-approved QAPP. As stated in Section 1.7.6.1 of the CASTNET QAPP, EPA and Wood E&IS management have developed a process for reviewing QA documents used in the CASTNET program. Section 7 of the QAPP (Revision Tracking Sheet) tracks the changes made to QAPP and appendices. The current QAPP (Revision 9.1) dated October 2017 has been reviewed by the appropriate Wood E&IS management and represents the quality plan for the CASTNET program. The last complete review and approval of the CASTNET QAPP (displayed by approval and signatures was January 2017 for Revision 9.0). When QAPP Revision 10 is developed, it will be sent for complete review and approval by Wood E&IS management and EPA management.

The QAPP is divided into five sections (Project Overview, Field Operations, Laboratory Operations, Data Operations, and Quality Assurance). The Project Overview section details purpose of the project, the organizational charts and personnel responsibilities for management of the CASTNET project, schedules and deliverables, data quality objectives (DQOs) and criteria, training, and data management requirements. The Field Operations section describes field activities such as sampling design, frequency, and acceptance criteria for collecting samples, field equipment verification and calibration, and field data management. The Laboratory Operations section details the sample handling and custody, the analytical methods, quality control, and data processing. The Data Operations section describes the software, verification and validation, calculations, and data submittal to EPA and NPS. The Quality Assurance section explains the assessment responsibilities through audits and reviews, examines the DQOs and data quality indicators (DQIs), and corrective action to nonconformities.

The CASTNET website lists the entire current field and data operations SOPs in Appendix 1 and 6 of the QAPP, respectively. These SOPs are reviewed annually and were approved by the Wood E&IS management (current SOPs are under review and approval). Each SOP has a review and approval (signed-off and dated) section, an overview flow chart of the SOP operations, step-by-step guidelines, and screen shot displays and completed example forms to assist the analyst during field and data review and management operations.

### Audit and Assessment Program

Quality control and quality assurance describe the two sets of practices related to a monitoring program that give agencies confidence that the data they collect represent the true air quality of the area. They are the mechanisms by which an organization manages its data collection in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization. A properly developed QA/QC program encompasses a variety of technical and administrative elements, including policies and objectives, organizational authority, responsibilities, accountability, and procedures and practices.

Quality assurance is a management or oversight function; it deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities, and the use of data in decision making. Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications that are needed to acquire data of known and adequate quality.

As stated in Section 5 of this report, all onsite ozone transfer standards are certified as Level III because they have been calibrated by a Level II ozone standard. The Level II transfer standards are used to calibrate the onsite ozone transfer standards twice per year during the 6-month check. The Level II transfer standards are calibrated once per year at NIST or at one of the EPA regional laboratories by a Standard Reference Photometer (SRP), otherwise known as a Level I standard. The CASTNET ozone analyzers undergo nightly zero, span, and precision (ZSP) checks to quickly diagnosis any problems with the system and also a multi-point verification every Sunday. A data review is performed daily on the ZSP checks by an automatic screening system. Every CASTNET ozone analyzer within the network is audited once per year by an independent auditor who completes a Performance Evaluation (PE). The PE results are required to be submitted to AQS before annual data can be certified. In addition, each year 20% of the network participates in the National Performance Audit Program (NPAP). State, local and Tribal agencies participate in the NPAP to provide consistency in the data across all monitoring organizations.

For the GAS153 site, two 6-month calibration checks were performed (January 1, 2018 and July 9, 2018) and the last PE and TSA by EE&MS was performed on May 10, 2018. The State of Georgia conducted an audit on May 10, 2018 and the EPA Regional Office conducted a NPAP audit on August 14, 2018. During the EE&MS and State of Georgia PE audits, it was determined that the pump was not operating properly and producing a low flow rate. A Problem Ticket (No. 153-192) was prepared at the Wood E&IS facility and the pump was determined to be the issue and replaced. ZSP checks were reviewed after the pump replacement to verify the flow rate was operating properly. Data was reviewed for days prior to the pump failure and invalidated based on acceptance criteria. The table below states the acceptance criteria for each of the assessments performed at the CASTNET monitoring sites.

Assessment	Acceptance Criteria
ZSP Checks	Zero value $\leq \pm 3.1$ ppb Precision/Span $\leq \pm 7\%$ between supplied and observed concentrations
6-Month Calibration Checks	All points within $\pm 2\%$ of full scale of the best fit straight line $\pm 5\%$ of actual for any value, $r^2 > 0.9950$ , $0.9500 < \text{slope} < 1.050$ $-3.0 \text{ ppb} < \text{intercept} < 3.0 \text{ ppb}$
PE Audits	Percent difference of each audit level $\leq 15\%$ or $\pm 1.5$ ppb for audit levels 1 & 2.

Wood E&IS has applied sufficient steps in the electronic data management system for the ozone collection process to manage both data input and QA/QC to provide precise data quality reporting. Wood E&IS management and the QA Manager have done an excellent job of maintaining good quality monitoring data for the CASTNET program and the current staff and management have displayed the commitment to provide informed quality data to AQS and AIRNow-Tech. Improvements in the current practices of tracking training record of the site operators; conducting follow up training with the site operators; ensuring the site operators have and are using the current SOPs; and developing a mechanism to remove obsolete documentation from the monitoring sites will help ensure that these practices continue in the future.

## FINDINGS

No problems or issues base on the review of the QMS documentation.

## **APPENDIX A**

### **Georgia Station (GAS153) Field Site Questionnaire**

# **Technical Systems Audits (TSAs) for Ozone Measurements in the Clean Air Status and Trends Network (CASTNET) Program**

## **Monitoring Site Technical Systems Audit Form**



RTI International  
3040 Cornwallis Road  
Research Triangle Park, NC 27709  
Telephone (919) 541-6000

## Table of Contents

### Technical Systems Audits (TSAs) for Ozone Measurements in the Clean Air Status and Trends Network (CASTNET) Program

#### Monitoring Site Technical Systems Audit Form

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This audit form was prepared by RTI International (RTI) to evaluate the technical systems for ozone measurements at the CASTNET air monitoring sites. This form will be used to evaluate the QA/QC documentation, network management, basic site operations (ozone specific), sample siting requirements, and data management at the Georgia Station (GAS153) field site in Georgia. All questions are based on Title 40 Code of Federal Regulations (CFR) Part 58 requirements and Appendix H of Volume II of the EPA QA Handbook. RTI will use the current Quality Assurance Project Plan (QAPP) and Standard Operating Procedures (SOPs) as well as quarterly Quality Assurance Reports posted on the CASTNET website ([www.epa.gov/CASTNET](http://www.epa.gov/CASTNET)). The current QAPP is Revision 9.1 dated October 2017 with eleven appendices. Several of these appendices or particular sections of the appendices will be used as a basis to prepare questionnaires for the TSA of the field sites (ozone activities), CASTNET Calibration Laboratory (ozone), and data management system for ozone reporting to the EPA Air Quality System (AQS) and AIRNow. Those appendices are:

- Appendix 1 CASTNET Field SOPs
- Appendix 2 EPA Site Contact List
- Appendix 5 CASTNET Health and Safety Plan
- Appendix 6 CASTNET Data Operations SOPs, and
- Appendix 8 CASTNET Quality Management Plan.

Appendices 3, 4, 7, 9, 10, and 11 most likely will not be used to develop the questionnaires, but will be made readily available if questions or issues arise and these appendices are needed to resolve the problem.



## Part 1. General Information

### Monitoring Site Information (GAS153)

NAME/LOCATION OF MONITORING SITE: (Ozone): Georgia Station

MONITORING SITE ADDRESS: University of Georgia Station, Matthew Evans  
Department of Biology & Ag Engineering  
Griffin, GA 30223-1797

MONITORING SITE AQS NUMBER: 132319991 CASTNET SITE NUMBER: GAS153

MONITORING AGENCY AFFILIATION: CASTNET

NAME OF ANALYSIS/SUPPORT LABORATORY: Wood E&IS Laboratory in Newberry, FL

AUDIT TEAM MEMBERS/AFFILIATIONS: Jeff Nichol (RTI auditor)

AUDIT DATE: November 6 (field site) and November 12 and 13 (Ozone Calibration Laboratory)

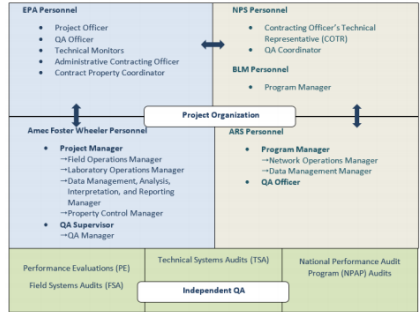
#### PERSONNEL INTERVIEWED:

NAME	POSITION	PHONE/E-MAIL
<b>Site</b>		
Samuel Wright	Site Operator	<a href="mailto:sw021683@uga.edu">sw021683@uga.edu</a> 256-530-3530
Daniel M. Evans	Backup Site Operator	<a href="mailto:dmevans@griffin.uga.edu">dmevans@griffin.uga.edu</a> 770-229-3440
<b>Field Calibration Laboratory</b>		
Kevin Mishoe	Field Operations Manager	<a href="mailto:kevin.mishoe@woodplc.com">kevin.mishoe@woodplc.com</a> 352-332-3318
Mike Smith	Assistant Field Operations Manager	<a href="mailto:michael.j.smith@woodplc.com">michael.j.smith@woodplc.com</a> 352-332-3318
Marcus Stewart	Quality Assurance Manager	<a href="mailto:marcus.stewart@woodplc.com">marcus.stewart@woodplc.com</a> 352-332-3318 (ext. 6608)
Chris Rogers	Data Management, Analysis, Interpretation and Reporting Manager	<a href="mailto:christopher.rogers@woodplc.com">christopher.rogers@woodplc.com</a> 904-391-3744
Kemp Howell	Project Manager	<a href="mailto:kemp.howell@woodplc.com">kemp.howell@woodplc.com</a> 352-332-3318

OPERATIONAL AREAS THAT WERE OBSERVED: Field site collection and ozone checking on Tuesday's events, level 1, 2, and 3 validation, and problem ticket process.

## Part 2: Basic QA/QC

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
<b>A. QAPP and SOPs</b>				
1. Is there an EPA approved quality assurance project plan (QAPP) specific to the CASTNET work being conducted by the laboratory?	X			Current QAPP is Revision 9.1 dated October 2017. Management is currently reviewing QAPP (Revision 9.2). Since last TSA, Amec Foster Wheeler is now John Wood Group. The new name will be identified as Wood Environment & Infrastructure Solutions, Inc. or Wood E&IS for this audit.
2. What is the level of detail Category (i.e., 1, 2, 3, etc.) consistent with EPA guidelines) of the QAPP?				Level 1
3. Does the QAPP reflect, present, and address specifications (i.e., MQOs, DQIs, MDLs, etc.) that are in accordance with those specified for the CASTNET program?	X			
4. Does the QAPP follow the guidelines and requirements outlined in the EPA Guidance Documents (EPA QA/G-5 and EPA QA/R-5)?	X			Note to Marcus that QA/R-5 has been reissued on May 2006 as a reference.
5. Are all the elements of the EPA Guidance Documents met in the QAPP?	X			
6. Has it been reviewed by all personnel (lab, field, management, etc.) associated with conducting the CASTNET work?	X			Amec Foster Wheeler management (H. Kemp Howell-Amec Foster Wheeler Project Manager, Ann Bernhardt-Amec Foster Wheeler Project Quality Assurance Supervisor, and Marcus Stewart-Amec Foster Wheeler Quality Assurance Manager). Note: Amec Foster Wheeler is now Wood E&IS.
7. Has the Regional EPA Clean Air Markets Division (CAMD) Project Officer and QA Officer reviewed the QAPP?	X			EPA (Melissa Puchalski-Project Officer and Andy Dupont-QA Officer) NPS (Barkley Sive-Contracting Officer's Technical Representative) BLM (Ryan McCammon-Air Resource Specialist)
8. Has the CAMD Project Officer and QA Officer approved and signed the QAPP?	X			Signed and approved QAPP (Revision 9.0) on January 30, 2017.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
9. Has the Wood E&IS Project Officer and QA Manager and other network leads approved and signed the QAPP?	X			Signed and approved QAPP (Revision 9.1) in January/February 2017. The QAPP version on the CASTNET website does not include a signed approval page, but I received a signed page from Marcus.
10. Is the purpose of the QAPP clearly stated?	X			
11. Is the project organization clearly identified with their roles and responsibilities?	X			EPA has general oversight that is displayed in the figure below.   <p>Figure 1. CASTNET Project Organization</p>
12. Is the organizational chart in the QAPP up-to-date?	X			In Draft Rev. 9.2 submitted Oct. 2018.
13. Is a copy of the approved QAPP available for review by the field operator(s)? If not, briefly describe how and where QA and QC requirements and procedures are documented.	X			Distributed via e-mail. On site's computer desktop.
14. Is a signed copy of the approved QAPP onsite and available to the field operator(s)?	X			On site's computer desktop.
15. Has the approved QAPP been reviewed (or will be reviewed) on a periodic basis? Ask to see.	X			Reviewed annually and posted on the CASTNET website. QAPP and SOPs are also posted on the site's computer desktop.
16. Is this review of the QAPP documented (or will it be documented)?	X			QAPP is reviewed annually
17. Are there amendments or deviations from the approved QAPP?		X		
18. Have they been EPA approved?			X	No amendments added
19. Are they available for review?			X	No amendments added

