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 Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) 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, Revision 1.0, May 2013* (*QA Handbook*). Prior to the TSA, two questionnaires (Monitoring Site and Ozone Calibration Laboratory and Data and Data Management) 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 Amec Foster Wheeler staff and the site operator(s) (subcontractors). The Amec Foster Wheeler 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 Amec Foster Wheeler 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 a monitoring site in Virginia and the Field Calibration Laboratory in Newberry, Florida. He conducted interviews with the Amec Foster Wheeler management and staff and site operators 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 Prince Edward (PED108) site and compared the data posted to AIRNow 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 Amec Foster Wheeler to AIRNow 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 Amec Foster Wheeler. 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). 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 Amec Foster Wheeler, RTI was extremely impressed with several aspects of the program such as:

- The Amec Foster Wheeler 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 LOE for data entry from SSRF and secondary data entry review; and overall improvement in communications between field site operators and Field Operations Laboratory.

- The AMEC Foster Wheeler data management system is impressive. All levels 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 art instrumentation (Thermo 49i, Campbell CR3000, and mass flow controllers).
- 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 by with the use of electronic data recording and management.

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.

- Quality document (QAPP) needed to be updated to fix inconsistencies between approval signature page (dated February 2011) and distribution list and organizational charts in the document; include roles and responsibilities of the five member organizations in the CASTNET program (US EPA, NPS, AMEC Foster Wheeler, ARS, and BLM); and document the working relationship based on roles and responsibilities of the five members. Review of the QAPP indicated some outdated links and incorrect references that will need to be updated as part of the QAPP Revision.
- Section 1.1 Purpose/Background of the QAPP (Revision 8.2) provides details of the program's growth/expansion over the years. Some of the changes from year to year are not provided with a date of the changes making it confusing when tracking changes (i.e., number of sites, number of site measuring ozone, site monitoring other gaseous pollutants) to the program. A table or graph showing the current status of the CASTNET program should be included to demonstrate the current status of the CASTNET program. This table should include the number of sites collection filter packs, the number of sites collecting ozone, number of sites collecting sulfur dioxide SO_2), number of sites collecting nitrogen oxide (NO)/nitrogen dioxide (NO_2)/oxides of nitrogen (NO_x), number of sites collecting carbon monoxide (CO), and number of sites collecting particulate matter (PM).
- Site operator could not provide any training records documenting their satisfactory completion of training for the ozone collection system. Amec Foster Wheeler has started developing a training documentation program (CASTNET Site Operator Evaluation Questionnaire) that is discussed during the 6-month ozone analyzer calibration, but this document was not available at the site.
- The data in the AIRNow system varies depending on the source from which the data is obtained. The data from AirNowTech is identical to the data in AQS, while the data from airnowapi.org is not identical to the data in AQS. Reasons for discrepancy are not apparent at this time. Amec Foster Wheeler will need to discuss with EPA and the AIRNow group to determine potential reasons, and update QAPP as necessary. It would be beneficial to note these observed differences in the QAPP and caution the reader on the correct data source to be used.

Section 1: Introduction

The Amec Foster Wheeler, Environment & Infrastructure Americas (Amec Foster Wheeler) 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 Amec Foster Wheeler. For this TSA, a RTI auditor visited a monitoring site located in Virginia (VA) and the Field Calibration Laboratory in Newberry, FL. The TSA was based the procedures and processes used by Amec Foster Wheeler 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 PED108 located in Prince Edward-Gallion State Forest in the piedmont of Virginia near Burkeville, VA 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 Amec Foster Wheeler 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 were:

- Mr. Eugene Brooks (PED108).

Sections 2, 3, 4, 5, 6, and 7 of this report discuss the general findings of the Amec Foster Wheeler'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 PED108 monitoring site.

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 complies with the data reporting deadlines set forth in the CFR. Amec Foster Wheeler 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. Amec Foster Wheeler submits the real time CASTNET hourly ozone data to AIRNow and also updates the data to the CASTNET website daily. In addition, Amec Foster Wheeler 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 Amec Foster Wheeler 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 8.2 dated October 2014 and posted at http://epa.gov/castnet/javaweb/docs/qapp_v8_Main_Body.pdf. 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, 2001), and "*EPA Guidance for Quality Assurance Project Plans (EPA QA/G-5)*" (EPA, 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), Amec Foster Wheeler, and the National Park Service (NPS). 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, 2001). Both QAPP and SOPs are reviewed and updated annually.

Amec Foster Wheeler has developed a Quality Management Plan (QMP) that is Revision 2, dated July 20, 2015. The QMP was written in accordance with U.S. EPA Guidance Documents, "*EPA Requirements for Quality Management Plans (EPA QA/R-2)*" (EPA, 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 Quality Management Program Director (Mr. Donald Chandler), and the President of Amec Foster Wheeler, Environment & Infrastructure Americas (Mr. Tom Logan).

Findings

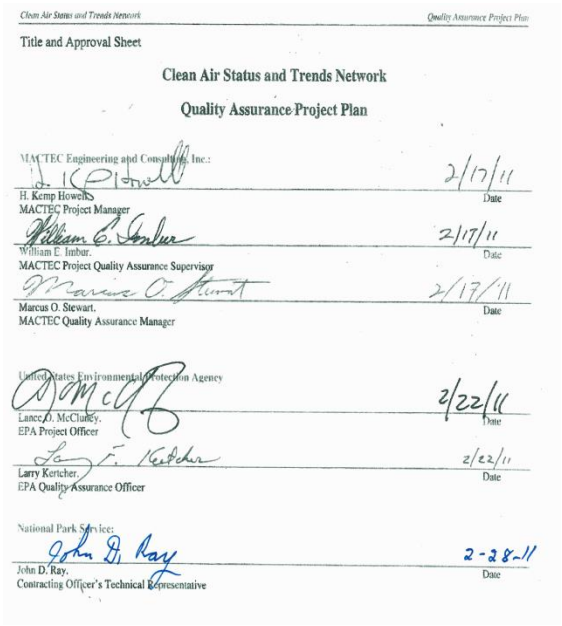
In reviewing the QAPP (Revision 8.2) dated October 2014 that is located on the CASTNET website, the RTI auditor found several concerns regarding the management structure. These findings are listed in **Findings 1, 2, 3, and 4**. After discussing the with the field operator regarding training and safety at the site, the RTI had one concern that is listed as **Finding 5**.

FINDING 1:

Outdated QAPP signature approval sheet with current QAPP

Discussion:
(*EPA QA/R-5: March 2001: Element A1*)

When the RTI auditor reviewed the QAPP on the CASTNET website, he noticed the dates (February 2011) on the signature approval sheet (see below) did not reflect the current QAPP Revision 8.2 dated October 2014. There was no evidence that the annual QAPP updating has not been through the approval process. The RTI auditor discussed this with Mr. Marcus Stewart (QA Manager for CASTNET program) and he stated the approval page has not been updated on the website at EPA's request, but for the next Revision (8.3), the personnel has been revised and updated and the new signature page will be posted with the Revision 8.3 QAPP.



Clean Air Status and Trends Network — Quality Assurance Project Plan

Title and Approval Sheet

Clean Air Status and Trends Network

Quality Assurance Project Plan

MACTEC Engineering and Consulting, Inc.:

H. Kemp Howell, MACTEC Project Manager — 2/17/11 Date

William E. Imber, MACTEC Project Quality Assurance Supervisor — 2/17/11 Date

Marcus O. Stewart, MACTEC Quality Assurance Manager — 2/17/11 Date

United States Environmental Protection Agency

Lance D. McClancy, EPA Project Officer — 2/22/11 Date

Larry Kertcher, EPA Quality Assurance Officer — 2/22/11 Date

National Park Service:

John D. Ray, Contracting Officer's Technical Representative — 2-28-11 Date

RECOMMENDATION:
Mr. Stewart should follow up with EPA to assure the signature approval sheet for each annual update/revision is posted with the current QAPP on the CASTNET website. The management that approves the QAPP should be current and also reflect the distribution list and organizational charts in the QAPP.

FINDING 2:

Inconsistencies with approval signature page and distribution list and organizational charts in QAPP

Discussion:
(*EPA QA/R-5: March 2001: Element A2*)

This is a carryover from Finding 1. The current distribution list and organizational charts were inconsistent with the names listed on the approval signature form. The management from Bureau of Land Management (BLM) does not even appear of the current (February 2011) approval form and are one of the five member organizations involved in the CASTNET program, but they are listed in the distribution list (see below). Based on the organizational charts in Revision 8.2, there are five member organizations in the CASTNET program (US EPA, NPS, AMEC Foster Wheeler, ARS, and BLM). Based on the organizational charts for Revision 8.3 draft QAPP provided by Mr. Stewart, some of the names have changed (see organization chart below). Also, under Field Operations Manager for Revision 8.3 there should be a box for Contracted Auditors that conduct the 6-month calibrations and external audits.

Distribution List (Revision 8.3)

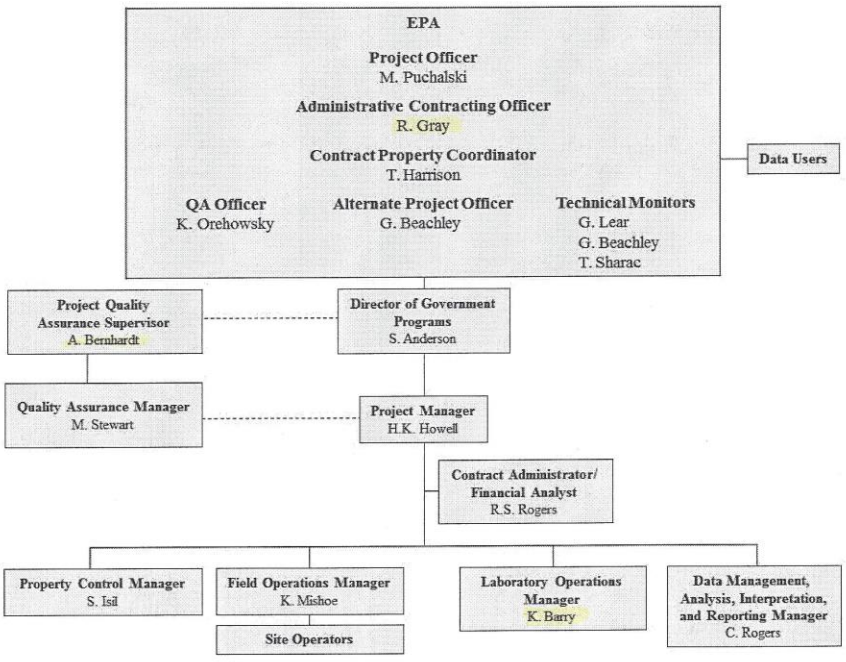
Amec Foster Wheeler
H. Kemp Howell, Project Manager
Ann Bernhardt, Project QA Supervisor
Marcus O. Stewart, QA Manager
Kevin P. Mishoe, Field Operations Manager
Garry L. Price, Laboratory Operations Manager (remove has since retired) replace with Katherine W. Berry
Christopher M. Rogers, Data Management, Analysis, Interpretation, and Reporting Manager
Selma Isil, Property Control Manager

US EPA
Melissa Puchalski, Project Officer
Gregory Beachley, Alternate Project officer/Technical Monitor
Karen Orehowsky, QA Officer
Gary Lear, Technical Monitor
Timothy Sharac, Technical Monitor
Rob Gray, Contracting Officer

NPS
Barkley Sive, Contracting Officer's Technical Representative

ARS
Joe Aldhoch, Program Manager
Christian Kirk, QA Officer
Jessica Ward, Data Management Section Manager
Mike Slate, Network Operations Section Manager

BLM
Ryan McCammon (Air Resource Specialist)
Charis Tuers (Air Resource Specialist)



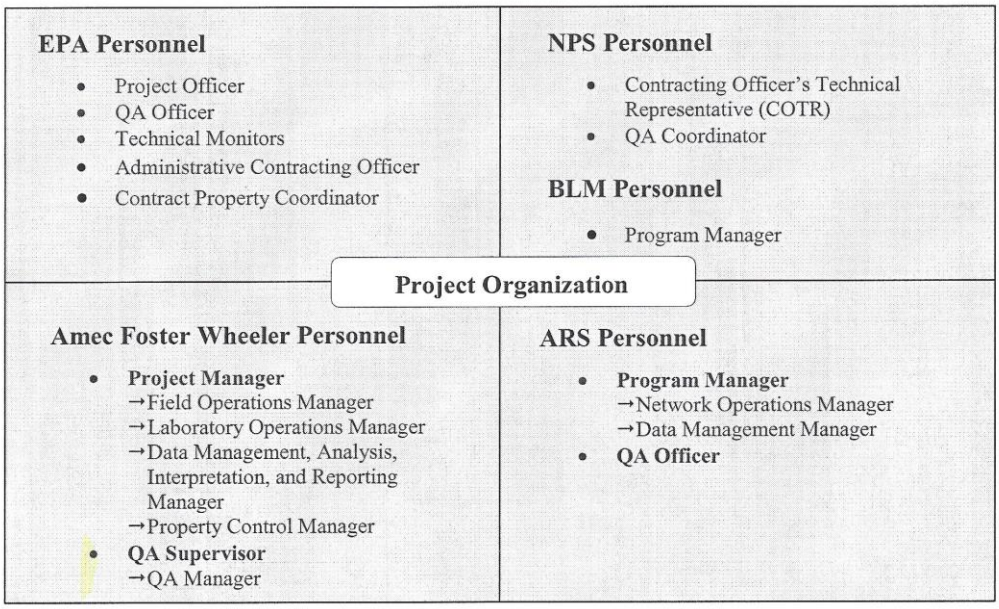
RECOMMENDATION:
Tracking the management changes from year to year to make sure the signature approval page, distribution list, and organizational chart are consistent is one of the most important and time consuming events when conducting the annual review of a QAPP. During next year's review of the QAPP, Mr. Stewart and Amec Foster Wheeler management should track any management change to the CASTNET program and make it a priority to confirm that the approval page, distribution list, and organizational chart are consistent.