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
20. What is the review/approval schedule for the QAPP?				The QA Manager, Project Manager, and selected project personnel review QAPP annually.  Annual review. A statement of review or revisions, if any, due 11/1/2018 followed by a 30-day EPA review period.
21. Are reviews/approvals documented? Review.	X			Current QAPP has a revision history page and approval signature page was also reviewed.
22. Does the QAPP cover the complete field/laboratory operation for the CASTNET program?	X			
22. Is there an internal assessment program to determine conformity to quality assurance has been maintained? What assessments are performed?	X			Performance evaluation reviews, TSAs, internal audits surveillance reviews.
23. Are Data Quality Objectives (DQOs) and Data Quality Indicators (DQIs) identified in the QAPP? How are realized?	X			Through internal reviews and audits.
24. What steps are performed if DQOs are not achieved and maintained?				Audit the issue, determine the problem, and develop a solution.
25. Is there a corrective action process in place when Measurement Quality Objectives (MQOs) or operational specifications (e.g., out-of-control calibration data) are not met?	X			
26. Is there a Quality Management Plan (QMP) developed by Wood E&IS?	X			Dated: June 1, 2018, Revision 4 On the CASTNET website, Appendix 8 is a place mark for the QMP. I requested and received a copy of the Wood E&IS QMP from Marcus.
27. Does the QMP follow EPA Guidance Document (EPA QA/R-2)?	X			EPA signs a single authorization page for the entire document, including appendices. QMP is Appendix 8 of the QAPP.
28. Can Wood E&IS provide an EPA signed and approved version of QMP?	X			EPA signs a single authorization page for the entire document, including appendices. QMP is Appendix 8 of the QAPP.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
29. Are written and approved standard operating procedures (SOPs) in place for the various samplers?	X			SOPs or revised SOPs are provided to the field operators annually by the QA Manager. At the GAS153 site, the SOPs were located on the site's computer desktop.
30. Does the format of the SOPs follow the guidelines outlined in the EPA Guidance Document (EPA QA/G-6)? If not, describe what significant information is missing?	X			
31. Does the SOPs reflect, present and address specifications and operations that are in accordance with those applicable to the CASTNET program?	X			Field site has current SOPs (Revision 9.1 dated October 2017)
32. Are the SOPs signed by management and QA staff?	X			
33. Are the SOPs available for review by auditor?	X			On site's computer desktop.
34. Are the SOPs controlled documents?	X			Has version and revision numbers
35. Are signed copies of the SOPs available to the field operator?	X			On site's computer desktop.
36. Does site operator have current up-to-date SOPs onsite? Electronic or hard copies.	X			Electronic copies on site's computer desktop. All obsolete hard copies or electronic versions remove from site shelter.
37. Are there deviations from the SOPs?		X		
38. If yes, have these deviations been documented and approved?			X	
39. Are documented deviations available for review?			X	
40. Has training been conducted for these SOPs?	X			Field operator was trained by the previous field operator. This seems to be the system used for all training. Training records for technicians and logisticians focus on the SOPs themselves as required for their job functions. The official and documented training is performed by Wood E&IS field personnel using the questionnaire discussed in Question 41 to document completion.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
41. Is this training documented?	X			<p>Wood E&amp;IS uses a questionnaire (CASTNET Site Operator Questionnaire) to track training of site operators. This document is maintained at the Wood E&amp;IS Facility in Newberry, FL on the Wood E&amp;IS network server. The current site operator's training was documented on May 8, 2016 by Michael Smith. The training documentation is not maintained on the site's computer desktop. The QA Officer reviews statistics (data capture and accuracy checks) pulled from database entries and logbooks of the site operator to determine if further training is needed. Training is also reinforced through the 6-month calibrations and through telephone communications.</p> <p>During the site visit, the auditor checked the logbook for the last 6-month calibration (July 9, 2018) and there were no notes of any training. In the GAS153 Calibration Folder, there was one copy of the ozone calibration, but no other forms. When visiting the Wood E&amp;IS Facility in Newberry, FL, the QA Officer opened the Excel spreadsheet and provided copies of the Site information, datalogger calibration form, and the temperature sensors form. The January 2018 calibration provided all of these forms.</p>
42. Are the SOPs current and up-to-date and met the specifications presented in the CASTNET program?	X			
43. Have the SOPs been reviewed on a periodic basis?	X			Annual review
44. What are the frequency and the approach?				Annually by the QA Manager and Project Management Team.
45. Is this review documented? (Review).	X			
46. Is there a CASTNET project work organizational chart available?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
<p><b>Additional Comments:</b></p> <p>It will be documented that the quality documents (QM and SOPs) are under review and will be updated from Amec Foster Wheeler to Wood Environment &amp; Infrastructure Solutions, Inc. (Wood E&amp;IS).</p> <p>Also note: Section 1.7.6.1 of the current QAPP is applied for QAPP review and EPA approval.</p> <p>41. At the field site, there are no records maintained to show the training of the site operators. Wood E&amp;IS should extend their current training program to include maintaining records for the site operators at the field sites. This can be set up at the Newberry facility and then placed on the site's computer desktop. If records are maintained at the Newberry facility, be advised that outside auditors will not have access to these files if they only visit the site. The QA Manager maintains records are on the network, including completed questionnaires and the annual review of performance metrics. ARS developed a Site Visitation Checklist that is a simple form to track activities during the 6-month calibrations. This form has 10 sections (included a training tracking section) that the field staff calibrator checks that will help supplement your current Site Operator Evaluation Questionnaire.</p>				
<p>Based on QAPP Revision 9.1</p> <p><b>Amec Foster Wheeler Environment &amp; Infrastructure, Inc.:</b>  H. Kemp Howell, Project Manager  Ann Bernhardt, Project QA Supervisor  Marcus O. Stewart, QA Manager  Kevin P. Mishoe, Field Operations Manager  Katherine W. Barry, Laboratory Operations Manager  Christopher M. Rogers, Data Management, Analysis, Interpretation, and Reporting Manager  Selma Isil, Property Control Manager</p> <p><b>United States Environmental Protection Agency:</b>  Melissa Puchalski, Project Officer  Gregory Beachley, Alternate Project Officer/Technical Monitor  Andy Dupont, QA Officer  Gary Lear, Technical Monitor  Timothy Sharac, Technical Monitor  Taylor Macy, Technical Monitor  Michael Fox, Contracting Officer</p> <p><b>National Park Service:</b>  Barkley Sive, Contracting Officer's Technical Representative</p> <p><b>Bureau of Land Management:</b>  Ryan McCammon, Air Resource Specialist</p> <p><b>Air Resource Specialists, Inc.:</b>  Joe Adlhoch, Program Manager  Emily Vanden Hoek, QA Officer  Jessica Ward, Data Management Section Manager  Mike Slate, Network Operations Section Manager</p> <p><b>Field Services Contractors</b></p>				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	

Based on QAPP (Revision 9.1)

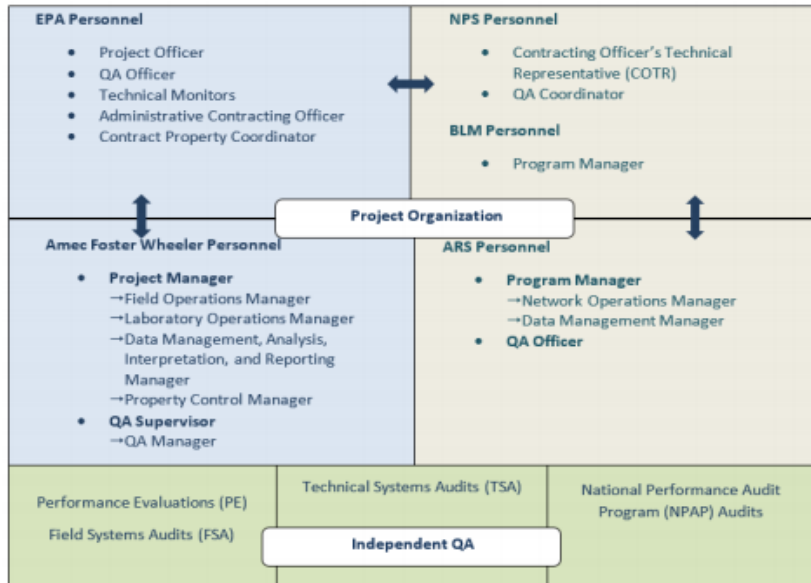
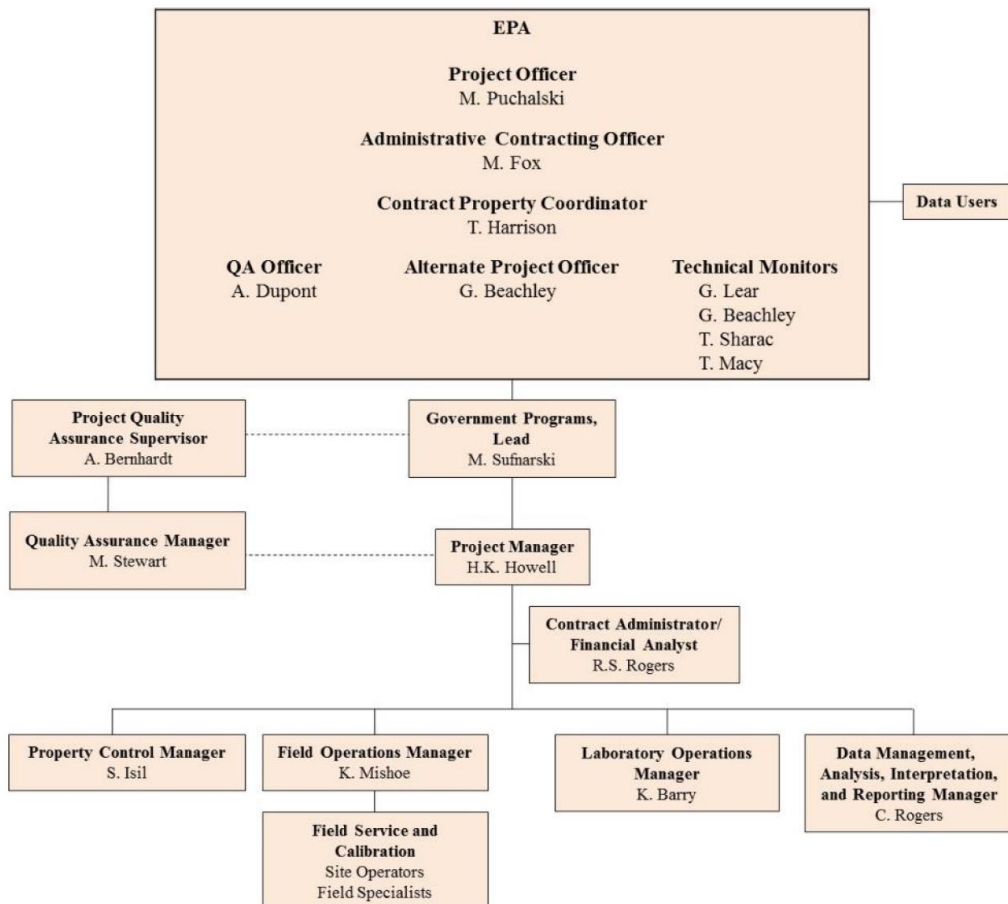


Figure 1. CASTNET Project Organization

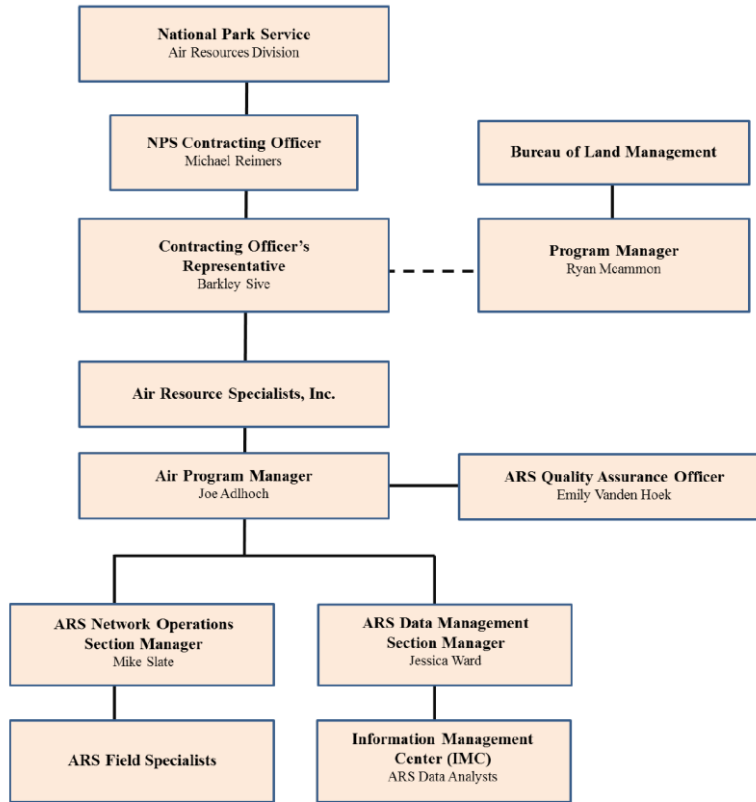
Based on QAPP (Revision 9.1) EPA-Wood E&IS Project Organization





AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	

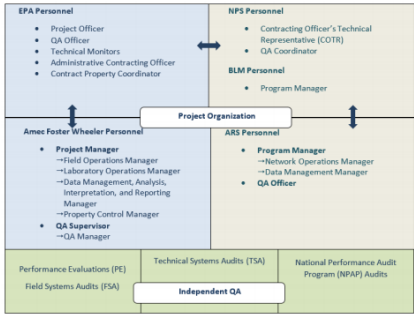
Based on QAPP (Revision 9.1) NPS-BLM-ARS Project Organization



**B. Organization and Responsibilities**

1. Key staff that oversee CASTNET operations:		
a. CASTNET Project Manager		Name: H. Kemp Howell
b. CASTNET Quality Assurance Manager		Name: Marcus Stewart
c. CASTNET QC Coordinator		Not a project title for CASTNET program
d. CASTNET QA Auditor(s) 6-month calibration		Name: Field staff and subcontractors
e. CASTNET Field Operations Manager		Name: Kevin Mishoe
f. CASTNET Data Management, Analysis, Interpretation, and Reporting Manager		Name: Chris Rogers
g. CASTNET Lead for AQS entries		Name: Chris Rogers
h. CASTNET Property Control Manager		Name: Selma Isil
2. Name of management responsible for (indicate which apply):		
a. Development of monitoring site,		Name: Kevin Mishoe

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
b. Coordinates field operations,				Name: Kevin Mishoe and Mike Smith
c. Logistical support of field operations,				Name: Heidi Schwing
d. Training monitoring site operators, and				Name: Kevin Mishoe and Mike Smith
e. Review of routine sampler data and quality control data.				Name: Anna Karmazyn (gas analyzers)
3. Name of Wood E&IS staff responsible for (indicate which apply):				
a. Operation of sampler, monitors, and equipment;				Name: Site operators
b. Calibration of sampler, monitors, and equipment;				Name: Field staff and subcontractors
c. Maintenance of sampler, monitors, and equipment;				Name: Site operators, field staff, and subcontractors
d. Maintenance of monitoring site,				Name: Site operators
e. Operation of ozone monitor,				Name: Kevin Mishoe and Mike Smith (working with site operators)
f. Calibration of ozone monitors, and				Name: Kevin Mishoe and Mike Smith (working with field staff and subcontractors)
g. Maintenance of ozone monitor.				Name: Kevin Mishoe and Mike Smith (working with site operators, field staff, and subcontractors)
4. What is the program relationship between Wood E&IS and ARS? QAPP shows two project organizations (ARS, Wood E&IS)				Discuss: Wood E&IS oversee the filter packs distribution and analyses for all sites under the CASTNET program. Wood E&IS oversees the EPA field sites for ozone collection and ARS oversees the ozone collection for NPS and BLM field sites.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
5. Can you provide a flow chart showing the management reporting and communications between Wood E&IS, ARS, US EPA, and NPS?	X			<p>From the 2018 Network Monitoring Plan - <a href="https://www.epa.gov/sites/production/files/2018-06/documents/castnet_plan_2018_final_0.pdf">https://www.epa.gov/sites/production/files/2018-06/documents/castnet_plan_2018_final_0.pdf</a></p>  <p>Figure 1. CASTNET Project Organization</p>
6. Is there someone who reviews the following completed forms:				
a. Field forms? Who?	X			Name: Selma Isil, Anna Karmazyn, and Kevin Mishoe
b. Chain of Custody (COC) forms? Who?			X	Operation is applicable to filter packs. Name: Elaine Valcourt, Richard Humes, and Ruby Wyrosdick
c. Review of electronic data from monitors? Who?	X			Name: Anna Karmazyn
d. Review of field logbooks (site, monitor). Who?			X	Hardcopies are metadata and reviewed as needed. Routine field data collection is in the Tuesday call-in log. Personnel recording the data reported are identified securely by their login.
7. Has the review of completed field and COC forms been done?	X			
8. Is anyone responsible for QA audits of the site (6-month check)? If so, who?	X			QA: Mr. Marcus Stewart has the overall responsibility, but Mr. Kevin Mishoe and Mr. Michael Smith manage the subcontractors that perform the QA audits. EPA also performs external audits through third-party audit contractors. Phil Grenville of Air Quality Services (AQS) conducts the 6-month calibrations.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
9. Are there two levels of management separation between QA and QC operations? The QC operations can be performed by the site operator.	X			
10. Does the QA auditor have unique standards and equipment? (The QA audit should not be using the same standards, equipment, etc. as the site operator that performs the QC checks.)	X			
11. Has an audit(s) been performed? If so, when?	X			January 1, 2018 and July 9, 2018
12. Were there any findings during the audits in Question 11?	X			January 2018 calibration showed 4 “as found” points on the site analyzer did not meet internal criteria of $\pm 3.5\%$ . this lets the calibrator know a calibration of this analyzer needs conducted.  During the July 2018 calibration, the field staff documented a communication problem and a LoggerNet issue. The phone problem was solved and documented on Problem Ticket 153-208. The LoggerNet issue may have been a calibrator problem and handled by Phil Grenville. No ticket was developed.
13. Are audits documented? How?	X			Electronic and hardcopy forms. Electronic forms stored on site’s computer desktop. Both also available as hardcopies grouped by site and date of visit in home office.
14. Are the audit results available for review by staff and auditors? Ask to view audits from this program.	X			
15. Does the site operator conduct performance checks of the ozone monitor? Frequency?			X	The ZSP check is performed daily at 1:45 am electronically by the CR3000 program. The site operator only performs a manual ZSP check if the electronically initiated ZSP check fails (Mr. Smith will call site if a failure or unacceptable ZSP check occurs.)
16. What types of QC checks are conducted?				Daily ZSP and weekly multi-point (5 concentrations and zero) checks are conducted automatically. The last multi-point check was 11/4/2018. The site operator performs a noise check weekly.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
17. Are the results of these checks available for review by staff and auditors? Ask to view check results from this program.	X			Results of 6-month PE checks are stored on site computer desktop under folder labeled "GAS153 Calibration." Audit reports track EPA Property Number, maybe include Manufacturer Serial Number
18. Is there any internal auditing program for the ozone monitor?	X			6-month calibrations, but no internal auditing by the site team. The "as found" audit functions as a 6-month PE, they check and record internal system monitoring data on iForms, and check and photograph facility (interior/exterior/equipment – condition and inventory) and siting criteria (photos, diagram compared with vegetation, etc.). All reported to Wood E&IS in combination of electronic and hardcopy records.
19. If yes to Question 18, who conducts the internal audit?				Field staff (6-month calibration) and Anna (ZSP results, one-minute data and housekeeping data (including internal flows and pressures)).
20. What is the frequency and where are the results posted?				6-month calibration audits: Data tables, network folder, hard copy files. Last four years of 6-month calibration were on the site's computer desktop under GAS153 Calibrations.  3 <sup>rd</sup> party PEs and TSAs: PEs conducted once per year and TSAs every 2 years. The last PE and TSA were conducted on May 10, 2018.
21. Is there a designated schedule for calibrations of the ozone monitor? Frequency?	X			Twice per year during 6-month calibration.
22. Are the calibration checks available for review by staff and auditors? Ask to view calibration checks from this program.	X			
23. Are the staff that work at the site agency employees? How many?		X		They work for CASTNET through a payment agency. One primary and one backup.
24. Do any contractors work at the site? How many? Name?	X			Staff from University of Georgia-Griffin campus