FINDING 3:

Missing roles and responsibilities of the five organizational members and their interactions in the CASTNET program

Discussion:
(*EPA QA/R-5: March 2001: Element A4*)

Based on the organizational chart (see below) in Revision 8.2, there are five member organizations in the CASTNET program (US EPA, NPS, AMEC Foster Wheeler, ARS, and BLM). The role and responsibilities for these five organizations are not fully explained in the QAPP. A complete list of responsibilities for each organization should be defined in the QAPP. The QAPP also needs to include interaction between the five organizations.



RECOMMENDATION:
Provide a bullet list of the operations performed by each of the five organizations. Be sure to document management and communication roles and how they might overlay between organizations to show the interactions of management and any support staff. The roles, responsibilities, and interactions should be for all aspects of the CASTNET program; not just the ozone sampling and data management of the program.

FINDING 4:

Missing date information for changes in the Background Section of QAPP

Discussion:

(*EPA QA/R-5: March 2001: Element A5*)

Section 1.1 Purpose/Background of the QAPP (Revision 8.2) provides details of the program's growth/expansion over the years. Some of the changes from year to year are not provided with a date of the change, making it confusing when tracking the program changes such as the number of total sites operating in the program; the number of site measuring ozone; or the sites monitoring other gaseous pollutants other than ozone.

RECOMMENDATION:

RTI recommends developing a table or chart to illustrate the current status of the CASTNET program. This table or chart would be a quick reference for staff to explain the current status of the program. During the annual review of the QAPP, this information can be transposed to text describing the activities during the previous year. A new table will be created showing the current status for the upcoming year. This table should include the number of sites collection filter packs, the number of sites collecting ozone, number of sites collecting sulfur dioxide (SO_2), number of sites collecting nitrogen oxide (NO)/nitrogen dioxide (NO_2)/oxides of nitrogen (NO_x), number of sites collecting carbon monoxide (CO), and number of sites collecting particulate matter (PM). As a footnote to the table, special circumstances can be listed for a site.

FINDING 5:

Training records at field site

Discussion:

(*EPA QA/R-5: March 2001: Element A8*)

Section 2.3.1 of Revision 8.2 QAPP discuss training regimen of the EPA-sponsored field sites. During the TSAs conducted by RTI in 2012, the two site operators for the North Carolina sites could not provide any documentation showing training for the ozone collection for the CASTNET program. But when the auditor visited the Field Operations Laboratory, Mr. Stewart was able to provide the auditor with documentation stating the site operator acknowledge by signature that they fully understood the operations of the ozone collection system. The acknowledgement form was coupled with signing off on the Safety Plan for the field sites. To not create any further confusing, RTI recommended for Amec Foster Wheeler (AMEC at that time) to develop a mechanism to track training of field operators. This process was developed through the "CASTNET Site Operator Evaluation Questionnaire" administered by the service technician during the 6-month calibration checks of the ozone analyzers. When the RTI auditor asked the site operator if he had been trained and could he provide a record showing this; he (Mr. Brooks) was unable to. When the auditor visited the Field Operations Laboratory in Newberry, FL, Mr. Stewart was able to provide the form (see below).

RECOMMENDATION:

RTI recommends that Amec Foster Wheeler through their iCASTNET software develop a folder to be placed on the desktop at each site that shows training and safety records along with the current QA documentations (QAPP and SOPs). The calibration records are already on the desktop; the addition of the records for the site activities and site operator's credentials would be a positive step. Not only would these records be maintained at the Field Operations Laboratory, but they would also be available at the field sites. The current CASTNET Site Operator Evaluation Questionnaire form is a hard copy. It could be saved in the site operator's folder on their site's desktop as a PDF copy or iCASTNET can develop an electronic form that would allow the service technician and site operator to sign and date during the 6-month calibration check of the ozone analyzers.

CASTNET Site Operator Evaluation Questionnaire
Interviewer Guide

Rev. 0.1
8/30/2013

Site ID Number: PED108 Site Operator Name(s): Gene Brooks Interviewer Name: Anthony Wood

FSO since 1987 Date of Interview: 2/5/15

	Site Operator Evaluation ("Open Book" Interview)	Satisfactory (y/n)	Notes
1	Have you read and understood the procedural overview section of your Site Operator Handbook?	Y	
	The **Site Operator Handbook** is **Section II.A** of the Field SOP (Appendix 1) of the QAPP. **Section II.A.1** is the site operations overview and the FSO's should be able to cite all main topic bullets from sec. 6.0. **Section II.A.2** provides an overview of each piece of equipment and **Section II.B** has detailed site visit instructions, but are covered in subsequent questions. The main purpose of this question is to make sure the FSO is familiar with the QAPP, has a current accessible copy, and knows how and where to look for information regarding site visits. In addition, if the FSO has difficulty with the overview of the visit, this question will help direct the rest of the interview.		CD; kept onsite looked @ it & prep f/ questionaire
2	Have you read and understood the hardware overview section of your Site Operator Handbook?	Y	
	Section II.A.2 of Appendix 1 of the QAPP. Should be able to identify key equipment and describe its basic purpose. At a minimum, the following should be verified ✓• Can identify the ozone analyzer, transfer standard and zero air generation system ✓• Can identify Raven, Router, data logger, switch, phone modem. (Does not necessarily need to know how a router works, but should know it is used for communications). ✓• Can identify flow components (MFC, knockout bottles, rotameter, pump, hour meter)		
3	What information is recorded in the site narrative log?	Y	
	Site ID on each page (important because the pages are removed from the book), Personnel onsite, Date and time, ... Sign each page (legibly) The reason some information is duplicated in the narrative log is because it serves as a backup for lost/illegible SSRF entries, problem ticket actions used during final data validation, which can be months after the event (after the semi-annual audit)		"About everything" clouds, upburn, weather, any things out of ordinary leak checks, etc...

CASTNET Site Operator Evaluation Questionnaire
Interviewer Guide

Rev. 0.1
8/30/2013

4	How do you interface with the site data logger during Tuesday site visits?	Y	
	Section II.B (Site Operator Instructions) – Should be able to describe procedure to down and up channels. *[Interviewer: Discuss the PC200 display screens – assess FSO understanding of field names as related to hardware and associated data fields. Note that AMEC is available to assist if any difficulties are encountered.]*		
5	How do you download data and review onsite?	N	
	Section II.D.1 (Site Data Acquisition System – Attachment: Manual Data Collection) – Most FSOs will probably not be able to do this, but they may be asked during an audit (since it is typical for most other monitoring networks). It will be included in future training, emphasis will be on what data is recorded in what tables (e.g. five minute data, ZPS results) and how to review the data (i.e. using View application).		Definitely could
6	How do you perform an on-demand zero/precision check?	N	
	Section II.D.3 (Ozone Monitoring) *[Interviewer: Assess FSO ability to perform. Discuss how to check results via the site laptop computer and assessment of good, bad, and suspicious results.]*		Never done
7	How do you reset the Raven?	Y	
	Section II.D.1 (Site Data Acquisition System)		Has done before
8	What is your weekly filter pack exchange procedure?	Y	
	Section II.D.2 (Filter Sampling) – Should be able to describe main bullets in section 6.0 with correct details for: • handling to avoid contamination (proper use of re-sealable bags, gloves and sampling cartridge end caps); • correct order of tasks (e.g. filter off DAS flow -> filter off pump off -> leak check for *both* weeks -> NEW gloves -> filter on pump off -> filter on DAS flow). • flow and gas analyzer system leak checks; Every other week • proper documentation (SSRF); • checking sample lines for obstructions including water; • checking and emptying knockout bottle *[Interviewer: Discuss situations that require direct communication with AMEC field technicians for troubleshooting (e.g. failed leak checks). Most likely this question should take the most amount of time to discuss. For sample contamination, small details are often the most important and difficult to discuss over the telephone (e.g. when gloves are changed, what is touched with gloved hands – hopefully not the tower, when and what caps are used]*		Operator very familiar with QAPP/SOP SOP states *Change O_3 inline filters monthly ?=> we every do other wk *Reset min/max temp ?=> Not on SSRF anymore *Send SSRF in envelope ?=> Goes in Filterpack tube *Turn off computer when done ?=> NO! *Tweezers f/ O_3 swirlex after?

Section 3: Network Management

Amec Foster Wheeler along with subcontractor, Air Resource Specialists, Inc. (ARS) operate and maintain the ozone collection network for the CASTNET program. ARS is primarily responsible for overseeing the NPS sites and reporting validated data from those sites to Amec Foster Wheeler. Amec Foster Wheeler oversees the EPA site, but Amec Foster Wheeler 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 Plan for Part 58 Compliance", dated June 29, 2015 and the annual network plan can be found at http://epa.gov/castnet/javaweb/ozone/Part58Summary.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 PED108 in Prince Edward-Gallion State Forest. 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 data loggers and strip chart recorders as a back-up data logging system.

Appendix A. Detailed Site Information (Page 71 of 79)

AQS ID	51-147-9991
CASTNET ID	PED108
Site Name	Prince Edward
GPS Coordinates	37.165222, -78.307067
Street Address	Prince Edward-Gallion State Forest, Burkeville, Va 23922
County	Prince Edward
Distance to Roadway	> 100 meters
Pollutant	Ozone, 1
Parameter Code	44201
NAAQS Monitoring Objective	Highest Concentration
Monitor Type	EPA
Instrument	Thermo 49I
Method Code	047
FRM or FEM	FEM
Collecting Agency	EPA/CAMD
Spatial Scale	Regional Scale
Reporting Agency	EPA/CAMD
Start Date	01-JAN-11
Sampling Frequency	Continuous
Sampling Season	01/01 - 12/31
Probe Height	10 meters
Distance to Trees	> 50 meters
Distance Between Collocated	N/A
Wind Obstruction	360 degrees
Probe Material	Teflon(R)
Changes w/in 18 months	N
Frequency for 1 Pt QC	Daily
Last PE Date	18-NOV-14

FINDINGS

No problems or issues base on the review of the visited site and discussions with the Amec Foster Wheeler management and QA Manager.

Section 4: Field Operations

Amec Foster Wheeler oversees the EPA-governed CASTNET monitoring sites. During this TSA, RTI visited the PED108 field sites in Prince Edward-Gallion State Forest in Virginia. 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.

	PED108
Site Location Address	Prince Edward-Gallion State Forest Burkeville, VA 23922
AQS Number	511479991
Site Operator Contact Information	Gene Brooks 751 Oak Hill Road Cumberland, VA 23040 cgenebrooks@verizon.net
Backup Site Operator Contact Information	Bill Overstreet boverstreet.42@gmail.net Ralph Harris rharris@hotmail.net
Site Ozone Analyzer (Manufacturer, S/N, EPA decal)	Thermo 49i S/N: 1105347319 Decal: 000732
Transfer Standard Site Ozone Analyzer (Manufacturer, S/N, EPA Decal)	Thermo 49i S/N: 0622717855 EPA Decal: 000214
GPS Coordinates	N 37.165º W 78.306º
Elevation	148.7 ft. (45.3 m)

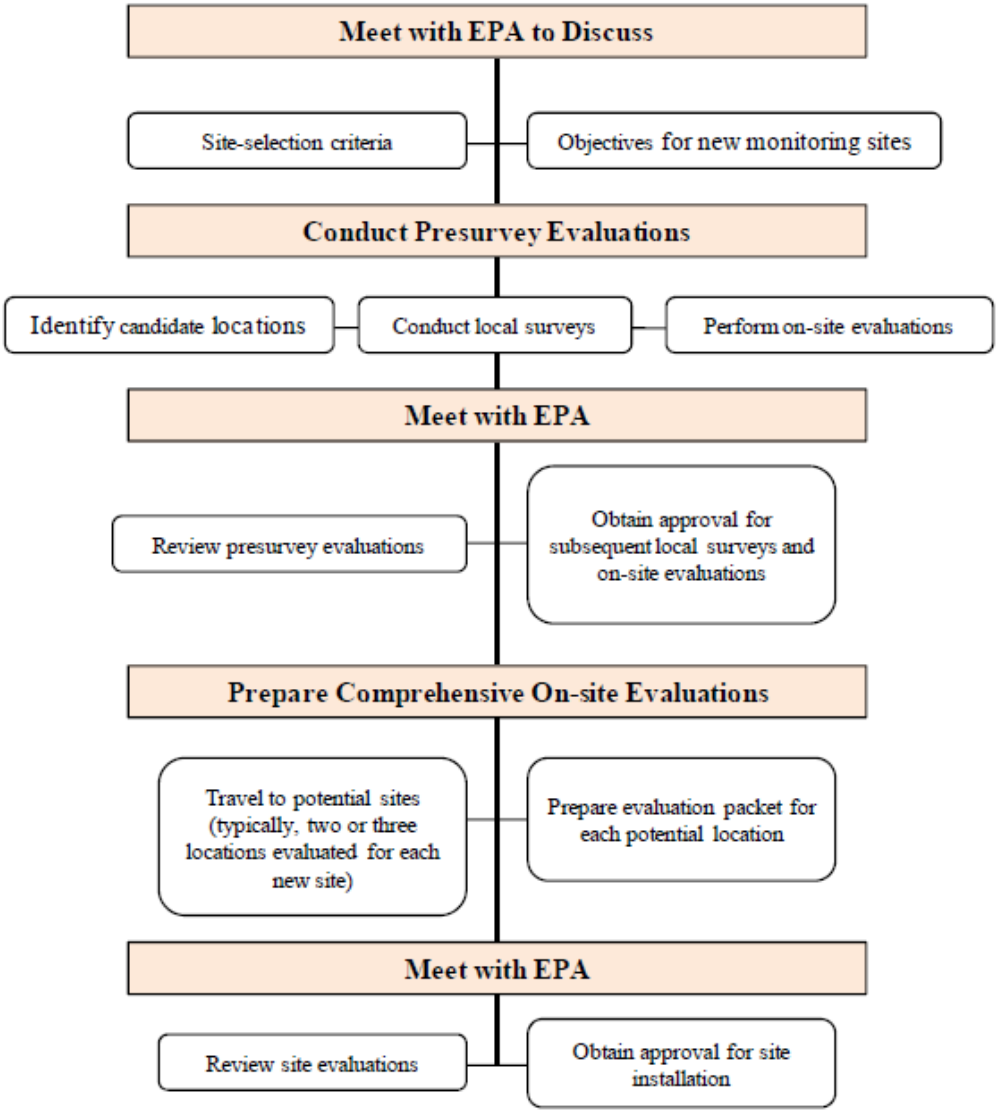
The CASTNET Field Operations Team oversees the field activities for the EPA-governed sites. The site operators (subcontractors) collect the field samples and complete the SSRFs based on procedures listed in CASTNET QAPP Appendix 1 Standard Operating Procedures, but Mr. Mishoe and Mr. Smith complete most 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. Mr. Smith remotely coordinates the field operations and provides logistical support of the field operations 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 the QA Manager (Mr. Stewart) reviews and authorizes her decisions. Mr. Mishoe and Mr. Smith also have knowledge of the ZSP checks. Ms. Selma Isil is the CASTNET Property Control Manager and reviews completed calibration forms. Ms. Ruby Wyrosdick and Ms. Helen Reed 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 and AQS. The site operator does enter some data from the CR3000 data logger program on the SSRF such as: 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 check (ZSP) 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 site's laptop and transmitted by the data logger to the Amec Foster Wheeler 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 Amec Foster Wheeler staff). The PED108 site was selected in 1987 for the National Dry Deposition Network (NDDN) and was later absorbed into CASTNET. Specific site selection documents from 1987 are not available. For future site installations, the staff will use the CASTNET Site Selection Process (see 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.