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
25. What steps are taken to ensure contract staff meets training and experience criteria?				At this site, the field operator was trained by the previous field operator. When Wood E&IS staff and external auditors (subcontractors) visit the site for calibration checks/audits, they reinforce the training with the field operator. The official and documented training is performed by Wood E&IS field personnel using the questionnaire.
26. Is this documentation maintained? Where?	X			A CASTNET Site Operator Evaluation Questionnaire was completed (last one was May 8, 2016). Follow on training (if needed) is conducted during the 6-month calibrations. The questionnaire is geared towards determining if the site operator understands the Field SOPs for conducting ozone collection, completing the SSRFs, understanding the DAS system, and filter packs and maintained on the Wood E&IS network server.
27. Is there a written procedure for the QA audit, QC checks, calibration, or internal audits for the CASTNET program?				QAPP (Appendix 1) Field Calibration Manual
a. QA audit?	X			EE&MS (Sandy Grenville). Results are not posted on site's computer desktop. These will eventually be available in the EEMS quarterly reports posted on the EPA website.
b. QC checks?	X			ZSP (maintained on site's computer and through PC200W software)
c. Calibrations?	X			6-month calibration (GAS153 Calibration Folder on site's computer desktop)
d. Internal audits?	X			No internal audits are conducted by the site team; only the data operations group of the data stream.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
e. External audits?	X			<p>Last audit date:</p> <p>5/10/2018 on the site analyzer (S/N 1030244807) by Glenn Vaughn of the State of Georgia Ambient Air Monitoring Unit.</p> <p>8/14/2018 on site analyzer by EPA Regional Office (NPAP)</p> <p>Neither results were posted on site's computer desktop. The QA Officer provided the state of Georgia audit results and Chris Rogers downloaded the NPAP audit results from EPA AQS on November 13, 2018.</p>
28. Who is responsible for reviewing results from audits and checks to determine if data should be invalidated?				Anna Karmazyn (validation reviewed and authorized by Marcus Stewart).
29. How is the audit data (6-month) reviewed and what are the decisions (criteria) based on?				<p>The GAS153 Calibration folder is on the site's computer desktop. The data is reviewed to determine if the analyzer is performing within the acceptance criteria listed below.</p> <p>All points on calibration curve within <math>\pm 2\%</math> of full scale as compared to the best fit straight line linearity error <math>&lt; 5\%</math>.</p>
30. Is this process documented? Where?	X			PDF files of each 6-month calibration are maintained in the GAS153 Calibration folder on the site's computer desktop.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
31. Are there corrective action steps in place?	X			<p>Criteria summarized in QAPP Table 4-12.</p> <p>If verification results are outside of the listed criteria, review the calibration forms, problem tickets and repair logs to confirm proper operation of the analyzer and onsite transfer standard. If a starting point for the problem can be determined and documented, use this period as that to be invalidated. If the problem can be verifiably traced to a system or subsystem that does not affect reported data, the associated data may be treated as valid. Otherwise, invalidate all associated data.</p> <p>All data collected “as found” and the audit (calibrator) makes corrections as needed and documents changes. The results are placed on the iForms spreadsheets and stored in the CASTNET database on the Wood E&amp;IS SQL server.</p>
32. Where are these steps documented? Review examples of corrective action, if possible.	X			<p>Actions taken are documented on hardcopy forms. Data are also flagged electronically. Routine actions are recorded in the problem ticketing system and a transaction log for database updates.</p>
<p><b>Additional Questions or Comments:</b></p> <p>27a, e. At the field site, there were no records of the last or any NPAP performance audits or TSAs or PEs conducted by EE&amp;MS. All audits of the site should have a record of the audit maintained at the site. Wood E&amp;IS should develop an assessment folder for the site’s computer desktop. Currently, there is a folder for the site’s 6-month calibrations, but other external audits, PEs, and TSAs should also be placed in a folder on the site’s computer. Be consistent in these folders from one site to another. For 6-month calibrations, be sure the calibrator places all forms in the folder for that audit. It would also be recommended to place the summary form so the auditor would have an understanding of the devices and parameters audited/calibrated. Wood E&amp;IS informed the RTI auditor that NPAPs may be out of their hands depending on EPA decisions on what their auditors leave onsite. The introduction of PEAT at least initially meant that there was no official document available to leave onsite. Data went directly into the interface program to be loaded automatically into AQS. What we have received since have been provided by the individual auditor from their personal record of the audit. If the NPAP audits are directly loaded to EPA AQS database through PEAT, Wood E&amp;IS management should be pulling the results to confirm the site is within NPAP acceptance limits for ozone. These results should then be posted to the site’s laptop computer as site records.</p>				



AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
<b>C. Training, Safety and Chain-of-Custody</b>				
1. Have the monitoring site operators been trained in the sampling procedures? If so, when? (Tuesday call, biannual calibration visit, other site visits, or on-site training seminar)	X			Training conducted onsite. Mr. Wright was trained by the previous site operator. He has been operating the site since 2015. He does participate in the 6-month visits.
2. Is it fully implemented?	X			
3. Is this training documented in a training record?	X			<p>A Site Operator Evaluation Questionnaire was completed by Michael Smith on May 8, 2016 for Samuel Wright. The QA Officer reviews statistics (data capture and accuracy checks) pulled from database entries and logbooks of the site operator's performance to determine if further training is needed. Training is also reinforced through the 6-month calibrations and through telephone communications.</p> <p>The questionnaire is maintained on the Wood E&amp;IS network server and the 6-month calibrations are maintained in the GAS153 Calibration Folder on the site's computer desktop. References regarding any training during the during the 6-month visit would be maintained '\\gmv-fs1\projects\ecm\p\castnet2\site calibration forms electronic'.</p>
4. Is the training record available for review?	X			<p>No training records found at this site. Since no follow-on training was requirement during the last 6-month calibration in July 2018, there were no records documented.</p> <p>The QA Officer provided the Site Operator Evaluation Questionnaire (May 8, 2016) and evidence (site logbook pages) to confirm site operator is conducting work successfully and no further training is needed at this time.</p>

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
5. Is there any documentation maintained at the site of training of the site operator? (site logbook)	X			Site operator was trained initially by the previous site operator. During the 6-month calibration checks, training might be provided, but there was no documentation in the site logbook suggesting any training of the site operator during the visit.
6. Is there a process of training, testing, and qualification for job responsibilities?	X			Initial training and 6-month visits
7. Has the operator been trained in the particular hazards of the instruments/materials that they are using?	X			
8. Are personnel outfitted with any required safety equipment?	X			No safety equipment required for monitoring the ozone analyzers. Operator trained for safety around site operations.
9. Are personnel adequately trained regarding appropriate safety procedures?	X			
10. Are personnel adequately trained regarding cylinder handling?	X			
11. Does the site use field data sheet (FDS) and Chain-of-Custody (COC) forms?	X			The form is the SSRF (Site Status Report Form).
12. Are these forms being completed properly?	X			The site operator maintains the past SSRFs in a folder.
13. Does sample ID's match the COC?	X			Tracking filter pack for the week of the audit on the SSRF.
<b>Additional Questions or Comments:</b>				
3. At the field site, there are no records maintained to show the training of the site operators				
<b>D. Monitoring Site Housekeeping</b>				
1. How long has this site been used for the CASTNET program?				April 21, 1998 CASTNET January 1, 2011 regulatory ozone
2. Are all site logbooks and/or forms filled in promptly, clearly, and completely?	X			
3. Does the operator(s) keep the handling area neat and clean?	X			
4. Is there adequate room to perform the needed operations?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
5. Does the samplers appear to be well maintained and free of dirt and debris, bird/animal/insect nests, excessive rust and corrosion, etc.?	X			
6. Are the walkways to the station and equipment kept free of tall grass, weeds, and debris?	X			
7. Is the shelter (if any) clean and in good repair?	X			
8. Does the site have safety equipment (fire extinguisher, first aid kit, etc.)?	X			
9. Is the ground surface mostly natural materials?	X			
10. Are there separate Operation and Maintenance (O+M) logs for the CASTNET samplers, monitors, and equipment?	X			
11. If yes to question 10, check the O+M or instrument logs against the SOPs. Are these acceptable?	X			
12. Can the site operator provide a copy of the Health and Safety Plan?	X			Onsite HASP was an electronic copy on the site's computer desktop. The HASP has remained the same for several revisions of the QAPP (i.e., prior to electronic delivery). Changing for the in-press revision.
13. Can the site operator provide a copy of signature page of acknowledgement for site operator to sign for safety plan?	X			
<b>Additional Questions or Comments:</b>				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
<b>F. Documentation</b>				
1. Is there a document control program?	X			The program consists of the QAPP and several attached appendices for SOPs used in the program. A SSRF is used by the laboratory and field staff to track samples collected from the field. All physical sample media is labeled and documented on the SSRF. For ozone collection, data (sample frequency, cell pressure, cell temperature, sampler flow rate, offset/background, span/coefficient, and the results of the last audit calibration) from the PC200W software package are documented on the SSRF and also reported during phone conversation with Wood E&IS Field Coordinator. The site operator uses a logbook (2- or 3- carbonless paper) and submits pages of the logbook with the SSRF to the Wood E&IS Ozone Calibration Laboratory.
2. Are the following necessary documents for this project in the controlled document program:				
a. EPA approved QAPP for the CASTNET Program work?	X			
b. SOPs?	X			
3. Have the following necessary quality documents for this project been reviewed, approved and signed:				
a. QAPP – by the CAMD Project Officer and QA Officer and Wood E&IS Project Officer and QA Manager	X			
b. SOPs – by the local CASTNET Program QA Manager	X			
4. Is distribution of the project documents controlled to prevent unauthorized copies from being made/distributed? If so, how?	X			QA documents are maintained on the CASTNET website in PDF format.
5. Are outdated controlled documents collected and disposed of?	X			
6. Is this documented?	X			
7. Are procedures in place if out-of-date documents are found? If so, briefly describe.	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
8. Are the following being filled out promptly, legibly, and clearly:				
a. Logbooks?	X			
b. Forms?	X			
9. Are all entries being made in indelible ink (preferably a dark color)?	X			
10. Are corrections to the data being made with a single line through the entry so as not to obliterate the original entry, initials of the corrector, and date of the correction?	X			
11. Are previous logbooks/forms onsite?	X			
12. If yes to Question 11, are the logbooks/forms available for review?	X			
13. Has a review of the logbooks/forms been performed? By whom?	X			Logbooks are reviewed during the 6-month calibration by the field staff and logbook copies and forms are reviewed by data review team.
14. Are logbooks/forms stored? How?	X			On-site
<b>Additional Questions or Comments:</b>				

### Part 3: Network Management

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
<b>A. Key Individuals</b>				
1. List all key individuals, job titles, e-mail extensions, and telephone numbers associated with this site.				
(Site operator)				Samuel Wright Research Associate <a href="mailto:sw021683@uga.edu">sw021683@uga.edu</a> 256-530-3530
(Backup operator)				Daniel M. Evans Electronics Engineer <a href="mailto:dmvans@griffin.uga.edu">dmvans@griffin.uga.edu</a> , 770-229-3440
2. Other than CASTNET, with what other networks is the site associated?				NADP and AMoN
3. What type of samples are collected at this site?				CASTNET filter pack, ozone, NADP, and AMoN
<b>Additional Questions or Comments:</b>				
<b>B. Network Planning (completed by CASTNET QA Manager)</b>				
1. What is the date of the most recent network assessment? (mostly likely performed by EPA CAMD)				June 29, 2015
2. Is the annual network plan up-to-date?	X			
3. Do you collect collocated samples?	X			Not at GAS153. CASTNET co-located sites are MCK131/231, KY and ROM406/206, CO.
4. What is the date of the current network plan?				June 29, 2018
5. Review the network plan includes the information required for each site.				GAS153 on page 32 of 2018 network plan.
a. AQS Site ID Number	X			
b. Street Address and geographic coordinates	X			
c. Sampling and Analysis Method(s)	X			
d. Operating Schedule	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
e. Monitoring objective and scale of representativeness	X			
f. Site suitable/not suitable for comparison to annual NAAQS standards	X			
g. Metropolitan Statistical Area (MSA), Core Based Statistical Area (CBSA), or Combined Statistical Area (CSA) indicated as required?	X			
6. Does the network plan include proposed changes to the network?		X		The procedure to propose changes is described none are proposed in the document. Section 11 notes changes already made for 2018.
7. Does any proposed change affect this site?			X	
8. Who (person) has custody of the network plan and where and how is it maintained?				EPA Tim Sharac
9. List any non-conformance waivers for the site visited?			X	
10. Where are the waivers documented and who gave approval?			X	
<b>Additional Questions or Comments:</b>				
<b>C. Monitors, Samplers, and Equipment at the Site</b>				
1. List of monitors/ samplers/equipment at the field site and confirm the instrumentation manufacturer, model number, and serial number with the Ozone Calibration Laboratory.				
a. (Site Ozone Analyzer)				Thermo Scientific 49i S/N 103244807 EPA No. 000705
b. (Transfer Ozone Analyzer)				Thermo Scientific 49i S/N 0726124692 EPA No. 000371
c. (Other) Zero air System pump				Werther International S/N 000814277 EPA No. 06865
2. Check for certification, validation, and calibration labels for samplers, monitors, and equipment.				
a. Shelter temperature sensor				VWR Model 6116-324 S/N 72710123