Figure 1-16 CASTNET Site Selection Process



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 PC200 software of the sampler's mass flow controllers. There is no independent flow rate check other than during the 6-month calibration, but the site operator does perform a leak check every two weeks. After collecting their filter packs and verifying the ozone collection process is working properly, the site operator calls the Amec Foster Wheeler Laboratory by telephone and discusses the weekly sampling event with the Field Operations Manager or other Amec Foster Wheeler staff (Mr. Justin Knoll, Mr.

Anthony Ward, or Ms. Heidi Schwing) and then submits sampled filter pack and SSRF to the Amec Foster Wheeler Laboratory. The site operators do not send any ozone data to the Amec Foster Wheeler 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 Amec Foster Wheeler management and QA Manager.

4.1 PED108 Field Site

On November 10, 2015, Mr. Nichol visited the PED108 site and met with Mr. Gene Brooks (Site Operator). The PED108 monitoring site is located in Prince Edward State Forest near Burkeville, VA and he has been in operating the site since inception in since October 1987. The site is also a National Atmospheric Deposition Program (NADP) National Trends Network (NTN) and Ammonia Monitoring Network (AMoN) site. Mr. Nichol discussed the field activities (electronic data review, paperwork, shipping, etc.), field operation management, the operation of the ozone analyzers (site and transfer), and quality assurance.

Operations at the site are performed by following an out-of-date checklist (dated November 9, 2007) with some variation (testing levels (0-, 225-, and 60-ppb) and acceptance criteria for ZSP checks have changed). The site has a CD that contains the CASTNET QAPP and Field SOPs. The site operator (Mr. Brooks) has been working the site since inception (October 1987) and is very knowledgeable of the field operations for the ozone sample collection process. He used to work for the Virginia Department of Natural Resources (VA DNR) and performs maintenance at the site on a regular basis. He stated that he has received training in the past, but could not provide documentation showing the dates and what training was received. During the visit, the RTI auditor asked him to contact the Field Operations Laboratory and ask for directions in downloading data from the datalogger at the site. He was very interested in understanding how to do this and is seeking further training since he is involved with air quality in the Virginia area.

Mr. Brooks maintains a field logbook (2-3 carbonless paper) and sends the white page to the Field Operations Laboratory upon completion. The current logbook was initiated on December 31, 2013. 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 Amec Foster Wheeler 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. There is one shed that houses the ozone analyzers, desk, data logger system, and site operator's files. 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 native trees in all directions.

Prince Edward (PED108) Measurements
(Distance measurements and compass directions are from the ozone inlet on the 10-m tall tower)

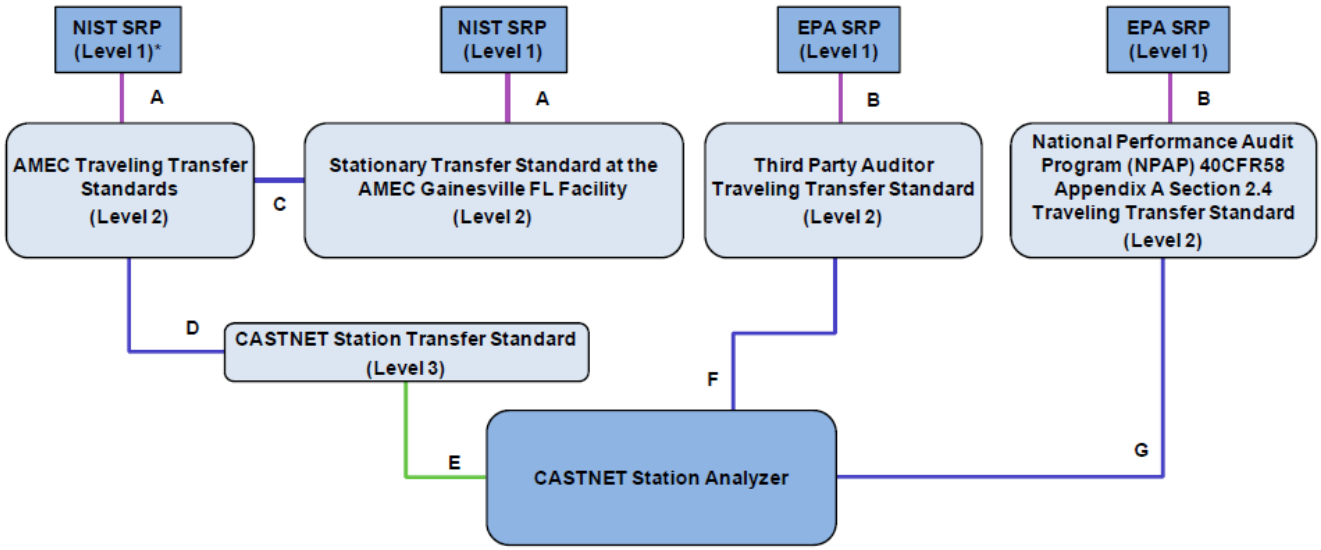
	Items	Compass Degrees	Distance (m)	Height (m)
T1	Tower (ozone inlet, filter pack, temperature sensor)	XXX	XXX	10
A	Shed	315	3.2	4.5
B	Rain gauge	140	3.7	0.5
C	NADP sampler	170	6.0	1.0
D	Passive AMoN sampler	260	14.1	2.0
E	Electric post	310	9.3	1.7

See Appendix A for responses to questionnaire and Appendix B for photos of the PED108 site.

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 Amec Foster Wheeler Laboratory maintains and control 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 Amec Foster Wheeler 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 (3 of the 5 are within certification) and four laboratory-controlled standards (2 of the 4 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: 1105347329; EPA Decal: 000736) is out of certification is and scheduled next week to be sent for certification. One of the transfer standards (Thermo 49i (S/N 1030244811; EPA Decal: 000691) was not operational during the audit. If this is repaired, it will be sent out for calibration prior to being used. Two of the laboratory-controlled standards (Thermo 49CPS (S/N 62939337; EPA Decal: 000122) and Thermo 49CPS (S/N 63110338; EPA Decal: 000582)) will no longer be sent for certification and eventually replaced.

Ms. Heidi Schwing maintains a spreadsheet (Certification Schedule) that list all standards that required annual recertifications and also maintains the database of certifications on the Amec Foster Wheeler server. Besides the ozone analyzers, the Field Calibration Laboratory also uses and tracks 15 flow meters (8 with current certification), 3 temperature sensors with current certifications, 2 barometric pressure sensors with current certifications, and 9 voltage units (6 with current certifications).

		Manufacturer S/N and EPA Decal Number	Last Certification Date
Level II Transfer Standards			
1	Thermo 49i	S/N: 1105347329 EPA Decal: 000736	Out of certification (last certified October 10, 2014) and is scheduled to be sent for certification next week
2	Thermo 49i	S/N: 1030244811 EPA Decal: 000691	Not operational at the time of the audit. Once repaired, the analyzer will be sent for certification prior to use in the field.
3	Thermo 49i	S/N: 1030244810 EPA Decal: 000679	June 1, 2015
4	Thermo 49i	S/N: 1030244813 EPA Decal: 000677	May 11, 2015
5	Thermo 49i	S/N: 1105347330 EPA Decal: 000747	May 11, 2015
Laboratory-Controlled Standards			
1	Thermo 49i-PS	S/N: 1022143674 EPA Decal: 000636	February 12, 2015
2	Thermo 49CPS	S/N: 62939337 EPA Decal: 000122	Will no longer be sent for certification and eventually replaced.
3	Thermo 49i-PS	S/N: 801827200 EPA Decal: 000380	November 10, 2015
4	Thermo 49CPS	S/N: 63110338 EPA Decal: 000582	Will no longer be sent for certification and eventually replaced.

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 base on the visit to the view of the Field Calibration Laboratory and discussions with Amec Foster Wheeler staff.

Amec Foster Wheeler should track the repaired Thermo 49i and verify it is recertified prior to use.

Section 6: Data 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 Amec Foster Wheeler 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 Amec Foster Wheeler 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, http://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 6, January 2015 in Appendix 6 of the CASTNET QAPP.
- EPA AQS system – This is the final repository of fully validated data for compliance and reporting purposes. Amec Foster Wheeler uploads data to AQS as described in CASTNET SOP "Data Deliverables", Appendix A.
- The AIRNow data also contains hourly data and are posted typically within the most recent hour of measurement. The data in AIRNow are therefore not validated except for broad range checks performed by the AIRNow system. The data are part of the air quality forecast system posted at www.airnow.gov. Based on the information posted on the AIRNow website, the raw data and documentation are available from the website https://docs.airnowapi.org/ through the creation of a user account. The archived raw hourly data are obtained from its ftp archives at ftp://ftp.airnowapi.org/HourlyData/ . Pursuant to discussions with Amec Foster Wheeler, the raw monitoring data was also accessed from http://www.airnowtech.org/.

Information Gathering:

1. Downloaded relevant sections of the CASTNET QAPP and SOPs from the CASTNET website. http://www.epa.gov/castnet . The CASTNET website had some access issues due to website reconfiguration by EPA. Therefore, the QAPP was obtained directly from Marcus Stewart, Amec Foster Wheeler QA Manager for the CASTNET program. 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. 8.2, October, 2014.

    b. QAPP Appendix 6: CASTNET Data Operations Standard Operating Procedures, October 2014.

    c. CASTNET Quality Assurance Reports

- First Quarter 2015
- Second Quarter 2015
- Third Quarter 2015
- Annual 2014

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 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 PED108 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 PED108 site as well as for two other sites to establish data traceability and to verify data flags:

   a. Raw data
      - 1-minute, 5-minute and hourly ozone data and related data for the PED108 site that had been acquired via the LoggerNet system were downloaded and provided to RTI by the Amec Foster Wheeler site operator during the onsite audit on 11/10/2015. The hourly data had been averaged by the data logger, and some flags had been applied.

      - Raw hourly ozone data, ozone flag, shelter temperature, and shelter temperature flag for the PED108 site were provided by Mr. Chris Rogers on 11/9/2015 for the three time periods identified in the data management questionnaire.

      - Hourly data were provided for the CDR119 by Mr. Rogers to verify data and flags for a power failure event.

   b. Data were downloaded from AQS for the following sites and time periods:

      - PED108, 1/29/2015-2/1/2015; 5/6/2015-5/9/2015
      - CDR119, 8/16/2015-8/31/2015
      - VIN140, 7/6/2015-7/11/2015
      - MCK131, 7/2/2015-7/5/2015
      - 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 http://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. Initially downloaded data on 11/30/2015, and repeated download on 12/6/2015 for one time period to verify corrections to missing data in the previous download.

d. Downloaded data from the AIRNow website. The archived raw hourly data were obtained from its ftp archives at ftp://ftp.airnowapi.org/HourlyData/ . The data were available for all sites for each hour of the day. The downloaded data were post-processed to extract data for the PED108 site for ozone for time periods of interest.

e. Downloaded data from the AIRNowTech website at http://www.airnowtech.org/. The data were available for each hour of the day for the time periods of interest.

Data Evaluation Activities:

1. Data were requested and obtained for the PED108 site for three time periods: 1/30/2015-1/31/2015, 5/7/2015-5/8/2015 and 9/16/2015-9/17/2015. 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 Amec Foster Wheeler, the hourly average data posted to the EPA CASTNET website, the hourly average data posted to the AQS website, and the hourly ozone data in the AIRNow dataset. Hourly ozone concentrations from AQS, CASTNET website and data from Amec Foster Wheeler all agreed perfectly for the three time periods for which data were requested, after truncating the Amec Foster Wheeler data in ppb to a whole number. Periods of invalidations also agreed between the hourly datasets.

2. The AIRNow data obtained from the airnowapi.org data source had to be converted from UTC to Eastern Time zone to align the time periods. Comparisons with the AIRNow data showed agreement for some records, but showed differences of about ±1 ppb for other records between the AIRNow and the AQS and/or the raw hourly data. There appeared to be no specific pattern. Amec Foster Wheeler noted that it creates the files and ftp's them to AIRNow. The data in the files prepared by Amec Foster Wheeler are sent with the same number of decimal places as available in the database. The AIRNow system should be truncating them to PPB. It is unclear why the data in AIRNow are slightly different from those in AQS and the CASTNET website. Amec Foster Wheeler should discuss with the AIRNow group at EPA and identify the cause of the difference and update the QAPP as appropriate.

3. The AIRNow data obtained from the airnowtech.org data source agreed perfectly with the data from the AQS and with the raw data. The data set also includes data for hour 2:00 A.M., but has a code of "7" indicating insufficient data. Hour 2:00 A.M. is when the daily calibration checks are performed and are therefore invalid in the AQS dataset.

4. 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 4. 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.

5. 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/precision/span checks.

6. Flags in the raw hourly data file provided by Amec Foster Wheeler 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.

7. Data for a few other sites (MCK131, VIN140) were examined to inspect time periods where the data had to be invalidated due to QA failures, equipment issues or power failures. Data were downloaded from AQS and CASTNET websites for the following time periods:

a. VIN140: 2015-07-06 00:00 to 2015-07-11 23:00
b. MCK131: 2015-07-02 00 to 2015-07-05 23:00
c. CDR119: 2015-08-17 01:00 to 2015-08-31 01:00

The time periods for which failures were identified agreed with the time periods with invalid data in the AQS and in the dataset on the CASTNET website in all three cases. The invalid flag for CDR119 was "AV" in AQS and "F" in the raw data set, both representing a power failure and agrees with the actual cause. The invalid flags in the AQS were "AS" for both VIN140 and MCK131. The flag is indicative of the QC failure at the MCK131 site. However, the issue for the VIN140 site was identified to be a "pump-out" issue for which a more relevant flag such as "AN" (Machine malfunction) may have been appropriate. While this is a subjective choice and does not change the fate of the data, use of a more relevant flag that is descriptive of the underlying problem would be useful from the perspective of a data user.

8. Raw data were also obtained from the PED108 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): 9/26/2015 7:00:00 PM to 9/26/2015 11:00:00 PM. The data from the CASTNET website had missing data for that time period with a QA code of "X". That CASTNET data was downloaded the morning of November 30, 2015. The qa_code was "1" for the records surrounding the above missing hours.

   Discussions with Mr. Rogers of Amec Foster Wheeler revealed that the "X" represents the qa_code for a placeholder record. Mr. Rogers responded that it indicated a break in polling. The break had lasted from 2015-09-26 20:43 through 2015-09-28 09:39. As per Mr. Rogers, the daily submittal was made before those final 5 hours were polled and the missing data were caught up in the EPA database when all of September was submitted at the end of November.

   In follow-up, the auditor re-downloaded data from the CASTNET website on Dec 6, 2015 to close the verification checks. In the latest download, the missing hours from 9/26/2015 7:00 PM to 9/26/2015 11:00 PM had valid ozone data that were reasonable in comparison to the data for the adjacent time periods and agreed with the raw hourly data. Data for other hours in September 2015 agreed exactly with the previously downloaded values. The "Update_date" in the dataset was 9/28/2015 9:39, the same as those for the rest of the time period indicated by Mr. Rogers. Further, the "QA_Code" was now updated to "2" indicative of the level-2 data validation. It appeared that these five hours were initially missed, but were fixed during the re-polling performed as part of the level 2 validation.

9. Example of hard copy and electronic logs of the level 3 validation was requested. Amec Foster Wheeler provided examples for the VIN140 site for the same time period and equipment issue discussed above. The attachments provided an example of the VIN140 pump-out issue noted. Both the electronic and hardcopy notes and data flags matched. The date of that review (8/27/15) also matched on the hard copy and electronic logs, as well as the "UPDATE_DATE" field in the dataset downloaded from CASTNET website.

FINDINGS

FINDING 1:

Review of the QAPP revealed that it is a comprehensive document with detailed descriptions. However, minor edits need to be made to correct minor errors. These include:

- Updating QAPP to correct figure and table references. Certain locations appear to have incorrect references. For example, on page 23 of 47 of section 4.0 of the QAPP (revision

8.2), the first line refers to Figures 2-10 and 2-11. It appears that these should instead refer to Figure 2-13 and Figure 2-15 respectively.

- Verifying and updating webpage links mentioned in the QAPP and the SOPs. The EPA webpage appears to be under reconfiguration, and some links appear to be broken during the audit review. However, we recommend that Amec Foster Wheeler verify all electronic links during the revision and finalization of the QAPP and the SOPs.
- In Appendix 6, SOP on CASTNET Data Operations, references to attachments of data sets appear to be incorrect. For example, the SAS Datasets REG1 and REG2 appear in Attachments "F" and "G", but the documents refer to attachments "D" and "E". The Attachment "E" is itself a SAS program. The references to the programs that require those datasets also need to be updated.
- Page 25 of 39 of section 1.0 of the QAPP refers to three levels of security. There is some confusion as to what it refers to and mix-up with the three levels of data validation. These references need to clarified and expanded upon.

RECOMMENDATION:

It is recommended that the incorrect references to figures, tables and attachments be corrected, and certain phrases be clarified, during the next revision of the QAPP. Further, we recommend that Amec Foster Wheeler verify all webpage electronic links at the time of the revision to ensure those are current.

FINDING 2:

In terms of data communication, two sites use dial-up modem, while the rest of the sites use cellular modems with internet access. Figure 4-1 in the QAPP currently lists cellular data network as the mode of communication.

RECOMMENDATION:

It is recommended that the exception for the 2 sites be noted in Figure 4-1 of the QAPP through a footnote.

FINDING 3:

The hourly ozone values in the AIRNow dataset vary depending on the data source. Data from the airnowapi.org website are off by ±1 ppb for some records compared to the values in AQS and/or the calculated hourly averages. It is unclear why the values are different from the other datasets, including the raw data. The data from the airnowtech.org website agrees perfectly with the data in AQS as well as with the raw data.

RECOMMENDATION:

It is recommended that Amec Foster Wheeler discuss with the AIRNow group at EPA to understand the reasons for this discrepancy and the types of processing performed to the data prior to posting it on AIRNow. The QAPP needs to be updated with the outcome of that discussion. It is also recommended that the QAPP note the potential differences in the AIRNow data based on the data source and caution the data user on the correct data source to be used.

FINDING 4:

Except for the discrepancy in AIRNow (noted in Finding 3), all other data agreed between the different data sets. No major discrepancies in data were identified upon comparing data, other than the 1-hour offset that was easily explained. The data from the CASTNET website is censored to not include flags associated with invalid

data.

RECOMMENDATION:

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. Not all users may have access to the data in AQS.

FINDING 5:

Comparison of the raw data with the data obtained from the CASTNET website revealed 5 hours with missing data. Discussions with Mr. Rogers of Amec Foster Wheeler indicated that it represented a break in the polling of the data logger and were addressed during the end of month validation. Re-download of data from the CASTNET website showed that the missing hours were replaced with valid ozone data that agreed with the raw hourly data. The qa_code had also changed from "1" in the original download from the CASTNET website to "2" in the second download. The replacement of missing hours, coinciding with the change in qa_code is consistent with the activities described in the QAPP associated with the different levels of data validation. This also served as a real example of where missing data was fixed through re-polling. The description of the flag or the qa_code was however missing from the QAPP.

RECOMMENDATION:

Table 4-7 of the QAPP does not describe the flag "X" in the raw data. Please update the table to include flag "X".

FINDING 6

An examination of electronic and hard copy of the level 3 validation log showed good agreement with the data set and against each other. Both electronic and hard copy notes match. The "Update_date" field in the dataset downloaded from CASTNET website matched with the date of the level 3 validation.

RECOMMENDATION:

No action required.

FINDING 7

Amec Foster Wheeler is moving from CDMSA to iCASTNET software for their data validation procedures. The software is still being completed and tested as part of their ongoing data validation.

RECOMMENDATION:

It is recommended that Amec Foster Wheeler continue to compile and maintain their ongoing tests to serve as documentation of the detailed evaluation of the iCASTNET software.

Section 7: Quality Control and Quality Assurance

Quality Management Documentation

The quality management system (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 Amec Foster Wheeler servers; and records of e-mail transmittals.

The current CASTNET QAPP and supplementary SOPs are Revision 8.2 and dated October 2014 (even though the approval signature page is dated February 2011). 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. 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.

Note: Section 2. General Program identifies 4 findings concerning the current QAPP that should be addressed in future revisions.

The CASTNET website lists the entire current field and data operations SOPs in Appendix 1 and 6 of the QAPP (October 2014), respectively. These SOPs are reviewed annually and were approved by the Amec Foster Wheeler management on October 30, 2014 (current under review and approval). This appendix section also includes a revision history of changes made to the SOPs. 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 6, 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 PED108 site, two 6-month calibration checks were performed (February 16, 2015 and August 17, 2015) and the last PE was performed on November 3, 2014 (scheduled for November 2015 and completed on December 3, 2015). 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 ≤ ±3 ppb Precision/Span ≤ ±7% between supplied and observed concentrations
6-Month Calibration Checks	All points within ±2% of full scale of the best fit straight line ±5% of actual for any value, $r^2 > 0.9950$, 0.9500 < slope < 1.050 -3.0 ppb < intercept < 3.0 ppb
PE Audits	Percent difference of each audit level ≤ 15% or ± 1.5 ppb for audit levels 1 & 2.

Amec Foster Wheeler 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. Amec Foster Wheeler 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. 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 except for issues listed in Section 2 General Program. Based on a conversation with Mr. Stewart, the acceptance criteria (zero value ≤ ± 3 ppb) in the table above are under review and will be tightened in the Revision 8.3 QAPP.

APPENDIX A

Prince Edward (PED108) 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

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 Prince Edward (PED108) field site in Virginia. All questions are based on 40 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). The current QAPP is Revision 8.2 dated October 31, 2014 with eleven appendices. Several of these appendices or particular sections of the appendices will 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 EPA AQS and AIRNow. Those appendices are:

- Appendix 1 CASTNET Field SOPs
- Appendix 2 EPA Site Contact List
- Appendix 3 ARS SOPs (secondary)
- Appendix 6 CASTNET Data Operations SOPs, and
- Appendix 8 CASTNET Quality Management Plan.

Part 1. General Information

Monitoring Site Information
(PED108)

NAME/LOCATION OF MONITORING SITE: (Ozone): **Prince Edward**

MONITORING SITE ADDRESS: **Cumberland State Forest**
751 Oak Hill Road
Cumberland, VA 23040

MONITORING SITE AQS NUMBER: **511479991** CASTNET SITE NUMBER: **PED108**

MONITORING AGENCY AFFILIATION: **CASTNET**

NAME OF ANALYSIS/SUPPORT LABORATORY: **Amec Foster Wheeler Laboratory in Newberry, FL**

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

AUDIT DATE: **November 10 (field site) and November 16 and 17 (Ozone Calibration Laboratory)**

PERSONNEL INTERVIEWED:

NAME	POSITION	PHONE/E-MAIL
Site		
Gene Brooks	**Site Operator**	**cgenebrooks@verizon.net** **804-492-9232 (home)** **434-390-8935 (cell)**
Bill Overstreet	**Backup Site Operator**	**boverstreet.42@gmail.com** **434-607-9507**
Ralph Harris	**Backup Site Operator**	**rharris@hotmail.net** **434-392-9825 (home)** **434-547-8929 (cell)**
Field Calibration Laboratory		
Kevin Mishoe	**Field Operations Manager**	**kevin.mishoe@Amecfw.com** **352-332-3318**
Mike Smith	**Assistant Field Operations Manager**	**michael.j.smith@Amecfw.com** **352-332-3318**
Marcus Stewart	**Quality Assurance Manager**	**marcus.stewart@Amecfw.com** **352-332-3318**
Chris Rogers	**Data Management, Analysis, Interpretation and Reporting Manager**	**christopher.rogers@Amecfw.com** **904-391-3744**
Kemp Howell	**Project Manager**	**kemp.howell@Amecfw.com** **352-332-3318**

OPERATIONAL AREAS THAT WERE OBSERVED: Observed field activities at the PED108 field site, data review, tracking, and reporting at Amec Foster Wheeler location in Gainesville, and answering phone conversations on Tuesday with site operators.