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
b. Temperature probe for shelter temperature measurement.				Currently measuring 27.3 °C; based on site operator the AC does not kick on until 28 C. The shelter was quite warm during the site visit. Operating temperature is between 20 to 30 °C.
3. List of calibration (include transfer) and verification standards and certificates. Verify at Ozone Calibration Laboratory. (5)				Level II Ozone Standards used for 6-month Calibration Audit.
a. Thermo 49i ozone analyzer (last calibrated March 1, 2018).				S/N: 1105347329 EPA Decal: 000736
b. Thermo 49i ozone analyzer (last calibrated July 19, 2018).				S/N: 1030244811 EPA Decal: 000691
c. Thermo 49i ozone analyzer (last calibrated February 7, 2018).				S/N: 1030244810 EPA Decal: 000679
d. Thermo 49i ozone analyzer (last calibrated February 7, 2018).				S/N: 1030244813 EPA Decal: 000677
e. Thermo 49i ozone analyzer (last calibrated August 21, 2017). Will be sent to EPA for certification.				S/N: 1105347330 EPA Decal: 000747
<b>Additional Questions or Comments:</b>				
3e. The Thermo 49i ozone analyzer last calibrated August 21, 2017 is out of certification. Kevin Mishoe will make sure analyzer is sent to EPA for certification				



## Part 4: Specific Sampling Criteria (Ozone Sampling)

(There are four operations (site installation and initiation, site operations, field calibrations, and field operations) conducted at each site. The following sections will discuss each operation.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
<b>A. Site Installation and Initiation Procedure</b>				
1. Is there a required training program for the Field Installation Team and the Station Initiation Team before they are able to perform site installation?	X			
2. Is there any certification records for instrumentation used to install a CASTNET site? (Examples of this instrumentation would be compasses, inclinometers, measuring tapes, voltmeters, etc.)	X			
3. The Site Installation, Initiation, and Operator Training SOP states that installation is subcontracted out. Does a Wood E&IS staff member oversee all of the installation process?	X			
4. Is there a checklist the Field Installation Team updates during installation?	X			
5. If yes to Question 4, where is it maintained and can it be reviewed?				Hard copies are archived.
6. Does Wood E&IS need to obtain EPA approval for CASTNET site location? Discuss steps in determining site.	X			EPA selects site locations based on partner support, spatial importance and data need. Site must contribute to network monitoring objectives including adherence to siting criteria in QAPP. Wood E&IS works with local representative to identify proposed site locations. Wood E&IS verifies siting criteria and submits to EPA for approval.
7. Can Wood E&IS provide the paperwork to show the site selection process for selecting the GAS153 site?				This site was selected in 1988 for the National Dry Deposition Network (NDDN) and was later absorbed into CASTNET. Specific site selection documents from 1988 are not available.
8. Does Wood E&IS perform an acceptance test or burn-in of all instrumentation prior to install at the site?	X			
9. Are record maintained of this acceptance testing and where are these records maintained?	X			iForms stored on server. '\\gnv-fs1\projects\air\cnet\fieldops\cal kits\maintenance records'
10. Are records maintained for the initial <u>onsite</u> equipment calibration?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
11. If yes to Question 10, where is it maintained and can it be reviewed?				Stored on Wood E&IS server. '\\gnv-fs1\projects\ecm\p\castnet2\site calibration forms electronic'
12. If calibration standards are used, can Wood E&IS provide records of certification? Records maintained where.	X			Filing drawers at Field Calibration Laboratory. Level 3 transfer certifications in database, Level 2 transfer certification scanned and on server.  '\\gnv-fs1\projects\ecm\p\castnet2\site calibration forms electronic'
13. Does the CASTNET sites need to be inspected by local municipalities for Building Codes and Restrictions during the installation process?	X			All electrical permits apply.
14. If yes to Question 13, where are these records maintained?				With licensed contractor.
15. Who provides the training to the site operator?				Station Initiation Team
16. Is there a checklist or confirmation documentation that the site operator has completed the training?	X			
17. If yes to Question 16, is this documentation maintained and where?	X			Maintained on the SharePoint server.
18. Is the data acquisition system (DAS) validated during the initial installation? By whom? Records?	X			Verifications are recorded on iForms. Stored on network server.
19. Are records maintained for the inventory of instrumentation installed at the site such as manufacturer, model number, Wood E&IS Property Number, EPA decal, etc.?	X			
20. Who is responsible for maintaining the inventory records and where are they maintained?				Selma Isil – Property Control Manager. SQL Inventory Database
21. Does a Wood E&IS management staff need to approve the site installation before sampling can begin?		X		The installation team leader may implement a stop work order.
22. If yes to Question 21, is this documented and where?			X	
<b>Additional Questions or Comments:</b>				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
<b>B. Site Operations Procedure</b>				
1. Is the ozone sampling performed within the guidelines of an EPA- and Wood E&IS-approved SOP?	X			
2. On the average, how often do you visit the monitoring site per week?				Once per week (Tuesday) and one extra time per month for site maintenance.
3. Is ozone sampling conducted year-round? If not, document the timeframe (NC should be from April to October).	X			
4. What is the frequency of sample collection during the peak season? (requirement = hourly)				Hourly (one minute available)
5. Does the site measure ozone during the off season? If yes, what is the frequency of sample collection?	X			Hourly (one minute available)
6. Does the site operator follow the SOP for the weekly site visit? Any deviations?	X			
7. Who is the Field Operations Manager (FOM) for this site?				Kevin Mishoe
8. Who is the Field Operations Coordinator (FOC) for this site?				Mike Smith
9. Where does the site operator obtain local weather conditions? Alternate source?				Local Weather Station (GAEMN) National Weather Service (NWS)
10. What device does the site operator use to confirm shelter temperature? Are values recorded with 20 to 30 °C?				Shelter temperature probe connected directly through computer system.
11. Is this device certified? Frequency?				The shelter temperature probe is verified against the transfer standard twice a year. If outside acceptance criteria, the probe is replaced.
12. What steps does the site operator perform to verify a zero, span, and precision check occurred on the ozone monitor?				ZSP checks are performed electronically. The site operators only perform a manual ZSP check if requested by Wood E&IS Ozone Calibration Laboratory.
13. If the operations in Question 12 were not successful, what does the site operator do? Document SOP number.				The site operators only perform a manual ZSP check if requested by Wood E&IS Ozone Calibration Laboratory.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
14. Does the ozone system use a Nafion dryer? When was it installed?	X			Installed July 22, 2017
15. Does the site operator perform a flow rate and leak check of the ozone monitor?				Within the past two months, the site operator was informed to stop conducting leak checks but start performing zero checks. There are no flow rate checks. Site operator reports the flow rates indicated by the PC200W software of the sampler's mass flow controllers. There is no independent flow rate check other than during the 6-month calibration.
16. What device (standard) does the site operator use to measure the flow rate?			X	There are no flow rate checks.
17. Is this standard certified? Review documentation.			X	There are no flow rate checks.
18. Where are these values (flow rate and leak checks) documented? Review previous entries if possible.				There are no flow rate checks. Leak check results are reported on SSRF and discussed with the Field Operations Coordinator on the phone before leaving the site.
19. Is there any documentation on the FDS/COC forms for ozone sampling?	X			
20. How are telephone conversations documented between the site operator and Wood E&IS Office?				Recorded in database call in log.
21. Review the DAS with the site operator. a. Data from ozone monitor to data logger (Campbell CR3000). b. Data logger to Raven modem and network router. c. Network router to computer for review onsite. d. Raven modem to Wood E&IS by Internet				DAS setup is as described in the SOP.
22. Do you use uninterruptable power supplies or backup power sources at the site?	X			Site operator believes the backup power source is not working. It should be checked and replaced if needed.
23. What instruments or devices are protected (electrically)?				Ozone analyzers (transfer and site) and computer.
24. How are the ambient ozone sampling and zero, span, and precision check (ZSP) controlled?				DAS controlled.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
25. What device is used for the ZSP checks?				Level 3 transfer standard. Thermo Scientific 49i S/N 0726124692 EPA No. 000371
26. What is the frequency of the ZSP checks?				Daily
27. Are the ZSP checks documented? Where and how.	X			Automatically through computer system and database.
28. Are steps in place if ZSP checks fail? Review.	X			Re-run. Site operator will perform a manual ZSP at the request of the Wood E&IS Laboratory. A problem ticket is created and problem investigated in Wood E&IS the Facility in Newberry, FL.
29. How long does it take to conduct a ZSP? Time of Day.				Less than 30 minutes and starting at 01:46.
30. Can the results of the ZSP be reviewed at the site? Review, if possible.	X			Site operator was unable to show the auditor the ZSP daily results.
31. What is the height of the inlet for the ambient ozone sampling?				10 meters.
32. What is the supply line made of?				FEP or PFA Teflon and Kynar.
33. Does it connect to a manifold or designated supply line to the monitor?				Supply line directly to monitor.
34. Does the air stream flow through any filters before entering the ozone monitor?	X			5 µm Teflon filter at inlet.
35. What is the reporting measurement unit for the ozone measurement?				PPB instrument output.
36. What device delivers zero air during the ZSP checks? List the device: manufacturer, model, and serial number.				Wood E&IS assembled system utilizing compressor and conditioning canisters with silica. Werther International S/N 000814277 EPA No. 06865
37. Does the air flow go through desiccant and carbon canisters from the zero air system during the ZSP checks?	X			
38. During the ZSP checks, does the air flow from the transfer ozone monitor to the inlet and then to the ambient ozone monitor?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
39. What concentrations are evaluated during a ZSP checks?				0, 60, and 225 PPB.
40. Are MQOs being met at the site for ZSP checks? ( <i>See Table 1 in SOP for MQOs.</i> )	X			Zero (< ±3.1 PPB) and precision and span (≤ ±7% between supplied and observed concentrations).
41. What is the frequency of calibrations of the ozone monitors?				Semi-annually.
42. Who repairs the monitors if outside acceptance during the calibration?				Wood E&IS and occasionally subcontractors if repairs can be made onsite. If the analyzer is unable to be repaired onsite, the analyzer is sent back to the Wood E&IS Ozone Calibration Laboratory.
43. What is the frequency of the replacing the Savillex 47 mm Teflon filter?				Only one outside filter replaced every two weeks.
44. What is the frequency of replacing the desiccant?				As needed (usually when 50% spent). About 2 to 4 weeks depending on the weather.
45. Who is responsible for providing maintenance to the DAS?				Wood E&IS or subcontractor (MSI or others)
46. Who does the site operator contact if there is a problem with the DAS?				The FOM (Mr. Mishoe) or Assistant FOM/FOC (Mr. Smith) at Wood E&IS.
47. Discuss PC200W software and document site operator's knowledge of the software and entries that he/she would make.				Site operator understands the PC200W programming to the point of completing SSRF and some basic operations. During the site visit, the auditor requested for the site operator to call the FOC to give him details on how to download data. This was a test to see the communications between the FOC and site operators to determine if the site operator could follow through the steps provided by telephone. Operation was a success.
48. Does the site operator follow the SOP for data entries in to the DAS?	X			
49. Can the site operator provide the auditor a copy of the last data logger calibration? (QAPP Figure 2-22). Review data and compare to form at the calibration lab.	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
50. Who is responsible for performing preventive maintenance?				Site operator through instructions from Wood E&IS Ozone Laboratory staff.
51. Is special training provided for site operator for performing preventive maintenance on the monitors/ samplers/equipment? Briefly comment on background or courses.	X			Through 6-month calibration.
52. Is this training routinely reinforced?	X			Through 6-month calibration visit.
53. What is the site's preventive maintenance schedule for the ozone measuring system?				Based on 6-month calibration and as-needed basis.
54. If preventive maintenance is MINOR, it is performed at (check one or more): field station, headquarters facilities, or equipment is sent to manufacturer				Field station
55. If preventive maintenance is MAJOR, it is performed at (check one or more): field station, headquarters facilities, or equipment is sent to manufacturer				Headquarters facilities or equipment is sent to manufacturer.
56. Does the agency have service contracts or agreements in place with instrument manufacturers? Indicate below or attach additional pages to show which instrumentation is covered?		X		
57. Comment briefly on the adequacy and availability of the supply of spare parts, tools and manuals available to the field operator to perform any necessary maintenance activities. Do you feel that this is adequate to prevent any significant data loss?				Basic supplies, filters, parts. This should be adequate for site and Wood E&IS Ozone Calibration Laboratory responses quickly to other needs.
58. Is the agency currently experiencing any recurring problem with equipment or manufacturer(s)? If so, please identify the equipment or manufacturer, and comment on steps taken to remedy the problem.		X		
59. Have you lost any data due to repairs in the last 2 years? More than 24 hours? More than 48 hours? More than a week?	X			Mid-July 2018. Checking with Anna, there was a loss of data for four hours due to power outage.
60. Explain any situations where instrument down time was due to lack of preventive maintenance of unavailability of parts.				Discussed steps site operator takes when instrumentation is down and how the system is placed back online and validated before re-use.
<b>Additional Questions or Comments:</b>				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
<b>C. Field Calibrations Procedure</b>				
1. Has a biannual TSA been conducted at the site? When and who performed the last TSA.	X			The site operator stated Sandy Grenville (Brookwood Environmental) conducted PE, but there is no record on the site's computer desktop of the audit or results. If a TSA was conducted during the PE, there is no record of one on desktop. The QA Officer provided a copy of the PE and TSA results for May 10, 2018. Brookwood Environmental is under contract to EE&MS to conduct the annual PEs.
2. Has an annual performance evaluation (PE) been conducted at the site? When and who performed the last PE.	X			The site operator stated Sandy Grenville (Brookwood Environmental) conducted PE on May 10, 2018, but there is no record on the site's computer desktop of the audit or results. A problem ticket (153-192) was developed to respond to the failed test point. The result was due to a bad pump which was replaced.
3. Is 'as found' data recorded?	X			At the site, the auditor could not verify data recorded because there was no record on the site's computer desktop of the PE audit.
4. Is "as found" data provided to the site operator after a PE is conducted? If so, review last few PEs.	X			See previous comment.



AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
5. Has a Wood E&IS site calibration been performed at this site? When and who performed the last calibration. Provide the Calibration Summary Form.	X			<p>The Wood E&amp;IS field team (Air Quality Services (AQS) Phil Grenville) conducted a 6-month calibration in January (January 1) and July (July 9) 2018. Both audit forms are on the site's computer desktop.</p> <p>The forms do not have a signature of the calibrator. The GAS153 Calibration folder on the site's computer desktop only contained the ozone calibration (missing DAS check). With no PE records, unable to determine if the shelter and cell temperature sensors were verified. The site logbook has an entry for the 6-month calibration, but the signature is unreadable. The July 9 calibration was reviewed in logbook. Noted issue with communication system and loggernet, but unable to read issue or future actions. At the Wood E&amp;IS Ozone Calibration Laboratory, a problem ticket (153-208) was developed explaining a communication issue with telephone. This issue was resolved with no loss of data. The loggernet problem was with the calibrator and no problem ticket was prepared.</p>
6. Are the results of the calibration documented? If so, where and review if possible.	X			<p>The last four years of 6-month calibrations are maintained on the site's computer desktop under the GAS153 Calibration folder. Each year has its own folder. For 2018, 6-month calibrations were conducted on January 1 and July 9. The auditor could not find the DAS check form for July, but one was conducted in January. All forms were reviewed with the QA Officer through "iForms project folder <a href="\\gmv-fs1\projects\ecm\p\castnet2\site calibration forms electronic">\\gmv-fs1\projects\ecm\p\castnet2\site calibration forms electronic</a>" when the auditor visited Wood E&amp;IS location in Newberry.</p>
7. What is the frequency of the Wood E&IS site calibration?				Every 6 months.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
8. Review iForms if possible, to track entries made during calibration.				Electronic copies can be found on site's computer desktop under the GAS153 Calibration folder. Data reviewed with site operator for January and July calibrations.
9. Is the transfer ozone monitor allowed time to stable? If yes, what amount of time is allowed?	X			1 hour
10. What device is used to provide air for the zero air check for the calibration?				Werther vacuum pump with scrubber media.
11. During the calibration are ozone calibration points taken over the range from 0 to 400 PPB?		X		The iForms show an ozone concentration range from (0 to 450 ppb), but in reviewing the last two 6-month calibrations, the maximum range was only 225 PPB. Range is from 0 to 225 PPB based on discussion with Kevin.
12. Is line loss test performed?	X			Both 2018 calibrations are within specs.
13. What does a high line loss indicate (greater than 5%)?				Troubleshooting is required. Most typically, the inlet filter or sample tubing require replacement.
14. How is this issue resolved and documented?				High line loss is resolved by the technician during the semi-annual calibration and documented on the iForms. 'As Found' and 'As Left'.
15. Is there criteria in place to determine if the ambient ozone or transfer ozone monitor used for ZSP checks need calibration?	X			
16. What is that criteria (ZSP)?				ZSP criteria: Zero value $< \pm 3.1$ PPB Precision/Span $\leq \pm 7\%$ between supplied and observed conditions. Semi-annual calibration verification criteria: All points within $\pm 2\%$ of full scale of the best fit straight line, $\pm 5\%$ of actual for any value, $r^2 > 0.9950$ , $0.9500 < \text{slope} < 1.050$ $-3.0 \text{ ppb} < \text{intercept} < 3.0 \text{ ppb}$

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
17. Besides running different concentrations of ozone through the site's ozone analyzer, what other steps are performed for the ozone collection system?				Leak and flow checks have stopped. This site operator conducts noise checks every week. During the semi-annual calibration, the instrument diagnostics (flow, pressure, lamp intensity, etc.) are recorded. Inlet filter replacement every two weeks.
18. Does the calibrator use NIST-traceable standards when conducting the calibration?	X			
19. Where is the documentation (certificates) maintained? Are they available for review during the audit?	X			Electronic copies can be found on site's computer desktop under the GAS153 Calibration folder for that calibration.  '\\gmv-fs1\projects\air\cnet\fieldops\cal kits\transfer certs'
20. Is there a checkout procedure for instrumentation taken from the Ozone Calibration Laboratory to the field sites during the 6-calibration?	X			
21. Are these checkout list maintained after the calibration? Where? ( <i>Calibration Box Inventory and Spare Parts Inventory</i> )				The checkout lists are filed in the meteorological laboratory.  Cal kit are assigned to the field staff for the calibration. A list is developed and taken to the site. The list is maintained in the database.
22. If an analyzer does not perform within acceptance criteria, what does the calibrator do?				Troubleshoot the problem and repair or replace the analyzer.
23. Who determines when an analyzer can be repaired in the field or needs to be shipped back to the Ozone Calibration Laboratory?				The technician onsite calls the Gainesville office after failing acceptance criteria and the decision is made by the FOM or designee (Wood E&IS field staff).
24. If an analyzer is removed from the field for calibration failure, what are the steps for replacement and is there a documentation trail? Where is the documentation maintained?				The removed analyzer is tagged and returned to the ozone laboratory for post-calibration. The property ID is recorded on the iForms.
25. If an analyzer fails the 6-calibration, is previous data collected from that site reviewed? By whom?	X			Anna Karmazyn
26. What steps are taken to confirm valid ozone data was collected? ( <i>ZSP checks</i> )				Data (hourly and one-minute) are reviewed for reasonableness. ZSP checks are reviewed for acceptance criteria. ZSP results are reviewed for validity.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
<b>Additional Questions or Comments:</b>				
2, 3. Copies of TSA and PE results should be posted on the site's computer desktop in Assessment Folder.				
<b>D. Field Operations Procedure (performed by the Ozone Calibration Laboratory)</b>				
1. What is the minimum frequency of certifying the ozone transfer standards?				1 per year
2. Is this documented and are the documents available for reviewing?	X			
3. What is the frequency of calibration of the site's ozone transfer standards?				The ozone transfer standards are not calibrated. Certifications are updated every 6 months.
4. Is this documented and are the documents available for reviewing?	X			
5. Describe the traceability process of all ozone analyzers used in the CASTNET program? (Level 1, 2, and 3)				Level 2 'travelling' transfer standards are certified by EPA regional Level 1 SRPs and used during site calibrations to update the certification for Level 3 'site' transfer standards. 'Bench' transfer standards are certified as Level 2 standards and used to confirm operation, but not update certification, of traveling Level 2 standards before and after shipping. Bench standards are also used to perform initial 6-day certifications of Level 3 site transfer standards
6. How many sample concentrations are performed during the transfer standards certification? What values are normally run?				6 concentrations are recorded. 0, 40, 60, 90, 150, 225 PPB
7. How many sample runs are performed during the transfer standards certification?				Initial certifications require 6 runs performed on different days
8. Where is this data maintained? Is it reviewable?	X			Data are maintained in the SQL server database.
9. Describe the process of certifying the transfer standard and document the SOP number?				The 6-point certifications are automatically performed and recorded using a data logger in the ozone calibration laboratory. The results of each 6-point certification are reviewed by the technician performing the certification and a second level review by the FOM or designee.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
10. Is there a single-point accuracy criterion (Level 2 control lab standard against Level 2 traveling standard)?		X		The certification reviewer uses professional judgment to verify single-point accuracy results are reasonable.
11. Describe the calculations for the slope, intercept, and correlation coefficient?				The slope, intercept, and correlation coefficient are automatically calculated on the 6-point certification result report.
12. Who performs the certifications of the transfer ozone analyzers?				Ozone laboratory technicians and site calibrators perform updates during the semi-annual calibration.
13. Who gives final approval the transfer standard is acceptable?				The FOM or designee
14. What are the acceptance limits (Level 2 control lab standard against Level 2 traveling standard)?				The average slope is $1 \pm 0.03$ for Level 2, and $1 \pm 0.05$ for Level 3. The average intercept is $\pm 1.5$ PPB. The relative standard deviation of the six slopes must be $\leq 3.7\%$ . The standard deviation of the six intercepts must be $\leq 1.5$ PPB. For certification updates, the new slope must be $\pm 0.05$ times the previous slope average.
15. What analyzer is used as the primary standard? Review documentation certificate.  6 flow meters (6 within certification) 2 temperature sensors (2 within certification) 1 barometric pressure sensor (1 within certification) 6 voltage units (6 within certification)  Maintained with Heidi Schwing in spreadsheet (Certification schedule) and Wood E&IS SQL database on server.				Lab controls (2 ozone primary standards certified)  Thermo 49i-PS (S/N 1022143674 EPA Decal: 000636) last certified on January 23, 2018.  Thermo 49i-PS (S/N 801827200 EPA Decal: 000380) last certified on December 8, 2017.  Standards with certifications used in the Field Calibration Laboratory  Temperature (ThermoWorks P655P)  Barometric pressure (Omega DPG-4000-30C)  Flow (BIOS Definer 220 and 530)
16. Is the certification of the transfer standards performed manually or automatic?				Automatically
17. Is there a maintenance and calibration schedule for the ozone analyzers? If yes, where is it maintained and review?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
18. What is the acceptance limit for the temperature sensor in the ozone sampler? What is done if the sensor is outside the limit? What standard is used to confirm the temperature sensor?				± 2 °C. Dostmann P600 Corrective Action: replace sensor
19. What is the acceptance limit for the barometric pressure sensor in the ozone sampler? What is done if the sensor is outside the limit? What standard is used to confirm the pressure sensor?				± 1 mmHg. Martel Electronics 330 Corrective Action: calibrate
20. What is the acceptance limit for the leak check in mm Hg for the ozone sampler? What is done if the leak check is outside the limit?				< 200 mmHg. The analyzer sample pump is tested and pneumatics are adjusted/replaced until the leak check passes. Corrective Action: replace tubing and check transducers
21. For the ozone line loss test, what ozone certification detector is used? When was it last certified and by who. Are records of the certifications maintained and where?				The ozone line loss test is performed using the site analyzer after calibration by a level 2 transfer standard.
22. Is the flow rate checked on the ozone analyzers? If yes, what device is used? Is it certified? Last certification.	X			Bios Definer 220. Multiple devices are used and certified.
23. How are transfer standards tracked when shipped to sites? Where is this documented?				Sign out and shipping log in the shipping room. Entries are transferred to SQL database.
24. Does the CASTNET QA Manager conduct internal audits of the Calibration Lab?	X			
25. If yes to Question 24, what is the frequency?				Annual
26. If yes to Question 24, can these audit reports be reviewed? Review past three reports.	X			
27. Can Calibration Lab provide the Sample Site Inventory Form for GAS153? If so, check items (ozone analyzers and data acquisition system) against equipment found at site.	X			
<b>Additional Questions or Comments:</b>				

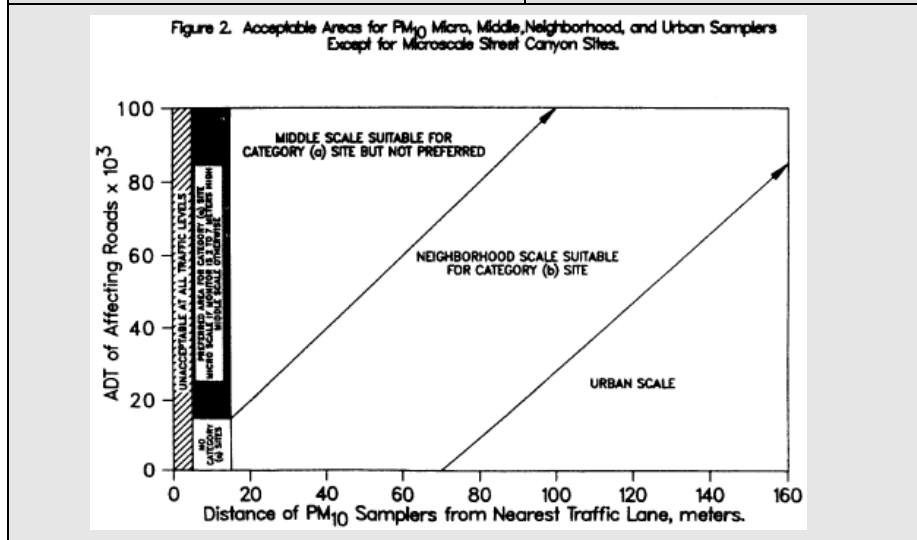
### PART 5. Sampler Siting

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
<b>A. Sampler Siting</b>				
1. Does the location for the samplers conform to the siting requirements of 40 CFR 58, Appendix E?	X			
2. Are there any visible hazards or noticeable problems at the site?		X		
3. Are there any changes at the site that might compromise original siting criteria (e.g., fast-growing trees or shrubs, new construction)?		X		
4. Are there any visible sources that might influence or impact the monitoring instrument?		X		
5. Is the spatial scaling for the site visited neighborhood (0.5 to 4 km), urban (50+ km), or regional (100+ km)?	X			Urban or regional
6. Sampler siting as stated in 40 CFR Part 58 Appendix E. Indicate Y/N to criteria for each sampler, and if no, specify why:				
a. The inlet probe must be between 2-15 m above ground level.	X			
b. The probe must be at least 1 m vertically or horizontally away from any supporting structure, wall, parapets, etc., and away from dusty or dirty areas. If the probe is located near the side of a building, it should be located on the windward side relative to the prevailing wind direction during the season of highest concentration potential for the pollutant being measured.	X			
c. Spaced properly from minor sources. (Away from direct flow of plumes, furnaces, etc.)	X			
d. The probe must have unrestricted airflow and located away from obstacles so that the distance from the monitoring path is at least twice the height the obstacle protrudes above the monitoring path.	X			
e. The monitoring path must be clear of all trees, brush, buildings, plumes, dust, or other optical obstructions, including potential obstructions that may move due to wind, human activity, growth of vegetation, etc.	X			
f. Airflow must be unrestricted in an arc of 270 degrees around the sampler except for street canyon sites.	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
g. The predominant direction for the season with the greatest pollutant concentration potential must be included in the 270-degree arc.	X			
h. The probe must be at least 10 m from the drip line of the tree or trees.	X			
i. Spacing from roadways. If the area is primarily affected by mobile sources and the maximum concentration area(s) judged to be a traffic corridor or street canyon, the monitor should be located near roadways with the highest traffic volume. See Figure 2 below or 40 CFR 58 App. E.	X			
7. What are the GPS coordinates (latitude and longitude) for the field site:				33.1812 -84.4101
8. What is the elevation of the site (feet)?				265
9. Nearest meteorological site?				Local Weather Station (GAEMN) National Weather Service (NWS)
<b>Additional Questions or Comments:</b>				



For Ozone Sampling	
Roadway Average daily traffic, vehicles/day	Minimum separation distance, m
<10,000	10
15,000	20
20,000	45
30,000	80
40,000	115
50,000	135
>60,000	150