Part 2: Basic QA/QC

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
A. QAPP and SOPs				
1. Is there an EPA approved quality assurance project plan (QAPP) specific to the CASTNET work being conducted by the laboratory?	X			Current QAPP in Revision 8.2 dated October 2014
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			
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 management (H. Kemp Howell-Amec Project Manager, William Imbur-Amec Project Quality Assurance Supervisor, and Marcus Stewart-Amec Quality Assurance Manager).
7. Has the Regional EPA Clean Air Markets Division (CAMD) Project Officer and QA Officer reviewed the QAPP?		X		Lance McCluney (EPA Project Officer) Larry Kertcher (EPA QA Officer) John Ray (National Park Service)
8. Has the CAMD Project Officer and QA Officer approved and signed the QAPP?		X		Current QAPP on website shows signatures from February 22, 2011 for Lance McCluney-EPA Project Officer and Larry Kertcher-RPA QA Officer) and February 28, 2011 for John Ray NPS-Contracting Officer's technical representative) This page has not been updated on the website at EPA's request, but for the next revision (8.3), the personnel has been revised and updated and the new signature page will be posted with the Revision 8.3 QAPP based by comments from Marcus Stewart.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
9. Has the Amec Foster Wheeler Project Officer and QA Manager and other network leads approved and signed the QAPP?		X		Date: February 17, 2011 Signature page is not current if annual reviews have been performed.
10. Is the purpose of the QAPP clearly stated?	X			
11. Is the project organization clearly identified with their roles and responsibilities?		X		Roles and responsibilities for each of the five organizations are not clearly defined.
12. Is the organizational chart in the QAPP up-to-date?		X		Names of management have changed.
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			
14. Is a signed copy of the approved QAPP onsite and available to the field operator(s)?	X			Copy of the QAPP is on a CD in a 3-ring binder maintained at the site. Version 8.2 with February 2011 signature page.
15. Has the approved QAPP been reviewed (or will be reviewed) on a periodic basis? Ask to see.	X			Reviewed annually, but signature page has not been updated with current management.
16. Is this review of the QAPP documented (or will it be documented)?	X			
17. Are there amendments or deviations from the approved QAPP?		X		
18. Have they been EPA approved?			X	
19. Are they available for review?			X	
20. Has the QAPP been reviewed or will be reviewed on a periodic basis and re-approved? What is the review/approval schedule?	X			
21. Are reviews/approvals documented? Review.	X			
22. Does the QAPP cover the complete field/laboratory operation for the CASTNET program?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
23. 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.
24. Are Data Quality Objectives (DQOs) and Data Quality Indicators (DQIs) identified in the QAPP? How are realized?	X			
25. What steps are performed if DQOs are not achieved and maintained?				Audit the issue, determine the problem, and develop a solution.
26. 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			
27. Is there a Quality Management Plan (QMP) developed by Amec Foster Wheeler?	X			Amec Foster Wheeler has a QMP, Revision 2, dated July 20, 2015. The document is based on EPA Guidance Document QA/R-2. The document is proprietary and will not be posted on the CASTNET website.
28. Are written and approved standard operating procedures (SOPs) in place for the various samplers?	X			QA document references in the reference section need to be reviewed and updated to the current EPA document.
29. Does the format of the SOPs follow the guidelines outlined in the EPA Guidance Document s (EPA QA/G-6)? If not, describe what significant information is missing?	X			
30. Does the SOPs reflect, present and address specifications and operations that are in accordance with those applicable to the CASTNET program?	X			
31. Are the SOPs signed by management and QA staff?	X			
32. Are the SOPs available for review by auditor?	X			
33. Are the SOPs controlled documents?	X			
34. Are signed copies of the SOPs available to the field operator?	X			Copies of the Field SOPs are on a CD maintained in a 3-ring binder at the site.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
35. Does site operator have current up-to-date SOPs onsite? Electronic or hard copies.	X			Note: At site, there is a yellow card (Site Operation Checklist) dated November 9, 2007, that list the ZSP as 0 PPB ±5, 90 PPB ±9, and 400 PPB ±40. This card needs to be updated and replaced.
36. Are there deviations from the SOPs?		X		
37. If yes, have these deviations been documented and approved?			X	
38. Are documented deviations available for review?			X	
39. Has training been conducted for these SOPs?	X			
40. Is this training documented?		X		No training documentation maintained at the field site.
41. Are the SOPs current and up-to-date and met the specifications presented in the CASTNET program?	X			
42. Have the SOPs been reviewed on a periodic basis?	X			
43. What are the frequency and the approach?				Annually by the QA Manager and Project Management Team.
44. Is this review documented? (Review).	X			
45. Is there a CASTNET project work organizational chart available?	X			Needs to be updated with new names.

Additional Comments:

Q6, Q7, Q8, Q9, Q13. Based on the signature page from February 2011, several of the names for Amec Foster Wheeler, Regional EPA CAMD, and NPS do not match the Distribution List provided by Marcus Stewart. The names in Comments for each question are the names on the signature page dated in February 2011. Below are the correct names based on the Distribution List for the recently revised QAPP under review. Also, the management for BLM should be listed on the Signature Approval Page.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	

Additional Comments:

Amec Foster Wheeler
H. Kemp Howell, Project Manager
Ann Bernhardt, Project QA Supervisor
Marcus O. Stewart, QA Manager
Kevin P. Mishoe, Field Operations Manager
Garry L. Price, Laboratory Operations Manager (remove has since retired) replace with Katherine W. Berry
Christopher M. Rogers, Data Management, Analysis, Interpretation, and Reporting Manager
Selma Isil, Property Control Manager

US EPA
Melissa Puchalski, Project Officer
Gregory Beachley, Alternate Project officer/Technical Monitor
Karen Orehowsky, QA Officer
Gary Lear, Technical Monitor
Timothy Sharac, Technical Monitor
Rob Gray, Contracting Officer

NPS
Barkley Sive, Contracting Officer's Technical Representative

ARS
Joe Aldhoch, Program Manager
Christian Kirk, QA Officer
Jessica Ward, Data Management Section Manager
Mike Slate, Network Operations Section Manager

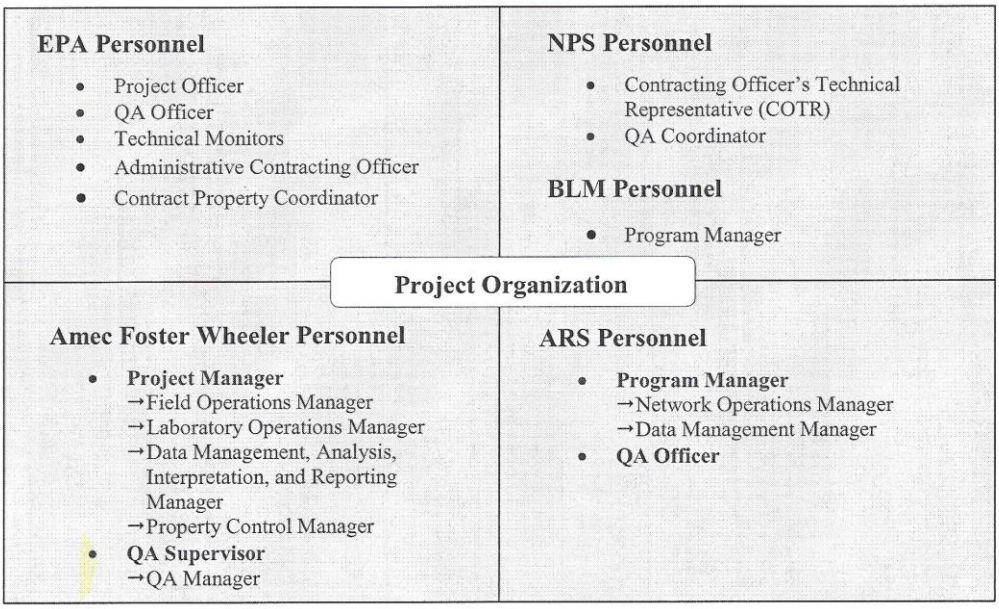
BLM
Ryan McCammon (Air Resource Specialist)
Charis Tuers (Air Resource Specialist)

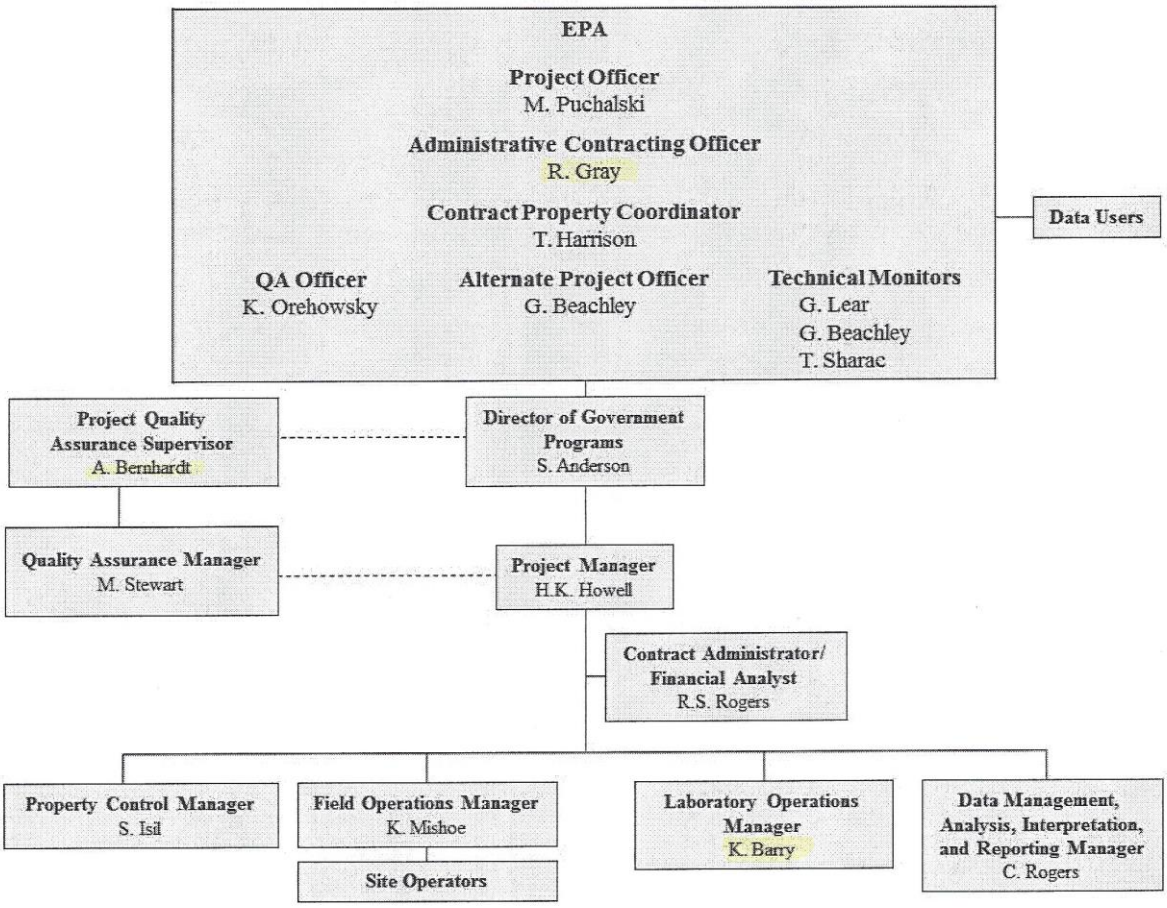
Q11. Based on the organizational charts in Version 8.2, there are five member organizations in the CASTNET program (US EPA, NPS, Amec Foster Wheeler, ARS, and BLM). The role and responsibilities for these five organizations are not fully explained in the QAPP. A complete list of responsibilities for each organization should be defined in the QAPP. The QAPP also needs to include interaction between the five organizations.

Q12. Based on the organizational charts in Version 8.2, there are five member organizations in the CASTNET program (US EPA, NPS, Amec Foster Wheeler, ARS, and BLM). Based on the organizational charts for Version 8.3 draft QAPP provided by Marcus Stewart, some of the names have changed (see organization charts below). Also, under Field Operations Manager for Version 8.3 there should be a box for Contracted Auditors.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	

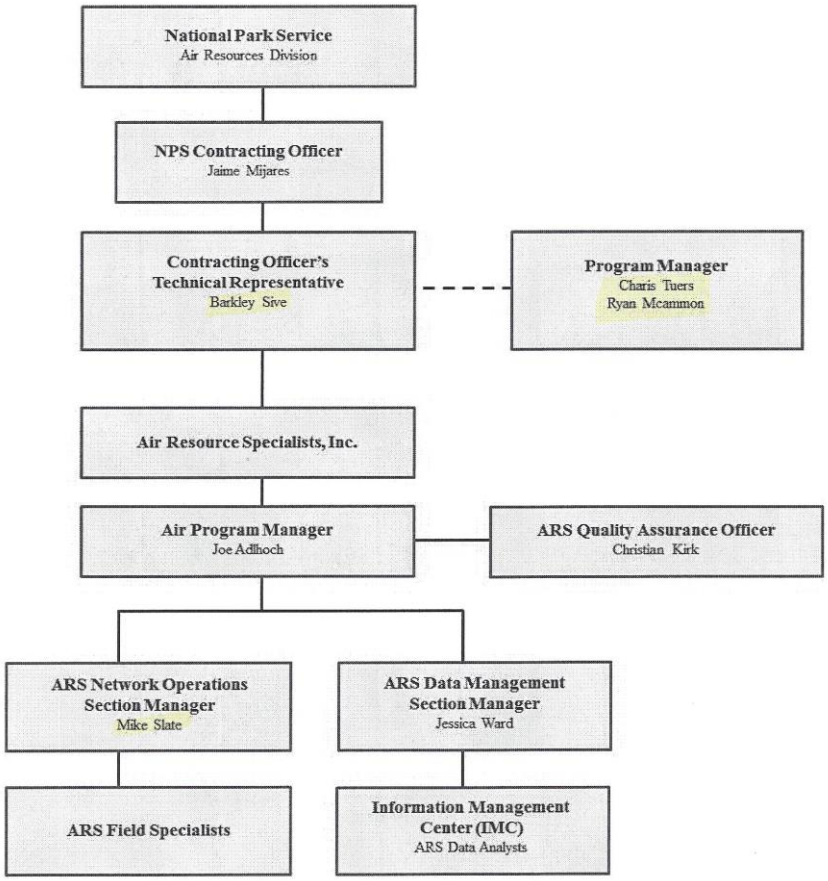
Additional Comments (Continued):





AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	

Additional Comments (Continued):



40. Any training provided by Amec Foster Wheeler staff to site operators needs to be documented. The documents should be maintained at both the field site and Amec Foster Wheeler location in Newberry, FL.

NOTE: Prior to Section 1.2 Project Organization in the QAPP, update to include activities through 2015. Also, for a more graph effect, tabulate the CASTNET site to include the number of sites collection filter packs, the number of sites collecting ozone, number of sites collecting sulfur dioxide SO_2), number of sites collecting nitrogen oxide (NO)/nitrogen dioxide (NO_2)/oxides of nitrogen (NO_x), number of sites collecting carbon monoxide (CO), and number of sites collecting particulate matter (PM).

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		Name: Department Managers
d. CASTNET QA Auditor(s) 6-month calibration		Name: Various – Inquest Environmental, AQS, Meteorological Solutions Inc.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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: Howell, Mishoe
b. Coordinates field operations,				Name: Mike Smith, Mishoe
c. Logistical support of field operations,				Name: Mishoe, Smith
d. Training monitoring site operators, and				Name: Mishoe, Smith
e. Review of routine sampler data and quality control data.				Name: Rogers
3. Name of Amec Foster Wheeler staff responsible for (indicate which apply):				Field Staff: Justin Knoll, Anthony Ward, Heidi Schwing
a. Operation of samplers/monitors/equipment,				Name: Mishoe, Smith, Knoll, Ward
b. Calibration of samplers/monitors/equipment,				Name: Mishoe, Smith, Knoll, Ward
c. Maintenance of samplers/monitors/equipment,				Name: Mishoe, Smith, Knoll, Ward, Schwing
d. Maintenance of monitoring site,				Name: Mishoe, Smith, Knoll, Ward
e. Operation of ozone monitor,				Name: Mishoe, Smith, Knoll, Ward (all working with site operators)
f. Calibration of ozone monitors, and				Name: Mishoe, Smith, Knoll, Ward (and Inquest Inc.)
g. Maintenance of ozone monitor.				Name: Mishoe, Smith, Knoll, Ward (all working with site operators)
4. What is the program relationship between Amec Foster Wheeler and ARS? QAPP shows two project organizations (ARS, Amec Foster Wheeler)				Discuss: Amec Foster Wheeler oversee the filter packs distribution and analyses for all sites under the CASTNET program. Amec Foster Wheeler oversees the EPA field sites for ozone collection and ARS oversees the ozone collection for NPS and BLM field sites.
5. Can you provide a flow chart showing the management reporting and communications between Amec Foster Wheeler, ARS, US EPA, and NPS?		X		Can discuss onsite. Sites comply with QAPP across the network. All parties teleconference at least once per month.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
6. Is there someone who reviews the following completed forms:				
a. Field forms? Who?	X			Name: Selma Isil
b. Chain of Custody (COC) forms? Who?	X			Name: Helen Reed, Clifford Hill, Ruby Wyrosdick
c. Review of electronic data from monitors? Who?	X			Name: Anna Karmazyn
d. Review of field logbooks (site, monitor). Who?	X			Name: Helen Reed, Clifford Hill, Ruby Wyrosdick. The logbooks have carbonless copies that are sent with the Site Status Report Form (SSRF).
7. Has the review of completed field and COC forms been done?	X			
8. Is anyone responsible for QA audits of the site? 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. Tyler Ward (MSI)
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			Date: February 16 and August 17, 2015
12. Were there any findings during the audits in Question 11?		X		Observation: low backup battery voltage
13. Are audits documented? How?	X			
14. Are the audit results available for review by staff and auditors? Ask to view audits from this program.	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
15. Does the site operator conduct performance checks of the ozone monitor? Frequency?		X		The ZSP check is performed daily ay 1:45 am electronically by the PC program. The site operator only performs a manual ZSP check if the electronically 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 checks. Check at Ozone Calibration to verify these are being done.
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 "PED108 Calibration." Audit reports track EPA Property Number, maybe include Manufacturer Serial Number.
18. Is there any internal auditing program for the ozone monitor?	X			
19. If yes to Question 18, who conducts the internal audit?				Field staff, including Inquest, etc.
20. What is the frequency and where are the results posted?				Semi-annual audits. Data tables, network folder, hard copy files.
21. Is there a designated schedule for calibrations of the ozone monitor? Frequency?	X			Audited every 6 months. Calibrated if needed.
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		Site operators are contracted by Amec Foster Wheeler to collect samples.
24. Do any contractors work at the site? How many? Name?	X			
25. What steps are taken to ensure contract staff meets training and experience criteria?				Training is performed by Amec Foster Wheeler field staff and subcontractors hired to conduct the calibration checks.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
26. Is this documentation maintained? Where?	X			Network SharePoint site. Review at Ozone Calibration Marcus Stewart provided a copy of the CASTNET Site Operator Evaluation Questionnaire (Interviewer Guide) for PED108 performed by Anthony Ward on February 5, 2015. This 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.
27. Is there a written procedure for the QA audit, QC checks, calibration, or internal audits for the CASTNET program?				Contained in the Field Calibration Manual in Appendix 1 of the QAPP.
a. QA audit?	X			
b. QC checks?	X			
c. Calibrations?	X			
d. Internal audits?	X			
28. Who is responsible for reviewing results from audits and checks to determine if data should be invalidated?				Anna Karmazyn
29. How is the audit data (6-month) reviewed and what are the decisions (criteria) based on?				Calibration folder with hardcopy printouts. Criteria summarized in QAPP Table 4-12. The data is reviewed to determine if the analyzer is performing within the acceptance criteria listed below. All points within ±2% of full scale of the best fit straight line ±3% of actual for any value
30. Is this process documented? Where?	X			Hardcopy forms on file.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
31. Are there corrective action steps in place?	X			Criteria summarized in QAPP Table 4-12. 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. All data collected "as found" and the audit (calibrator) makes corrections as needed and documents changes. The results are placed on the iForms spreadsheets on the Amec SQL server.
32. Where are these steps documented? Review examples of corrective action, if possible.	X			Actions taken are documented on hardcopy forms. Data are also flagged electronically.
Additional Questions or Comments:				
C. Training, Safety and Chain-of-Custody				
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. Brooks has operated the site since 1987; initially trained in Gainesville. He requested to the auditor more training on the ozone analyzers regarding data review, function, and internal operations of the analyzers.
2. Is it fully implemented?	X			Site operator would like further training on the ozone analyzer data collection process.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
3. Is this training documented in a training record?		X		Documented training forms have not been filed for all operators. Need to develop program to track site operator training and follow up training.
4. Is the training record available for review?		X		No training records found at this site. Amec Foster Wheeler Ozone Calibration Laboratory maintains copies of training conducted during the 6-month calibration visits but the RTI auditor could not find evidence of the training records maintained at the field site.
5. Is there any documentation maintained at the site of training of the site operator? (site logbook)	X			Site operator was trained initially when the site was set up in 1987. These records are not available for reviewing during the audit. 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			
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			Hard hat. No safety equipment required for monitoring the ozone analyzers.
9. Are personnel adequately trained regarding appropriate safety procedures?	X			
10. Are personnel adequately trained regarding cylinder handling?			X	There are no gas cylinders at the site.
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 and NH3 filter for the week of the audit on the SSRF.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
Additional Questions or Comments: 2, 3. Recommends that during the 6-month calibration audit provide some onsite training and develop a mechanism to document this training. The site operators are hired contractors to Amec Foster Wheeler and Amec Foster Wheeler are ultimately responsible for their training, work performance, and quality of data collected at the field sites. By developing and maintain documentation (records) for the training of field staff will help future audits of the complete field sample collection and laboratory analyses systems. Develop a mechanism for documenting training records at the field sites.				
D. Monitoring Site Housekeeping				
1. How long has this site been used for the CASTNET program?				Site initiated in October 1987.
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			
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/equipment?		X		O&M information documented in site logbook. There is no separate O&M logbook.
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			Maintained on CD in 3-ring binder at field site.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
13. Can the site operator provide a copy of signature page of acknowledgement for site operator to sign for safety plan?		X		Acknowledgement page was signed on March 3, 2014 by site operator and March 17, 2014 by backup operator. Provide by AMEC Ozone Calibration Lab.
Additional Questions or Comments:				
F. Documentation				
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 PC200 computer program are documented on the SSRF and also reported during phone conversation with Amec Foster Wheeler Field Coordinator. The site operator uses a logbook (2- or 3-carbonless paper) and submits pages of the logbook with the SSRF to the Amec Foster Wheeler 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			Maintained on CD in 3-ring binder at field site.
b. SOPs?	X			Maintained on CD in 3-ring binder at field site.
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 Amec Foster Wheeler Project Officer and QA Manager	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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			At site, there is a yellow card (Site Operation Checklist) dated November 9, 2007, that list the ZSP as 0 PPB ±5, 90 PPB ±9, and 400 PPB ±40. This card needs to be updated and replaced.
6. Is this documented?	X			
7. Are procedures in place if out-of-date documents are found? If so, briefly describe.	X			
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			Current logbook runs back to December 31, 2013.
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			Auditor.
14. Are logbooks/forms stored? How?	X			Logbooks are maintained at the site on a shelf in the shelter. The SSRFs are maintained in a 3-ring binder.
Additional Questions or Comments:				

Part 3: Network Management

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
A. Key Individuals				
1. List all key individuals, job titles, e-mail extensions, and telephone numbers associated with this site.				
(Site operator)				Gene Brooks
(Backup operator)				Ralph Harris
2. Other than CASTNET, with what other networks is the site associated?				AMoN
3. What type of samples is collected at this site?				Filter pack, hourly ozone, and NH3 samples
Additional Questions or Comments:				
B. Network Planning (completed by CASTNET QA Manager)				
1. What is the date of the most recent network assessment? (mostly likely performed by EPA CAMD)				CASTNET Plan for Part 58 Compliance dated June 29, 2015
2. Is the annual network plan up-to-date?	X			See here - http://epa.gov/castnet/javaweb/ozone/Part58Summary.pdf
3. Do you collect collocated samples?	X			"NAAQS Excluded" at POC2.
4. What is the date of the current network plan?				June 30, 2015
5. Review the network plan includes the information required for each site.				Plan appended to questionnaire. PED108 information attached.
a. AQS Site ID Number	X			
b. Street Address and geographic coordinates	X			
c. Sampling and Analysis Method(s)	X			
d. Operating Schedule	X			
e. Monitoring objective and scale of representativeness	X			
f. Site suitable/not suitable for comparison to annual NAAQS standards	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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			
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?				Tim Sharac (EPA Clean Air Markets Division); Washington D.C. on CASTNET website.
9. List any non conformance waivers for the site visited?			X	See additional comments section.
10. Where are the waivers documented and who gave approval?			X	

Additional Questions or Comments:

Appendix A. Detailed Site Information (Page 71 of 79)

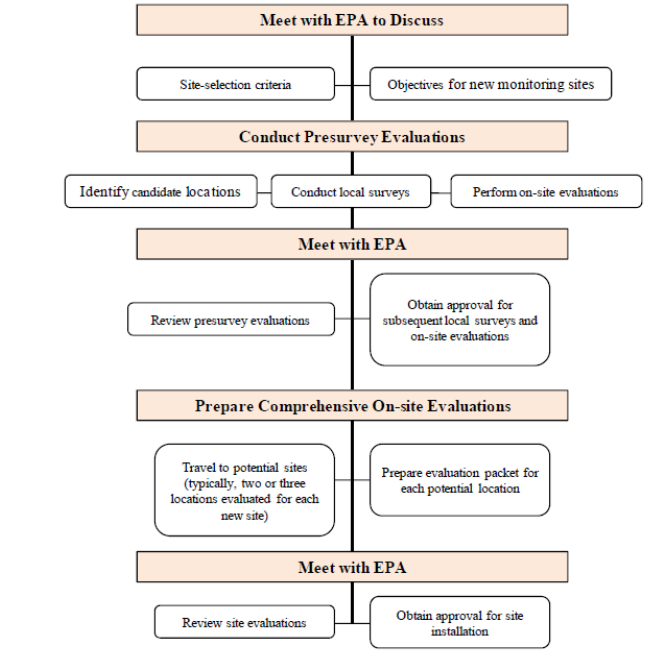
AQS ID	51-147-9991
CASTNET ID	PED108
Site Name	Prince Edward
GPS Coordinates	37.165222, -78.307067
Street Address	Prince Edward-Gallion State Forest, Burkeville, Va 23922
County	Prince Edward
Distance to Roadway	> 100 meters
Pollutant	Ozone, 1
Parameter Code	44201
NAAQS Monitoring Objective	Highest Concentration
Monitor Type	EPA
Instrument	Thermo 49I
Method Code	047
FRM or FEM	FEM
Collecting Agency	EPA/CAMD
Spatial Scale	Regional Scale
Reporting Agency	EPA/CAMD
Start Date	01-JAN-11
Sampling Frequency	Continuous
Sampling Season	01/01 - 12/31
Probe Height	10 meters
Distance to Trees	> 50 meters
Distance Between Collocated	N/A
Wind Obstruction	360 degrees
Probe Material	Teflon(R)
Changes w/in 18 months	N
Frequency for 1 Pt QC	Daily
Last PE Date	18-NOV-14

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
C. Monitors, Samplers, and Equipment at the Site				
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 1105347319 EPA S/N 000732
b. (Transfer Ozone Analyzer)				Thermo Scientific 49i S/N 0622717855 EPA S/N 000214
c. (Other) Zero air System pump				Werther Instruments C 70/4 S/N 000815757 CASTNET # 06883
2. Check for certification, validation, and calibration labels for samplers, monitors, and equipment.				
a. Shelter temperature sensor				Sensor is verified against standard at each 6-month calibration of the ozone analyzers.
b. Campbell Scientific CR3000 Temperature probe for shelter temperature measurement.				CASTNET # 000406
3. List of calibration (include transfer) and verification standards and certificates. Verify at Ozone Calibration Laboratory.				Level II Ozone Standards used for 6-month Calibration Audit.
a. Thermo 49i ozone analyzer (last calibrated October 10, 2014). It will be sent next week for certification.				S/N: 1105347329 EPA Decal: 000736
b. Thermo 49i ozone analyzer is not in operation. After repair, the analyzer will be sent for re-certification.				S/N: 1030244811 EPA Decal: 000691
c. Thermo 49i ozone analyzer (last calibrated June 1, 2015).				S/N: 1030244810 EPA Decal: 000679
d. Thermo 49i ozone analyzer (last calibrated May 11, 2015).				S/N: 1030244813 EPA Decal: 000677
e. Thermo 49i ozone analyzer (last calibrated May 11, 2015).				S/N: 1105347330 EPA Decal: 000747
Additional Questions or Comments:				

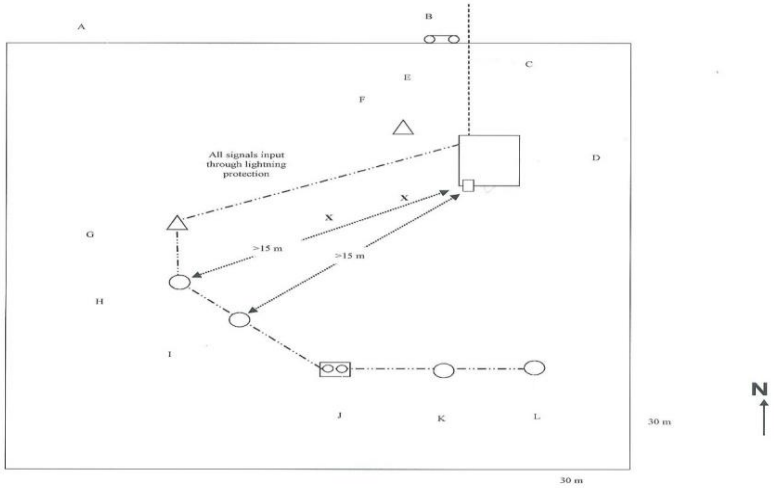
Part 4: Specific Sampling Criteria (Ozone Sampling)