## B. Site Sketch

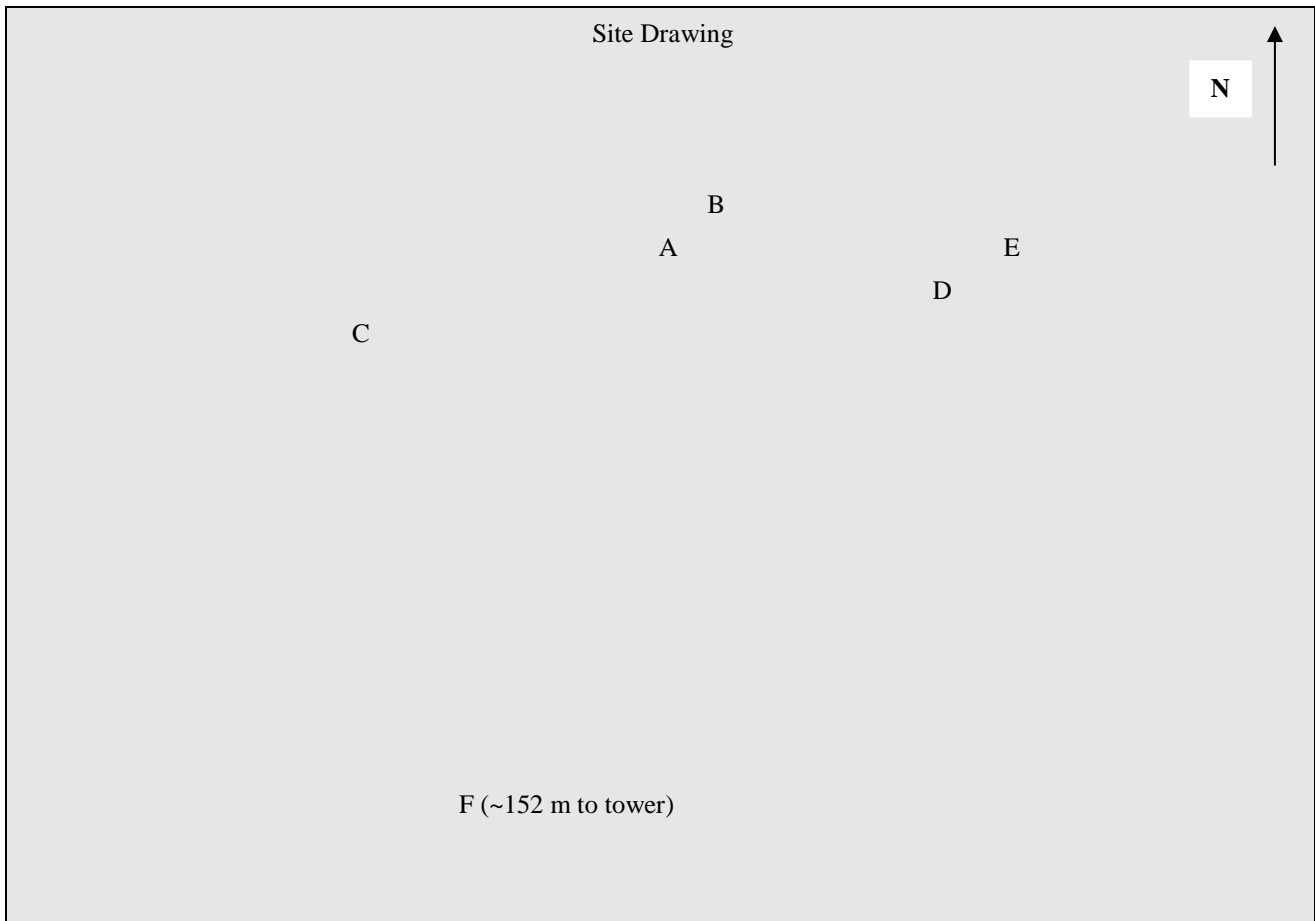
### Georgia Station (GAS153) Measurements

Georgia Station is a rural station located near agricultural fields operated by the University of Georgia (UGA) - Griffin campus. It is a secure location and only UGA staff have access. The agricultural fields are located south of the CASTNET and NADP/NTN sites. A minimum 100-ft. circle extending around the ozone collection-CASTNET filter pack sampling tower is native grass. The NADP/NTN site is approximately 500 feet (152 m) to the south of the CASTNET site. The shelter is roughly 8-ft tall with a 10-m (ozone collection-CASTNET filter pack sampling) tower located slightly to the west at approximately 2.2 meter distance. There is a second shelter (trailer) approximately 18.2 meters to the east of the 10-meter tower (ozone collection). A satellite dish is located next to the second shelter approximately 22.3 meters from the ozone collection-CASTNET tower. An AMoN sampler is 12.4 meters to the west of the ozone collection-CASTNET tower. Pictures of the 8 cardinal directions were taken and will be provided with the report.

### Georgia Station Field Site (GAS153) Measurements (11/6/2018)

(Distance measurements and compass directions are from the ozone inlet on the 10-m tall tower)

Items	Compass Degrees	Distance (m)	Height (m)
A. CASTNET ozone tower	-	-	10
B. CASTNET shed	30	2.2	2.8
C. AMoN sampler	260	12.4	2.4
D. Satellite dish	110	22.3	2.7
E. Shed	90	18.2	2.8
F. NADP/NTN site	190	~152	1.2



## Part 6. Data Management (Site)

### Data to gather at the field monitoring sites:

- Download or print data from Ozone instrument, if possible. Include time and O<sub>3</sub> ppb data at a minimum, but include other information such as ambient temperature, BP, RH, shelter temperature, flow rate, etc., if available. Include a zero-span check if available. Later, the times and O<sub>3</sub> results will be compared with the reported data in AIRNow and AQS.
- Hand-record several hours of ozone, date/time, and temperature data directly from the front panel and compare it with the data above while you are on site. No follow-up should be necessary unless discrepancies are found.

Interval	Time	Ozone Reading		Interval	Time	Ozone Reading		Interval	Time	Ozone Reading	
		Screen	Data file			Screen	Data file			Screen	Data file
1	9:53	16.2	16.18	16	10:08	26.2	26.05	31	10:23	29.5	29.08
2	9:54	16.5	16.72	17	10:09	31.5	31.76	32	10:24	29.9	30.88
3	9:55	16.4	16.34	18	10:10	31.9	32.45	33	10:25	30.4	29.92
4	9:56	19.6	19.9	19	10:11	32.1	32.09	34	10:26	29.3	29.01
5	9:57	28.3	28.43	20	10:12	X	32.12	35	10:27	29.0	28.69
6	9:58	28.7	28.96	21	10:13	X	32.51	36	10:28	29.7	29.79
7	9:59	29.1	29.2	22	10:14	32.4	32.45	37	10:29	28.3	28.4
8	10:00	29.7	30.45	23	10:15	31.8	32.2	38	10:30	28.4	28.41
9	10:01	30.9	31.23	24	10:16	31.9	32.71	39	10:31	X	28.55
10	10:02	29.4	29.68	25	10:17	31.5	31.73	40	10:32	X	29.55
11	10:03	29.7	30.9	26	10:18	X	31.6	41	10:33	28.0	27.98
12	10:04	X	30.9	27	10:19	X	30.04	42	10:34	30.1	30.34
13	10:05	29.6	30.9	28	10:20	28.6	28.81	43	10:35	30.2	30.26
14	10:06	29.4	30.9	29	10:21	29.2	29.6	44	10:36	30.0	29.48
15	10:07	X	30.9	30	10:22	X	29.56	45	10:37	X	28.97

**NOTE:** The site operator and auditor downloaded the (1 minute), hourly, and ZSP checks from November 4 through 6 from the datalogger (PC200W software) and saved to a portable hard drive. On November 7, Marcus Stewart (QA officer) sent the data as requested to compare against the downloaded data. When reviewing the downloaded data, the records stopped at November 1, 2018. The auditor compared the data provided by Marcus to the data in the table above and the data matches.

- Make a note of any interruption in monitoring data that occur due to the TSA (however, no interruptions of data are planned). Record exact times when the ozone data was interrupted. This will be checked later against the data records.

**NOTE:** No interruptions in the data noted during the TSA.

- With the Site Operator, discuss any recent instances when data was flagged because of malfunctions, weather, site conditions, or any other reason. Get a copy, if possible, of the reporting forms, logbook pages and any other backup data. This information can be examined at the data center as part of the validation process audit, and later when the flags in AQS and AIRNow data are checked.

**NOTE:** The site operator noted that there was an area power outage in the area during mid-September. He notified Wood E&IS and visited the site on Wednesday and found all systems operational. RTI (Prakash) will check ozone data stream to determine how data was treated during this occurrence.

### Activities and data gathering at the laboratory or data management center:

- Review findings of recent PE audit reports and discuss these findings, corrective actions, and data flagging with the data management and validation staff. Make notes of site ID, dates and times so that we can look at the flags in AIRNow and AQS.

**NOTE: Lack of TSAs and PEs by EE&MS, NPAP audit results, and incomplete 6-month calibration results were reviewed at the Wood E&IS Ozone Calibration Laboratory with Marcus Stewart (QA Officer) and Kevin Mishoe (Field Operations Manager). Problem tickets were discussed showing problems and issues and corrective actions. Kevin and auditor had a discussion on the Nafion dryer addition and adding text to field SOPs for maintenance and operation to address the site operator's responsibility.**

- Observe the data validation process using the iCASTNET software and other procedures and software – follow the SOP to the extent possible. Download electronic data and take screen shots, if possible, of O<sub>3</sub>, shelter temp, ambient temp, flow, BP, RH, and other data that were downloaded or printed during the on-site audit. Note any deviations from the SOP and discuss. If any validity flags were applied while you were observing the process, include them as examples to use for the next item.

**NOTE: Raw data was provided by Marcus on November 7 for 1-min and 1-hr ozone results for October 14 and 15, 2018 (within a month), August 13 to 16, 2018 (prior quarter), July 9 to 12, 2018 (within 6 months), and consecutive 4-day period in January 2018 centered on the calibration date – 2 days before the calibration and 2 days following the calibration. The data will be checked by RTI (Prakash) against data placed on AQS.**

- Ask the data management staff to identify a few examples where they had to add data flags or change/invalidate data, as a result of higher level data validation. Record the reason for the change, and site IDs, dates and times of the data affected. Example data need not be for the two sites that had field TSAs. If changes were made to data that had previously been entered into an external database (AIRNow or AQS), also record the date/time when the change was uploaded to the external database.

**NOTE: Conducted data review of issues previously listed when auditor visited the Wood E&IS Laboratory in Newberry, FL. Data flagged as needed based on SOPs requirements.**

- Perform other records checking that you would normally do for a TSA. If you encounter any information that should have resulted in data flags or changes, make a note so that the data changes can be verified later in AQS.

**NOTE: ZSP checks were provided by Marcus from October 2 through 29 and November 4 through 6. There were no issues noted and ZSP checks were within acceptable limits.**

## **APPENDIX B**

### **Georgia Station (GAS153) Site Photos**



LOOKING SOUTH



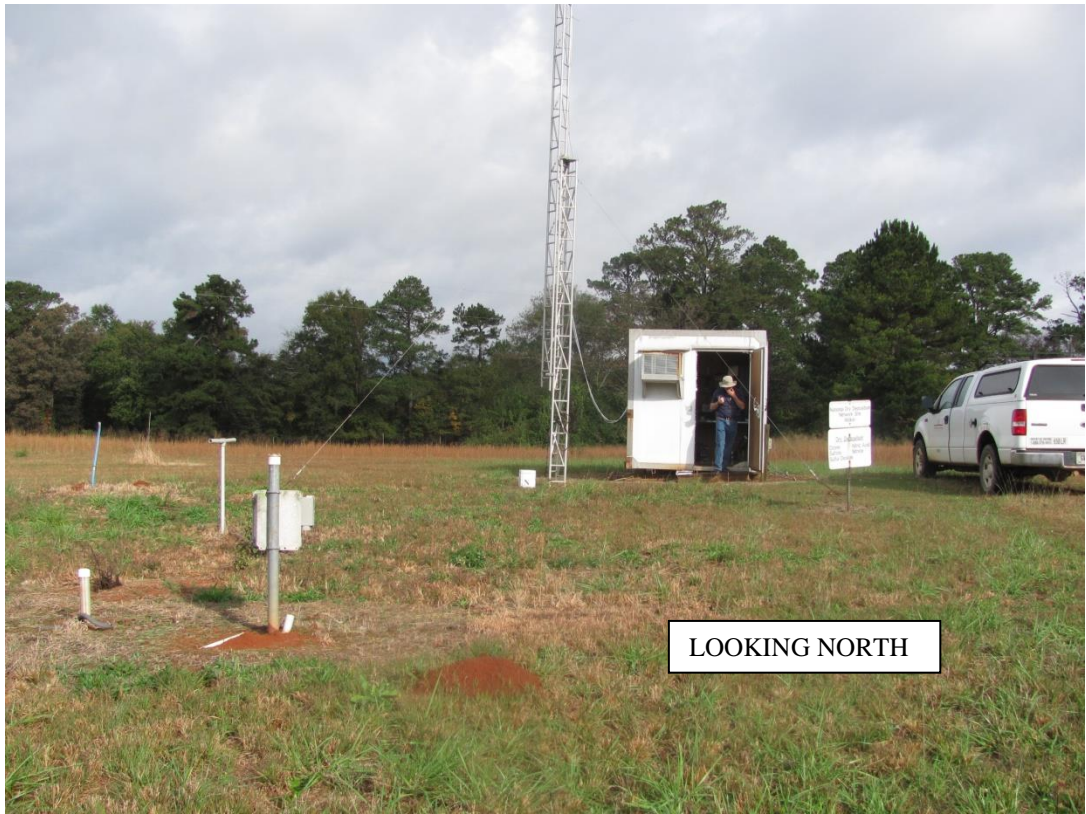
LOOKING SOUTHEAST



LOOKING EAST



LOOKING NORTHEAST



LOOKING NORTH



LOOKING NORTHWEST





## **APPENDIX C**

### **Data and Data Management Questionnaire**

**Technical Systems Audits (TSAs) for Ozone  
Measurements in the Clean Air Status and Trends  
Network (CASTNET) Program**

**Data Review and Data Management  
Technical Systems Audit Form**



RTI International  
3040 Cornwallis Road  
Research Triangle Park, NC 27709  
Telephone (919) 541-6000

**DATA REVIEW AND DATA MANAGEMENT**

Auditee Identification: **CASTNET Data Management (Wood Environment & Infrastructure Solutions, Inc. (Wood)).**

Location of Audit: **Georgia Station (GAS153), Ozone Calibration Laboratory and Data Management in Newberry, FL, and remote communications with Data Management team**

Audit Date: **October 18 through November 14, 2018**

Auditor's name and affiliation: **Jeff Nichol (on-site); Prakash Doraiswamy (off-site), both from RTI International**

**PERSONNEL INTERVIEWED:**

<b>NAME</b>	<b>POSITION</b>	<b>PHONE/E-MAIL</b>
<b>Chris Rogers</b>	<b>Data Management, Analysis, Interpretation and Reporting Manager</b>	<b><a href="mailto:christopher.rogers@woodplc.com">christopher.rogers@woodplc.com</a> 904-391-3744</b>
<b>Marcus Stewart</b>	<b>Quality Assurance Manager</b>	<b><a href="mailto:marcus.stewart@woodplc.com">marcus.stewart@woodplc.com</a> 352-332-3318 (ext. 6608)</b>

**OPERATIONAL AREAS THAT WERE OBSERVED:**

## Part 1. Data Management

Audit Questions	Response			Comments and References (provided by Wood personnel unless otherwise indicated)
	Y	N	NA	
<b>A. Data Handling</b>				
1. Is there a procedure, description, or a chart which shows a complete data sequence from point of acquisition to point of submission of data to EPA?	<b>X</b>			Described in QAPP Section 4.0. Figure 4-1 shows the flow of data from acquisition through submittal.
2. Is there a detailed data flow diagram that shows the data flow within the reporting organization, including inputs and outputs from the system?	<b>X</b>			QAPP Figures 2-21 and 4-1.
3. What hardware components are used in each step of the procedure from acquisition to submission?				Ambient ozone monitor, in-station transfer standard, data logger, Ethernet port, cellular modem, polling server, SQL server, personnel workstations
4. Are procedures for data handling (e.g., data reduction, review, etc.) documented?	<b>X</b>			QAPP Section 4 and Appendix 6.
5. Does any personnel (site operator, field specialist, data analyst, etc.) have the permission/ability to change or alter any of the data on the collection instrumentation? Has there been any situation where this was done?		<b>X</b>		Site personnel do not have permission to change calibration parameters. There is no way to alter data recorded in the datalogger data tables.
6. Are site operator comments included in any reports?	<b>X</b>			Field operator comments are documented in written form on a narrative log, which is shipped to the Newberry location when a page is complete and filed in the site notebook (a copy is included onsite). In addition, verbal comments made during weekly call-ins are logged electronically in the database. Weekly SSRF include a comment section that is entered in the database.
7. How are these comments captured and utilized?				They are reviewed during the validation process. Comments affecting validation decisions are referenced on validation documents.
8. Are field specialist comments included in any reports?	<b>X</b>			In the comment fields of calibration forms, site condition forms, site narrative logs and in the problem ticketing system.
9. How are these comments captured and utilized?				They are reviewed during the validation process. Comments affecting validation decisions are referenced on validation documents.
10. In what media (e.g., diskette, data cartridge, or telemetry) and formats does data arrive at the data processing location?				Telemetry
11. How often are data received at the processing location from the field sites and laboratory?				Hourly
12. Is the routine data retrieval process conducted automatically?	<b>X</b>			