(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	
A. Site Installation and Initiation Procedure				
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			Probably not for the types of instrumentation except those used to calibrate instruments (e.g. voltmeter). Not for measuring tapes or GPS. Ozone Travel transfer standard (Thermo 49i) Temperature (Euthenics 4600) Barometric pressure (Omega DPG4000-30C) Fluke (Fluke 8060A) Flow (BIOS Definer 220)
3. The Site Installation, Initiation, and Operator Training SOP states that installation is subcontracted out. Does an Amec Foster Wheeler staff member oversee all of the installation process?	X			Typically remotely, but occasionally onsite.
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 copy archives.
6. Does Amec Foster Wheeler 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.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
7. Can Amec Foster Wheeler provide the paperwork to show the 5-step site selection process for selecting the PED108 site? **Figure 1-16** CASTNET Site Selection Process  		X		This site was selected in 1987 for the National Dry Deposition Network (NDDN) and was later absorbed into CASTNET. Specific site selection documents from 1987 are not available.
8. Does Amec Foster Wheeler 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.
10. Are records maintained for the initial onsite equipment calibration?	X			Stored on Amec Foster Wheeler server.
11. If yes to Question 10, where is it maintained and can it be reviewed?				Stored on Amec Foster Wheeler server.
12. If calibration standards are used, can Amec Foster Wheeler provide records of certification? Records maintained where.	X			Filing drawers near Field Calibration Laboratory. L3 transfer certifications in database, L2 transfer certification scanned and on server.
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.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
15. Who provides the training to the site operator?				Amec Foster Wheeler field staff (Installation 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 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 server.
19. Are records maintained for the inventory of instrumentation installed at the site such as manufacturer, model number, Amec Foster Wheeler 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. Inventory Database
21. Does an Amec Foster Wheeler 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	
Additional Questions or Comments:				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
Figure 1. Typical EPA Sponsored CASTNET Site Configuration  A – Site Perimeter B – Stub Pole, Disconnect, Electric Meter C – 220 VAC/100 amp and Telephone Line (underground for at least the final 15 to 35 meters) D – 8' x 10' Aluminum Environmental Shelter (Temperature Controlled) E – Air Sampling Tower F – Approximate Position of Tower Tops when lowered G – Meteorological Tower H – Tipping Bucket Rain Gauge (> 15m from shelter) I – Solar Radiation Sensor (>15 m from shelter) J – Wet/Dry Collection (optional) K – Belfort Weighing Rain Gauge (optional) L – Wetness Sensor				
B. Site Operations Procedure				
1. Is the ozone sampling performed within the guidelines of an EPA- and Amec Foster Wheeler-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 form 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

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
9. Where does the site operator obtain local weather conditions? Alternate source?				9-meter tower (temperature probe and onsite observation. Also radio station in Farmville to the west.
10. What device does the site operator use to confirm shelter temperature? Are values recorded with 20 to 30 ºC?				Shelter temperature probe connected directly through computer system.
11. Is this device certified? Frequency?	X			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 request by Amec Foster Wheeler Ozone Calibration Laboratory.
13. If the operations in Question 12 were not successful, what does the site operator do?				The site operators only perform a manual ZSP check if requested by Amec Foster Wheeler Ozone Calibration Laboratory.
14. Does the site operator perform a flow rate and leak check of the ozone monitor?	X			The site operator performs leak checks every two weeks after replacing filters. There are no flow rate checks. Site operator reports the flow rates indicated by the PC200 software of the sampler's mass flow controllers. There is no independent flow rate check other that during the 6-month calibration.
15. What device (standard) does the site operator use to measure the flow rate?			X	There are no flow rate checks.
16. Is this standard certified? Review documentation.			X	There are no flow rate checks.
17. 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.
18. Is there any documentation on the FDS/COC forms for ozone sampling?	X			
19. How are telephone conversations documented between the site operator and Amec Foster Wheeler Office?				Recorded in database call in log.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
20. 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 Amec by Internet				DAS setup is as described in the SOP (photo taken while at the site).
21. Do you use uninterruptable power supplies or backup power sources at the site?	X			APC Model 900 (US EPA Property Number 06313) that only had the computer connected.
22. What instruments or devices are protected (electrically)?				Computer system
23. How are the ambient ozone sampling and zero, span, and precision check (ZSP) controlled?				DAS controlled.
24. What device is used for the ZSP checks?				Level 3 transfer standard. Thermo Scientific 49i S/N 0622717855 EPA S/N 000214
25. What is the frequency of the ZSP checks?				Daily
26. Are the ZSP checks documented? Where and how.	X			Automatically through computer system and database.
27. Are steps in place if ZSP checks fail? Review.	X			Re-run. Site operator will perform a manual ZSP at the request of the Amec Laboratory. An Amec staff member will call the site operator and explain the manual ZSP check procedure. A ticket is created and problem investigated in the Ozone Calibration Lab in Newberry, FL.
28. How long does it take to conduct a ZSP? Time of Day.				Less than 30 minutes and starting at 01:46.
29. 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.
30. What is the height of the inlet for the ambient ozone sampling?				10 meters.
31. What is the supply line made of?				FEP or PFA Teflon and Kynar.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
32. Does it connect to a manifold or designated supply line to the monitor?				Supply line directly to monitor.
33. Does the air stream flow through any filters before entering the ozone monitor?	X			5 µm Teflon filter at inlet.
34. What is the reporting measurement unit for the ozone measurement?				PPB instrument output.
35. What device delivers zero air during the ZSP checks? List the device: manufacturer, model, and serial number.				Amec Foster Wheeler assembled system utilizing compressor and conditioning canisters with silica.
36. Does the air flow go through desiccant and carbon canisters from the zero air system during the ZSP checks?	X			
37. During the ZSP checks, does the air flow from the transfer ozone monitor to the inlet and then to the ambient ozone monitor?	X			
38. What concentrations are evaluated during a ZSP checks?				0, 60, and 225 PPB. At site, there is a yellow card (Site Operation Checklist) dated November 9, 2007, that list the ZSP as 0 PPB ±5, 90 PPB ±9, and 400 PPB ±40. This card needs to be updated and replaced.
39. Are MQOs being met at the site for ZSP checks? (*See Table 1 in SOP for MQOs.*)	X			Zero (≤ ±3 PPB) and precision and span (≤ ±7% between supplied and observed concentrations).
40. What is the frequency of calibrations of the ozone monitors?				Semi-annually.
41. Who repairs the monitors if outside acceptance during the calibration?				Amec Foster Wheeler 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 Amec Foster Wheeler Ozone Calibration Laboratory.
42. What is the frequency of the replacing the Savillex 47 mm Teflon filter? (outside is every other week and the inside is the first Tuesday of the month)				Only one outside filter replaced every two weeks.
43. What is the frequency of replacing the desiccant?				As needed (usually when 50% spent).

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
44. Who is responsible for providing maintenance to the DAS?				Amec Foster Wheeler or subcontractor (MSI or others)
45. Who does the site operator contact if there is a problem with the DAS?				The FOM (Mr. Mishoe) or Assistant FOM (Mr. Smith) at Amec Foster Wheeler.
46. Discuss PC200 software and document site operator's knowledge of the software and entries that he/she would make.				Site operator understands the PC200 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.
47. Does the site operator follow the SOP for data entries in to the DAS?	X			For the entries to the SSRF.
48. 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			Information was on the desktop in a folder labeled PED108 Calibrations. Files were downloaded by auditor and later reviewed as complete.
49. Who is responsible for performing preventive maintenance?				FSO replaces filters and scrubbing media – repairs performed by Amec Foster Wheeler.
50. Is special training provided for site operator for performing preventive maintenance on the monitors/ samplers/equipment? Briefly comment on background or courses.	X			Onsite training with Amec Foster Wheeler and recurring phone or in person training.
51. Is this training routinely reinforced?	X			Phone interviews and as needed when deficiency is detected.
52. What is the site's preventive maintenance schedule for the ozone measuring system?				Every six months during the calibration audit.
53. 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.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
54. If preventive maintenance is MAJOR, it is performed at (check one or more): field station, headquarters facilities, or equipment is sent to manufacturer				Amec Foster Wheeler Ozone Calibration Laboratory or sent back to the manufacturer if laboratory is unable to perform the repair.
55. 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		
56. 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?				No spare parts at the site. Spare parts would be sent from the Amec Foster Wheeler Ozone Calibration Laboratory.
57. 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		
58. 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		
59. Explain any situations where instrument down time was due to lack of preventive maintenance of unavailability of parts.				Ozone analyzers have not been down for any amount of time based on the site operator's memory.
Additional Questions or Comments:				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	

Table 1. Ozone Measurement Quality Objectives

Type of check	Measurement Criteria	Corrective Action*		Multi-Point Calibration Criteria
		Field	Data	
Zero	≤ ± 5 ppb	Perform adjusted calibration	Invalid from the last good check until the next good check or adjusted calibration completed	Between 0.0 and ± 5 ppb
Precision/Span	≤ ± 7 percent between supplied and observed concentrations	Contact the field coordinator	Invalid from the last good check until the next good check or adjusted calibration completed	± 5 percent between supplied and observed concentrations
Correlation Coefficient				≥ 0.995
Frequency of analyzer checks				
ZSP**	One ZSP every day On demand to facilitate trouble shooting Following a multipoint calibration prior to leaving the site			
Calibration	Minimum one multipoint calibration every 6 months As required per QC results When performing the semi-annual multipoint calibration, adjusted calibration must occur within 24 hours of the unadjusted calibration			
General				
Unadjusted calibration does not have to be followed by an adjusted calibration if all analyzer responses are in a 2 percent of full scale range. **Shelter temperature acceptable range: 20 – 30 degrees C**				

Notes: * Display drifts are frequently due to leaks in the system or lamp degradation/ageing. Verify lamp intensity settings against previously documented values. Perform internal and external leak checks by plugging inlet line in back of the instrument (internal) or tower inlet port (external). A line plug should reduce the internal pressure down to 250 mm Hg or so. Verify external ozone generator pump function and internal pressure using the manual pressure gauge located inside the instrument.

** Zero, Span, Precision automated QC check

C. Field Calibrations Procedure

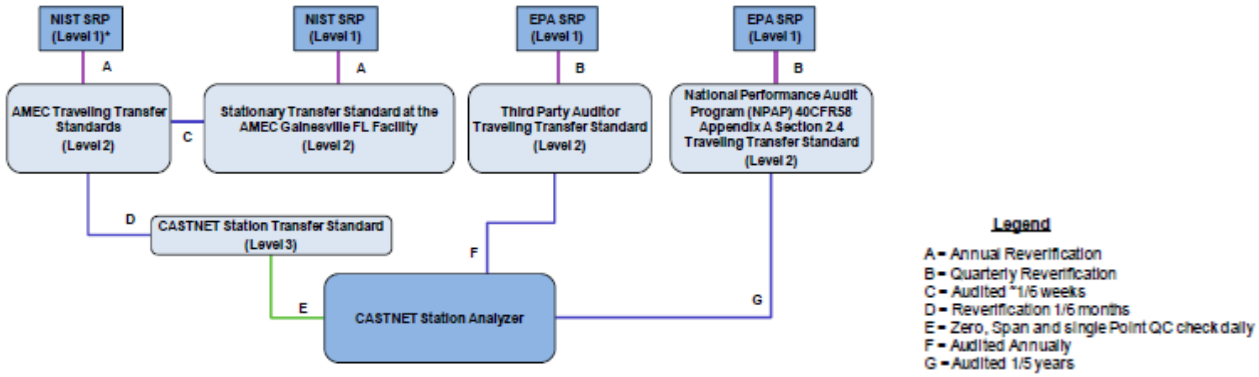
1. Has a biannual TSA been conducted at the site? When and who performed the last TSA.	X			Tyler Ward (MSI) conducted audits on February 16 and August 15 for 2015.
2. Has an annual performance evaluation (PE) been conducted at the site? When and who performed the last PE.	X			On the schedule for November 2015 with EE & MS (conducted December 3, 2015). The last PE was conducted on November 3, 2014.
3. Is 'as found' data recorded?	X			
4. Is "as found" data provided to the site operator after a PE is conducted? If so, review last few PEs.	X			MSI audits were found on computer desktop, but the auditor could not find results of the annual PE by EE & MS.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
5. Has an Amec Foster Wheeler site calibration been performed at this site? When and who performed the last calibration. Provide the Calibration Summary Form.	X			Details in iForms on site computer.
6. Are the results of the calibration documented? If so, where and review if possible.	X			Details in iForms on site computer and server at Newberry.
7. What is the frequency of the Amec Foster Wheeler site calibration?				Every 6 months.
8. Review iForm if possible to track entries made during calibration.				Need to review at Newberry office.
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 C70/4 air compressor S/N 000815257.
11. During the calibration are ozone calibration points taken over the range from 0 to 400 PPB?	X			New range is 0 to 225 PPB.
12. Is line loss test performed?	X			
13. What does a high line loss indicate (greater than 5%)?				Tubing should be replaced.
14. How is this issue resolved and documented?				Tubing is replaced and commented in iForms.
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?				Calibration criterion is the 2% of full scale criterion.
17. Besides running different concentrations of ozone through the site's ozone analyzer, what other steps are performed for the ozone collection system?				Housekeeping data reviewed (flows, pressure, etc) sample line integrity check, line loss verification, FSO training as needed.
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			Traveling Transfer Standard information can be found on CASTNET website and also in the Field Calibration Laboratory (on the Amec server).