Audit Questions	Response			Comments and References (provided by Wood personnel unless otherwise indicated)
	Y	N	NA	
13. Who is responsible for the conducting the data retrieval? Who is their back-up?				Chris Rogers, backed up by Kevin Mishoe. Jeannette Muzslay and field specialists also involved/capable.
14. What are the processes if a reporting location cannot transmit data?				Data are re-pollled when communication is restored. If communication will not be restored for an extended period the site operator will download the data to portable media and ship it to the Gainesville office.
15. If part of dataset (i.e. ozone results) is not transmitted, is an attempt made to retransmit the whole dataset or just the missing information? If the whole dataset is retransmitted successfully, does repeated data overwrite already captured data?			X	LoggerNet takes care of this automatically. LoggerNet either polls or doesn't poll. There is no way to miss data. LoggerNet polls based on sequential numbering. There are not "missing" periods in between the numbering. It goes in and picks up where it left off based on the record number. So it polls to record X, next time it starts at X+1. If it cannot connect, it just goes to X+1 the next time it tries.
16. Is there documentation accompanying the data regarding any media changes, transcriptions, or flags which have been placed into the data before data are released to agency internal data processing?	X			Electronic transaction log and hardcopy forms.
17. How is data actually entered to the computer system (e.g., computerized transcription (copy from disk or data transfer device), manual entry, digitization of strip charts, or other)?				Computerized transcription. Data are stored in txt files on the polling server. A program inserts data from the txt file into SQL Server database.
18. If data is manually entered by a person, is it checked for transcription errors? Is data doubly entered and automatically checked for comparability?	X			Note: No missing monitoring data are manually entered. Calibration results and field form entries (on the SSRF) are double entered.
19. Is Blank-filling done at any point before Level 0 Validation? If so, what circumstances would cause this?		X		
20. What information/data is contained in: a. Datalogger b. Computer How often is each queried? Can systems be controlled remotely?				Assuming this is the site computer, no data are stored on site laptop. Data are stored on datalogger depending on data table for up to a year. Dataloggers are queried hourly. Yes, VNC can be used to control the laptop and LoggerNet can be used to connect to the datalogger.
21. How frequently are collected <u>and</u> calculated data stored? Where and how are they stored?				Stored in SQL Server in multiple tables/databases in perpetuity. All validation levels are archived so that raw data can be reviewed and validated data can be restored if necessary.
<b>Additional Comments:</b>				

Audit Questions	Response			Comments and References (provided by Wood personnel unless otherwise indicated)
	Y	N	NA	
<b>B. Hardware and Software Documentation</b>				
22. What hardware components are used in each step of the data handling procedure from acquisition to submission?				Ambient ozone monitor, in-station transfer standard, data logger, Ethernet port, cellular modem, polling server, SQL Server, personnel workstations
23. When were the hardware systems last updated? Are these systems under warranty? Are there periodic checks / maintenance of the hardware systems?				Site communication packages are currently being updated. Plan is developed to reduce downtime during system upgrades. New Ethernet ports and cellular modems along with updated data logging software.
24. Would documentation regarding the latest semi-annual check of the data acquisition system (DAS) be available for review?	X			The auditor checked the datalogger and observed that the system passed. The calibrator did not post the results at the site, but the QA officer provided the auditor with a copy of the results.
25. Please list the documentation for the most important custom software currently in use for data processing. Include the original author, current revision number and date. Include the required operating system and application (e.g., Microsoft Windows, Microsoft Access)				CASTNET Data Management System Application (CDMSA): QAPP 9.1 Appendix 6 (Data Management System Application User Manual) and iCASTNET data review tools: QAPP 9.1 Appendix 6 (Review of Ozone Data Using iCASTNET). Windows required. CDMSA requires installation on workstation. iCASTNET requires internet browser. For the former original author is Christopher Rogers, Rev is 5.1, Date is 12/21/17. For the latter, original author is Christopher Rogers (assisted by Jeannette Muzslay), Rev is 3, Date is 10/31/17.
26. Does your agency use any AQS Manual?	X			
27. Does your agency use any AirNow Manual?	X			
28. If yes, list the title of manual used including the version number and date published.				AQS User Guide 2018 Issue 2.1 <a href="https://www.airnowtech.org/Resources.cfm">https://www.airnowtech.org/Resources.cfm</a>
29. What is the current Network Operating Systems?				The polling server runs Windows Server 2012, the RDBMS server runs Windows Server 2008, and workstations run Windows 7.
30. Are there any software incompatibilities which require human transcription/transfers of datasets to achieve final reported data? If so, which process in the chain requires human intervention?		X		
31. How often are software updates/changes made and by whom?				As available or as needed. Wood IT for workstations. Data and Field Operations managers for validation/reporting and collection/polling respectively.
32. What determines the need for the changes?				Workstations are most often updated to maintain security. Data processing software most often for efficiency improvements.

Audit Questions	Response			Comments and References (provided by Wood personnel unless otherwise indicated)
	Y	N	NA	
33. How thoroughly are internal programs tested, and by whom?				Software is tested based on QAPP 9.1 Appendix 6 (Software Management Plan) by DMAIRM (Christopher Rogers), QA Manager (Marcus Stewart) and by end users where appropriate.
34. Have there been any recent upgrades?				Not to anything related to ozone data collection or validation.
35. Are procedures in place to protect data and minimize downtime in the event of a significant computer problem, power outage, etc. at the datacenter? Cite documentation that describes contingency planning applicable to this program.	X			Appendix 6 Hardware Plan, Software Plan and Database Backup sections, QAPP section 4.2
36. Has data processing software been tested to ensure its performance? (See QA Handbook, Volume II, Section 14.0.) Are any previous test results available?	X			Ongoing data validation procedures verify performance in accordance with elements in QA Handbook table 14-3.
37. What software packages (if any) are used to automatically review the data?				Automated email reports are delivered to users on a daily basis. One report details the results of QC checks and housekeeping data. A second report shows missing data and outliers in the ambient concentrations.  The auditor (Jeff Nichol) obtained a hard copy of each email (QC checks and housekeeping – moisture content; outliers and ambient concentrations) sent to all project personnel.
38. Does any software package have the capability of automatically changing the data?	X			Only for preliminary (Level 1) data sent hourly to AIRNow and daily to EPA. These flags for outliers (P flag) are not maintained in the final Level 3 data submitted to AQS.
39. Does any software package have the capability to automatically assign validation flags? Can the flags be changed if they are assigned in error?	X			See above.
40. Is there a unique log-in into programs where data can be changed? Who has access to make the changes?	X			All SQL Server databases are password protected. Only Anna Karmazyn (lead validator) and Selma Isil (backup) have rights to make changes to data.
41. Who has the technical expertise to make changes to the Oracle database? CASTNET database?				Chris Rogers, Jeannette Muzslay, and Ramesh Seerangan
42. Is data automatically sorted into defined tables after transmission? Is this process QC checked to ensure data is incorporated into the correct location?	X			Database triggers are used to move polled data through the LNDB tables into production tables.



Audit Questions	Response			Comments and References (provided by Wood personnel unless otherwise indicated)
	Y	N	NA	
43. Is software capable of disseminating multiple units (ppb/ppm, °C/°F, etc.) and correcting values automatically? Is user intervention ever needed?	X			Database triggers are used where necessary to change units. User intervention is never needed.
44. Does the agency have information on reporting precision and accuracy data available?	X			Previous AQS submissions of 1-pt QC checks from April 1, 2018 to June 30, 2018 were provided to the auditor (Jeff Nichol).
<b>Additional Comments:</b>				
<b>C. Data Validation and Correction</b>				
45. Who performs the different levels (levels 0-3) of data review/validation? List their educational background/ qualifications and years of experience performing this specific task.				Anna Karmazyn – lead validator, BA in Pedagogy (Warsaw University), 25 years in field Selma Isil – backup, MS in Ecology (Michigan), 20 years in field
46. Who approves the different levels (levels 0-3) of data validation? List their educational background/ qualifications and years of experience performing this specific task.				Marcus Stewart, BS Applied Mathematics (Florida), 32 years in field
47. Is the validation criteria established and documented?	X			In QAPP and appendices
48. Does the ozone instrument provide a direct readout on the screen? Is there a check of the instrument readout to the data from the data logger as part of the data validation steps? If so, at what level of data validation is this performed?	X			During initial validation of data logger performance, digital transfer of data from analyzer to data logger was verified. Ongoing verification of instrument accuracy through the data logger is performed during semi-annual visits.
49. What is the time resolution at which data is collected?				10 seconds
50. Is it recorded in the instrument and if so at what time resolution?	X			10 sec measurements by analyzer. Data logger records 10-sec values during QC checks, 1 minute during ambient monitoring (both are polled). No data are actually stored on the instrument.
51. At what time resolution is it recorded in the datalogger?				See above. Hourly averages are also stored. Five and 15-minute averages from the onsite standard.
52. What is the minimum number of individual points to obtain a suitable hour average for reporting?				75% data completeness required. Between 75% and 90% received a < flag (assigned by data logger). >90% gets no flag (null).
53. Does documentation exist on the identification and applicability of flags (i.e. identification of suspect values) within the data as recorded with the data in the computer files?	X			In QAPP and appendices

Audit Questions	Response			Comments and References (provided by Wood personnel unless otherwise indicated)
	Y	N	NA	
54. Is there documentation for the data validation criteria including limits for values such as flow rates, calibration results, or range tests for ambient measurements?	X			In QAPP and appendices
55. What actions are taken if data is found outside limits in the validation process (e.g., flags, modifications, deletions, etc.)?				Data are appropriately flagged.
56. Please provide an example of actions taken when limits were exceeded.				Failed QC Check: The issue is investigated. Appropriate corrective action is taken as warranted. Associated ambient data are flagged as invalid from the previous passing QC check to the subsequent passing check.  In the case where the site failed the PE and state audit within a few days, the issue was a bad pump. A problem ticket (153-192) was developed to replace the pump. Corresponding ZSP checks were monitored along with the next multi-point verification to valid operation.
57. Can data be changed after submission to AQS?	X			
58. Please describe documentation procedures for changes made to data already submitted to AQS.				Updates are delivered as documented in QAPP Appendix 6 (Data Deliverables). As described, the updates are included in a future monthly submittal and processed along with the regular data submittal. Update submittals are noted as such in the routine submission documents.
59. Who has signature authority for approving corrections? Does the same personnel have authority for updating submitted data to AQS?				Christopher Rogers is the only person authorized to make changes to data in AQS (including initial submittals of data). Changes to data are always approved by Marcus Stewart. Access to the CASTNET screening group is password protected and Christopher Rogers is the only person with the password. It is not possible for unauthorized personnel to change data values.
60. Are data points ever deleted? What criteria are used to determine if a data point should be deleted? When in the validation process is this determined?		X		Data points are flagged as necessary. Not deleted.
61. Are data points ever reprocessed? What criteria are used to determine if a data point should be reprocessed? When in the validation process is this determined?		X		Data may be re-polled to recover it if missing. Higher level validation may require addition of flags.
62. Are changes to site information/coding/file structures/units documented in CASTNET database? Are there any records available for review?	X			There is a network change table with this information.

Audit Questions	Response			Comments and References (provided by Wood personnel unless otherwise indicated)
	Y	N	NA	
63. In the past year, were there any instances of power loss at the GAS153 site? Please identify relevant dates if applicable. In such events, did the data have to be corrected?	X			1/1/18 0900 No, data are flagged F and are invalid for that hour
64. Who is responsible for determining when the data review steps are within DQO goals and can be sent on to data validation processes?				Marcus Stewart
65. How many data review steps are performed when reviewing ozone data?				The review process is described in QAPP Appendix 6 (Review of Ozone Data using iCASTNET)
66. Is other data (meteorological) reviewed as well? Does it go through the same review steps?				Meteorological data collection has been discontinued at GAS153 and nearly all other EPA-sponsored project sites. Temperature data is still available and may be used to assess reasonableness of the ozone data. The QAPP describes the review process for meteorological data.
67. Who is responsible for each step of the data validation? Is there one person assigned to each of the three levels of validation, or is one person responsible for multiple levels?				Anna Karmazyn is responsible for non-automated steps.
68. Are any QC checks done to ensure that transferred data is accurate?	X			Described in QAPP Appendix 6 (Data Deliverables). As shown on the submittal checklist - SQL query statements, sites list, date ranges, and checksums are verified.
69. Are any components of the data other than the ASCII files reviewed regularly (i.e. strip charts, ZSP, calibrations)? Are these performed by software, staff or both?	X			Described in QAPP Appendix 6 (Review of Ozone Data using iCASTNET). Involves both staff and software.
70. Are there any typical post-processing calculations done to any of the data (STP corrections, modifications for humidity levels, etc.)?		X		
71. If a data correction is performed, how is this documented? Is there a table of the allowable times where this is correction is used? Who has authority to approve these corrections?				NA
72. What is the minimal amount of minutes of collected data are needed to report an hourly point? Are there any requirements excluding two back-to-back minimal collections?		X		75% data completeness required. Between 75% and 90% received a < flag (assigned by data logger). >90% gets no flag (null). No exclusion of back to back minimal collections
73. Could a 30 minute block of missing time still produce no missed data points?	X			It depends on whether the missing 30-min period is within a whole hour or if it overlaps subsequent hours. 75% of 1-min data (i.e., 45 minutes) are required to calculate a valid hourly average.

Audit Questions	Response			Comments and References (provided by Wood personnel unless otherwise indicated)
	Y	N	NA	
74. Examine a few recent examples of actions that were taken when data had to be flagged: <ul style="list-style-type: none"> <li>• Please provide an example of software flagging and validation flagging (2 records - does not need to be for the same time period)</li> <li>• Identify the flagging criteria and SOP or other document where these are defined</li> <li>• RTI will examine the AQS and/or the CASTNET website database to verify that the data records were appropriately flagged.</li> </ul>				<p>The auditor (Jeff Nichol) went through the validation checks with Anna Karmazyn.</p> <p>Data is never adjusted. Data is Level 3 validated monthly and reviewed against 6-month calibration.</p> <p>Auto flagging and staff-assigned flagging is defined in the QAPP (Section 4).</p>
75. Are there any instances where a non-documented database or program would be used in the validation process?		X		
76. Is any original/raw data over-written if it is altered?		X		Neither altered nor overwritten
77. If a change to a data point needs to be made prior to submission to AQS (and other reporting databases), are any records of the original point maintained?	X			Raw data is maintained unaltered.
78. What does “blank-filling” missing data entail? Are these values updated after Level 0 validation?			X	Not relevant to our processing.
79. Does blank-filling entail entering a -999 value? At what point (if ever) is the value removed prior to reporting? What is it replaced with?			X	
80. Is there a list of validation codes?	X			QAPP Table 4-7
81. Are data flags (anomaly screening, datalogger, etc.) reported to AQS?	X			AQS flags are used as required
82. Are comments from data validating incorporated into flags?		X		
83. Are these reported to AQS?		X		
84. Is invalid data every changed to valid during final validation?	X			Incorrect flags may be removed. For example, a field technician applies “C” flags for “calibrator onsite” while performing service. This status may occasionally be left active by the technician after departure. The flags active after their departure are incorrect and therefore removed during validation.
85. Are there copies of the monthly validation checklist available for review? Are the monthly validation checklists maintained electronically anywhere?	X			<p>These are hardcopy forms.</p> <p>Ozone validation is done by Anna Karmazyn. The auditor (Jeff Nichol) noted that Anna had monthly validation checklist from 2011 to 2012. Other booklets are in the office library. Booklets are arranged by year, monthly, and site information. Approved by QA Officer.</p>

Audit Questions	Response			Comments and References (provided by Wood personnel unless otherwise indicated)
	Y	N	NA	
86. How are “expected” values/limits defined?				Expected values are generated by the onsite standard. Limits are in the QAPP and taken from the EPA QA Handbook Vol II.
87. Are there any additional data post-processing steps (after Level 3 validation) before reporting?		X		Only to prepare data for transfer as described in QAPP Appendix 6 (Data Deliverables)
88. If a request is received for high resolution data traces, is it QC checked prior to submission to the requestor? Does it go through the same review process, or is it presented as is with a disclaimer?	X			Client may request 1-minute data. QC is checked. Data are presented with a disclaimer.
<b>Additional Comments:</b>				
<b>D. Data Processing</b>				
89. Are regular data summary reports issued by the organization? Please attach a list of reports routinely generated, including title, distribution, and period covered. Provide a citation to project documentation	X			Data Quarterly Reports, QA Quarterly and Annual Reports, Annual Reports. QA Quarterly and Annual Reports are delivered electronically to EPA and posted on the EPA CASTNET website: <a href="https://www.epa.gov/castnet">https://www.epa.gov/castnet</a> . The Data Quarterly Reports are delivered electronically to EPA but not currently posted.
90. How often are data submitted to AQS and the CASTNET website?				Monthly
91. Has there been any recent difficulties in coding and submitting data following AQS guidelines?		X		
92. Are hard copy printouts requested after submission to AQS?		X		
93. What is the contractual requirement for maintaining and archiving records? Are records maintained for that long by the organization in an orderly, accessible form? Does this include raw data, calculations, QC data, reviewed data, and reports? If no, please comment.	X			Five years for hardcopy records. Database records are maintained in perpetuity.
94. If records are kept, do they include raw data, calculation, QC data, and reports?	X			
95. Are concentrations of ozone corrected to EPA standard temperature and pressure before input into AQS?		X		
96. Are audits (internal or external) on data reduction procedures performed on a routine basis?	X			
97. If audits on data reduction are performed, what is their frequency?				Monthly

Audit Questions	Response			Comments and References (provided by Wood personnel unless otherwise indicated)
	Y	N	NA	
98. Are data precision and accuracy checked each time they are calculated, recorded, or transcribed to ensure that incorrect values are not submitted to EPA?			X	Programs are verified initially and upon change. Calculations made by established programs are not double-checked each time.
99. Are partial monthly reports ever submitted to AQS?		X		
100. Does the AQS report come directly from CASTNET database?	X			Extracted and submitted as pipe-delimited files.
101. Does the CASTNET database directly supply any other place with data (CASTNET website, etc.)?		X		Extracted and submitted to EPA personnel as pipe-delimited files via email. Wood does not submit directly to another database or website.
<b>Additional Comments:</b>				
<b>E. Reporting (Internal and External)</b>				
102. Are internal reports prepared and submitted as a result of the audits (NPAP and any TSA performed outside of Wood) required under 40 CFR 58, Appendix A? List Report Titles and Frequency.	X			<p>Audit results are reviewed and if necessary acted upon (including resolution of any safety issues identified). If actions are taken they are described in the relevant QA Quarterly Report. Additionally, results of these audits are summarized in an annual Managerial Review report (internal report to Wood management).</p> <p>The auditor (Jeff Nichol) reviewed recent audit by the state of Georgia, the last two PEs by EE&amp;MS and the last TSA, and the last two 6-month calibrations. The auditor is satisfied with the responses and how Wood E&amp;IS addressed the issues, documented the problem through tickets, and reviewed site data afterwards through ZSP and multi-point verification checks. Chris printed out results of the last NPAP audit (August 14, 2018) from EPA AQS and handed it to the auditor for his records.</p>
103. What internal reports are prepared and submitted as a result of precision checks required under 40 CFR 58, Appendix A? (List Report Titles and Frequency)				EPA produces reports based on precision checks as required. EPA also produces the annual network plan and applies for verification of data. Wood is only involved in a support role as requested by EPA.
104. Do either the audit or precision check reports include a discussion of corrective actions initiated based on audit.	X			See above.
105. Who has the responsibility for the calculation and preparation of data summaries? To whom are such summaries delivered? List Name, Title, Type of Report, and Recipient(s).				EPA/CAMD (Timothy Sharac) produces the reports required for verification and the annual network plan.
106. Is the data reported to the AQS?	X			NPAP and precision check data

Audit Questions	Response			Comments and References (provided by Wood personnel unless otherwise indicated)
	Y	N	NA	
107. When was the last annual data summary report submitted (40 CFR 58.15(b))?				Handled by Timothy Sharac
108. Was precision and accuracy information included?			X	Handled by Timothy Sharac
109. Was location, date, pollution source and duration of all episodes reaching significant harm levels included?			X	Handled by Timothy Sharac
110. Was Data Certification signed by a senior officer of your agency?		X		Data are certified by Timothy Sharac
<b>Additional Comments:</b>				

## Part 2. Data Review

### Detailed questions and data requests:

Request to see raw data from the GAS153 site for:

1. October 14 and 15, 2018 (within a month),
2. August 13 to 16, 2018 (prior quarter),
3. July 9 to 12, 2018 (within 6 months), and
4. Consecutive 4-day period in January 2018 centered on the calibration date – 2 days before the calibration and 2 days following the calibration.

Audit Questions	Response			Comments and References (provided by Wood personnel unless otherwise indicated)
	Y	N	NA	
<p>111. Download or print hourly data from Ozone instrument. Include time and O<sub>3</sub> ppb data at a minimum, plus other information such as ambient temperature, BP, RH, shelter temperature, flow rate, etc., if available. Include a zero-span check if available.</p> <p>Auditor will compare the data obtained at the site vs. the data reported in the CASTNET website and AQS. Identify any discrepancies and follow-up with Wood staff.</p>				<p>Doraiswamy: Data for GAS153 site were obtained from Marcus Stewart for 4 periods:</p> <ul style="list-style-type: none"> <li>- 10/14/2018-10/15/2018</li> <li>- 8/13/2018 - 8/16/2018</li> <li>- 7/9/2018 – 7/12/2018</li> <li>- 1/7/2018-1/8/2018</li> </ul> <p>In addition, Marcus provided data for 11/4/2018-11/6/2018, to cover the onsite audit time period.</p> <p>Data were also downloaded from AQS and CASTNET for the same time periods. Data in AQS were only available until 8/31/2018. Hourly ozone concentrations from AQS, CASTNET and data from Wood E&amp;IS all agreed perfectly for the above time periods, after truncating the Wood E&amp;IS data in ppb to a whole number. Periods of invalidations also agreed between the hourly datasets.</p>



<p>112. While on site, for the TSA, the auditor will record (if possible) several hours of raw ozone data directly from the front panel or instrument outputs and compares it versus raw data obtained from Wood.</p> <ul style="list-style-type: none"> <li>• Are there any discrepancies in ozone concentration between the monitor readout and downloaded or printed data?</li> <li>• If any data flags are appended to the data by the instrument, later trace them to records on AQS and on the CASTNET website.</li> </ul>		X	<p>Doraiswamy: The onsite auditor, Jeff Nichol, recorded 1-min data from the screen when he was onsite for about 44 minutes. He later compared the values from the screen to the 1-min data provided by Marcus. Values agreed in general for most time periods, with some differences around 1 ppb for a few instances. The onsite auditor attributes it to potential lag between reading off the display on the screen as opposed to instantaneous capture by the data logger.</p> <p>The hourly data were compared between the raw data obtained onsite and the data obtained from CASTNET website for time period from 11/4/2018 to 11/6/2018. After offsetting 1-hr to account for the assignment to beginning of the hour, the data agreed for all hours except for the following period (beginning of hour): 11/6/2018 9:00:00 AM to 11/6/2018 10:00:00 AM. The CASTNET data has missing data for that time period with a QA code of "1". This time coincides with the period of the onsite audit.</p>
<p>113. Obtain 1-minute data directly from the instrument or from Wood.</p> <p>Do recalculated hourly averages agree with the reported hourly data? (The auditor will calculate data completeness for hourly data that contains one or more invalidated 5-minute values and verify any completeness flags that should have been applied.)</p>		X	<p>Doraiswamy: 1-min raw data was obtained from Wood. The 1-min data were converted to hourly averages. Data for the daily zero/span/precision (ZSP) checks were deleted through manual inspection of the data. It typically lasted from 1:48 am to 2:18 am, but there were instances where the length longer or multiple checks were performed within a few minutes of each other.</p> <p>Chris noted that if the ZSP check fails because of moisture interference in the measurement and a delay in stabilization, they adjust the ZSP to run longer. The data logger will run a second ZSP automatically if the first one fails. If they both fail because of the stabilization problem, field staff may go in and lengthen the run to allow sufficient time for readings to stabilize.</p> <p>Ozone values for minute 01 to 00 of the following hour were averaged and stored in minute 00 of the following hour. Finally, the calculated hourly average was offset by 1-hr to match the data in CASTNET/AQS. The calculated hourly averages were compared to the hourly data provided by Marcus.</p> <p>Calculated data agreed with the hourly averages in CASTNET and AQS databases. No 5-min data was obtained or used in the comparisons.</p>

<p>114. While on site, the auditor performing the TSA should note the time of any interruption in monitoring data that occur during the TSA. If any were observed:</p> <ul style="list-style-type: none"> <li>• Check that the raw data records reflect the data gap at the correct time.</li> <li>• Do the correct flags appear in the hourly data records?</li> </ul>	X		<p>Doraiswamy: The onsite auditor noted that the TSA was conducted to limit the amount of downtime for collecting ozone data. But the amount of time the site operator normally spends on Tuesday operations may have increased due to the RTI auditor asking questions during the Tuesday operation. This delay may have caused a flag for the hours from 9:00 to 11:00 on November 6. It should also be noted during this event, it was raining causing slight delays in the normal Tuesday operations of the site operator.</p>
<p>115. Have any recent PE audits resulted in data revisions or reflagging? List site IDs, dates and times. RTI will compare corresponding data records on the CASTNET website and in AQS and will determine if the appropriate changes or flags were applied.</p>	X		<p>GAS153 failed a state audit 5/9/18 and its annual 3<sup>rd</sup> party PE 5/10/18 both at 30ppb. Investigation showed the flow pump had been failing. Data from 4/2/18 when the system flow dropped below 1 lpm until replacement on 5/11/18 were invalidated.</p> <p>Doraiswamy: Data from AQS and CASTNET were verified for the above time periods and were found to be invalidated (null data) with flag of “AS – Poor Quality Assurance Results” in AQS from April 2 to May 11, 2018.</p>
<p>116. Auditor will observe the data validation process with the datalogger and Data View software and will follow the steps in the SOP.</p> <p>Were any deviations from the data processing and validation SOPs observed? Note any significant deviations that should be reflected in a revised SOP.</p>	X		<p>Doraiswamy: Onsite auditor, Jeff Nichol, discussed with Anna Karmazyn on the data validation procedures and observed actual data validation activities. No deviations from SOP were observed.</p>
<p>117. Auditor will ask the data management staff to identify a few examples where they had to add data flags or change/invalidate data, as a result of higher-level data validation. Record the reasons for the changes, site IDs, dates and times of the data affected. (Example data need not come from the two sites that were audited for the field TSA.) Answer the following questions:</p> <ul style="list-style-type: none"> <li>• When higher-level validation identifies new data flags or other data changes, how are these sent to the CASTNET website to replace data already posted?</li> <li>• Have data already in AQS ever had to be changed or updated? Is the process for making changes to AQS data documented?</li> </ul>			<p>Doraiswamy: Onsite auditor Jeff Nichol conducted data review of issues previously listed when he visited the Wood E&amp;IS Laboratory in Newberry, FL. Data flagged as needed based on SOPs requirements.</p>

Audit Questions	Response			Comments and References (provided by Wood personnel unless otherwise indicated)
	Y	N	NA	
<p>118. Based on the three data sources (Wood raw data; AQS; CASTNET web site) determine the following:</p> <ul style="list-style-type: none"> <li>Do all identifiers and flags from the three sources agree? If not, prepare a table or crosswalk of discrepancies or apparent correspondences.</li> <li>Do hourly concentration averages computed from 1-minute data sources agree?</li> <li>Do hourly averages posted on AQS and the CASTNET website agrees as to both concentration and time?</li> </ul>	X			<p>A comparison of the hourly data calculated from the 1-min data to data reported in AQS and CASTNET showed that the data agree, except for the missing data in CASTNET for 11/6/2018 for hours 9 and 10 am. Data was not available in AQS for that time frame.</p> <p>Data posted on CASTNET and AQS agree perfectly.</p> <p>The only comment is that the choice of invalid flags applied to the AQS data does not always correlate with the cause. For example, ZSP checks are invalidated as “AN – Machine Malfunction” while a flag such as “BF=Precision/Zero/Span” or “AY – QC Control Points (Zero/span)” might have been more representative. All “B” flags in their database are translated to “AN.”</p>
<p>119. Review Wood’s validation records for a past issue. How are outliers identified and marked invalid by the validation process?</p> <ul style="list-style-type: none"> <li>Was the outlier correctly identified?</li> <li>Was the correct data flag applied?</li> </ul>	X			<p>While invalid data were flagged appropriately in AQS, the only comment is related to the choice of flags used in the AQS data. The auditors recommend that Wood choose appropriate flags for the activity to enhance the detail of the hourly flagging for the users.</p>
<p>120. Was anyone contacted (site operator, auditor, and network service person) to ask about the outlier? Discuss the general process of investigating unexplained outliers in the data.</p>	X			<p>The onsite auditor, Jeff Nichol, discussed with Anna on the data validation processes and review of housekeeping data (flow rate, shelter temperature, and sample temperature). The process was satisfactory and there was no specific discussion of outliers.</p>
<p>121. For the observed issue, did enough valid observations remain to compute a valid hourly average? (RTI will re-compute the hourly average and compare it to the hourly averages posted in AQS and on the CASTNET website)</p>	X			<p>For hours with issues/QC checks, hourly averages were calculated appropriately.</p>
<p><i>In the following questions RTI will download previous data from AQS and the CASTNET web site and compare hourly data over several months and sites.</i></p>				
Audit Questions	Response			Comments and References (provided by Wood personnel unless otherwise indicated)
	Y	N	NA	
<p>122. Do the hourly data received directly from Wood agree with the corresponding data downloaded from the EPA data sources (AQS and the CASTNET website operated by EPA/CAMD)?</p>	X			<p>Data agree for the time periods examined. Please see response to question 112.</p>
<p>123. Do time stamps agree?</p>	X			
<p><b>Additional Comments:</b></p>				