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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? (*Calibration Box Inventory and Spare Parts Inventory*)	X			Two copies, one goes with the kit and the other is maintained in the filing cabinet in the Field Calibration Laboratory. Validated against the copy in the filing cabinet when returned from the field. New parts ordered as needed.
22. If an analyzer does not perform within acceptance criteria, what does the calibrator do?				The calibrator attempts to determine problem; makes repairs or corrections; re-calibrates. If unable to repair, he contact Field Calibration Laboratory and request part or replacement analyzer, he receives and installs analyzer, and performs calibration. He does not leave the site without a successful calibration.
23. Who determines when an analyzer can be repaired in the field or needs to be shipped back to the Ozone Calibration Laboratory?				For minor problems, the field technician, but most problems are decided by Amec Foster Wheeler.
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?				Replacement analyzer is installed by calibrator; documentation is maintained on iForms and in inventory database.
25. If an analyzer fails the 6-calibration, is previous data collected from that site reviewed? By whom?	X			Data validators, although ZSP results are reviewed as well. FOM and QA Officer review.
26. What steps are taken to confirm valid ozone data was collected? (*ZSP checks*)				The entire data validation process. ZSP checks are reviewed.
Additional Questions or Comments:				

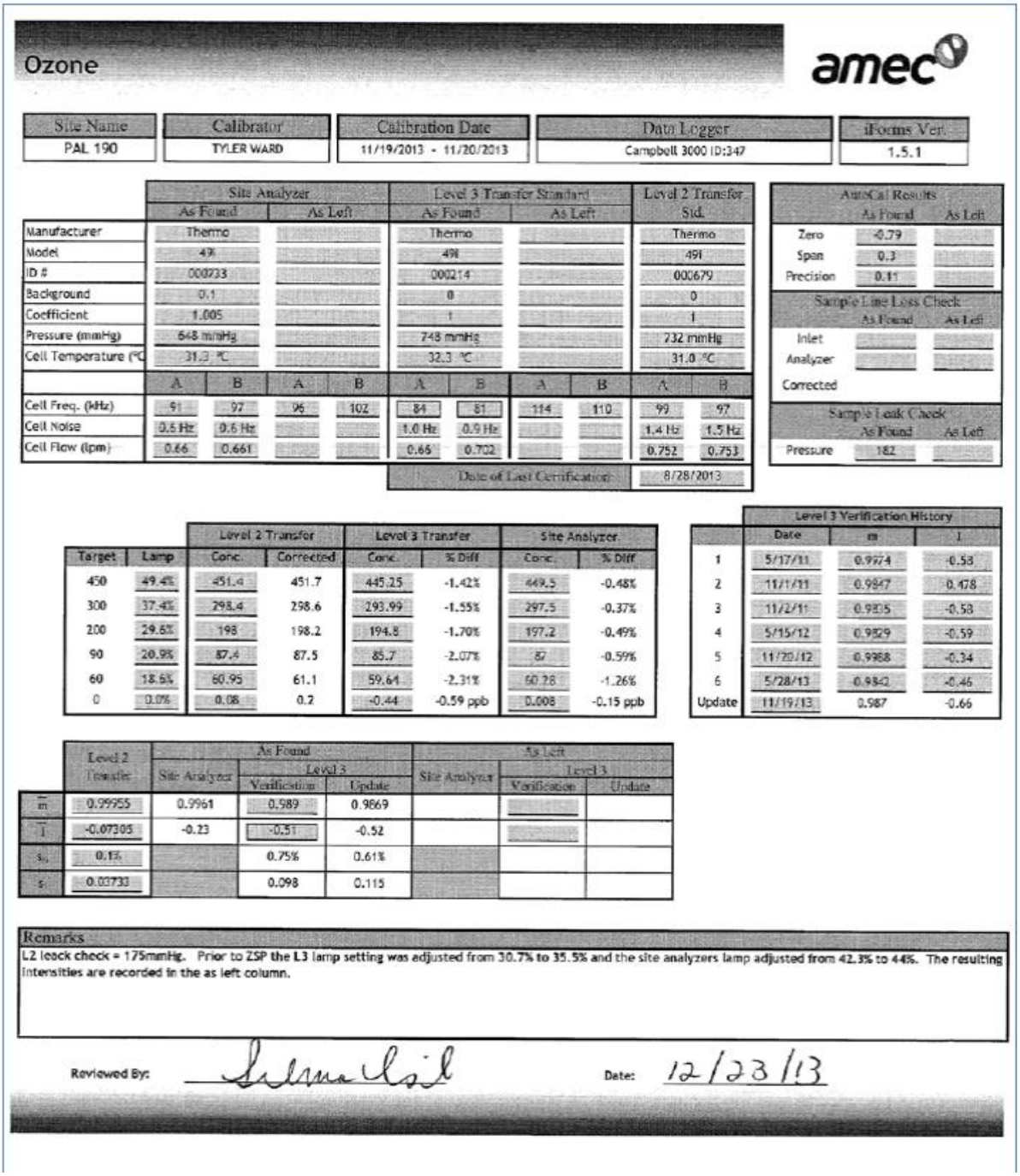
AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	

Figure 2-14 Ozone Standard Verification



AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	

Figure 15. Ozone Calibration Form



Ozone

amec

Site Name	Calibrator	Calibration Date	Data Logger	iForms Ver.
PAL 190	TYLER WARD	11/19/2013 - 11/20/2013	Campbell 3000 ID:347	1.5.1

	Site Analyzer As Found	Site Analyzer As Left	Level 3 Transfer Standard As Found	Level 3 Transfer Standard As Left	Level 2 Transfer Std.
Manufacturer	Thermo		Thermo		Thermo
Model	49i		49i		49i
ID #	000733		000214		000679
Background	0.1		0		0
Coefficient	1.005		1		1
Pressure (mmHg)	648 mmHg		748 mmHg		732 mmHg
Cell Temperature (°C)	31.3 °C		32.3 °C		31.0 °C
	A / B	A / B	A / B	A / B	A / B
Cell Freq. (kHz)	91 / 97	96 / 102	84 / 81	114 / 110	99 / 97
Cell Noise	0.5 Hz / 0.6 Hz		1.0 Hz / 0.9 Hz		1.4 Hz / 1.5 Hz
Cell Flow (lpm)	0.66 / 0.661		0.65 / 0.702		0.752 / 0.753
Date of Last Certification					8/28/2013

AutoCal Results	As Found	As Left
Zero	-0.79	
Span	0.3	
Precision	0.11	

Sample Line Loss Check	As Found	As Left
Inlet		
Analyzer		
Corrected		

Sample Leak Check	As Found	As Left
Pressure	182	

Target	Lamp	Level 2 Transfer Conc.	Level 2 Transfer Corrected	Level 3 Transfer Conc.	Level 3 Transfer % Diff	Site Analyzer Conc.	Site Analyzer % Diff
450	49.4%	451.4	451.7	445.25	-1.42%	449.5	-0.48%
300	37.4%	298.4	298.6	293.99	-1.55%	297.5	-0.37%
200	29.6%	198	198.2	194.8	-1.70%	197.2	-0.49%
90	20.9%	87.4	87.5	85.7	-2.07%	87	-0.59%
60	18.6%	60.95	61.1	59.64	-2.31%	60.28	-1.26%
0	0.0%	0.08	0.2	-0.44	-0.59 ppb	0.008	-0.15 ppb

Level 3 Verification History	Date	m	I
1	5/17/11	0.9974	-0.58
2	11/1/11	0.9847	0.478
3	11/2/11	0.9835	-0.58
4	5/15/12	0.9829	-0.59
5	11/20/12	0.9988	-0.34
6	5/28/13	0.9842	-0.46
Update	11/19/13	0.987	-0.66

	Level 2 Transfer	As Found Site Analyzer	As Found Level 3 Verification	As Found Level 3 Update	As Left Site Analyzer	As Left Level 3 Verification	As Left Level 3 Update
$\bar{m}$	0.99955	0.9961	0.989	0.9869			
$\bar{I}$	-0.07305	-0.23	-0.51	-0.52			
s_m	0.15%		0.75%	0.61%			
s_I	0.03733		0.098	0.115			

Remarks

L2 leack check = 175mmHg. Prior to ZSP the L3 lamp setting was adjusted from 30.7% to 35.5% and the site analyzers lamp adjusted from 42.3% to 44%. The resulting intensities are recorded in the as left column.

Reviewed By: Selma Asil Date: 12/23/13

D. Field Operations Procedure (performed by the Ozone Calibration Laboratory)

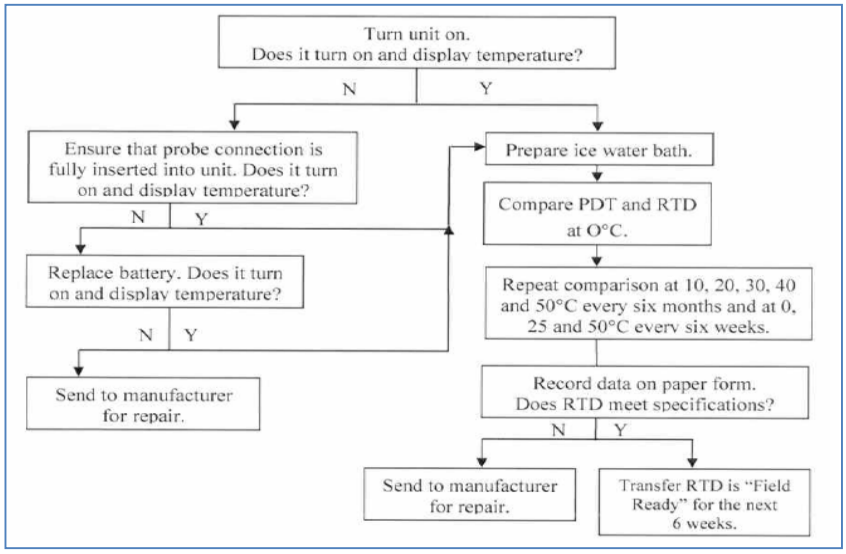
1. What is the minimum frequency of certifying the ozone transfer standards?				Annually, intermediate verifications are performed before and after field use.
2. Is this documented and are the documents available for reviewing?	X			Ozone report database.

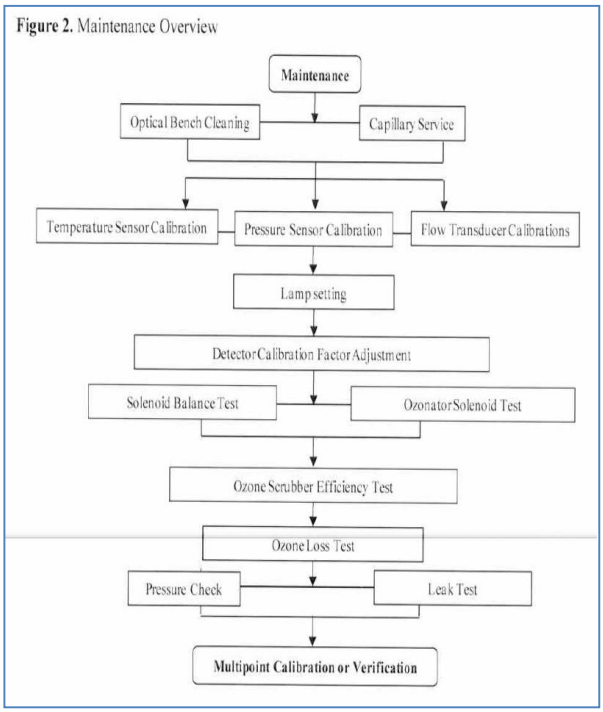
AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
3. What is the frequency of calibration of the site's ozone transfer standards?				Semi-annual verifications, not calibrated.
4. Is this documented and are the documents available for reviewing?	X			iForms on site computer and Amec server.
5. Describe the traceability process of all ozone analyzers used in the CASTNET program? (Level 1, 2, and 3)				1 = NIST, EPA Regions 4 and 7; 2 = Verified by 1 annually; 3 = Verified by 2 semiannually.
6. How many sample concentrations are performed during the transfer standards certification? What values are normally run?				Six points at 0, 225, 150, 90, 60, and 40.
7. How many sample runs are performed during the transfer standards certification?				Six readings for Level 3. NIST and EPA use their own procedure.
8. Where is this data maintained? Is it reviewable?	X			Ozone report database.
9. Describe the process of certifying the transfer standard?				6 x 6 for Level 3 then semi-annual for 1 x 6 as explained by Mr. Smith
10. Is there a single-point accuracy criterion?	X			± 5%
11. Describe the calculations for the slope, intercept, and correlation coefficient?				RSD of six slopes ≤ 3.7%; Std. Dev. of 6 intercepts 1.5. New Slope = ±0.05 of previous and RSD of six slopes≤ 3.7%; Std. Dev. of 6 intercepts 1.5.
12. Who performs the certifications of the transfer ozone analyzers?				Level 2 certified by NIST or EPA Regional Office, and Level 3 certified by Amec Foster Wheeler Field staff.
13. Who gives final approval the transfer standard is acceptable?				Field Manager or delegate.
14. What are the acceptance limits?				RSD of six slopes ≤ 3.7%; Std. Dev. of 6 intercepts 1.5. New Slope = ±0.05 of previous and RSD of six slopes≤ 3.7%; Std. Dev. of 6 intercepts 1.5.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
15. What analyzer is used as the primary standard? Review documentation certificate. 15 flow meters (8 within certification) 3 temperature sensors (3 within certification) 2 barometric pressure sensors (2 within certification) 9 voltage units (6 within certification) Maintained with Heidi Schwing in spreadsheet (Certification schedule) and Amec SQL database on server				Lab controls (2 ozone primary standards certified) Thermo 49i-PS (S/N 1022143674 EPA Decal: 000636) last certified on February 12, 2015. Thermo 49i-PS (S/N 801827200 EPA Decal: 000380) last certified on November 10, 2015. Thermo 49CPS (S/N 62939337 EPA Decal: 000122) will no longer be sent for certification. Thermo 49CPS (S/N 63110338 EPA Decal: 000582) will no longer be sent for certification. Standards with certifications used in the Field Calibration Laboratory Temperature (ThermoWorks P655P) Barometric pressure (Omega DPG-4000-30C) Flow (BIOS Definer 220)
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			Ozone Calibration Laboratory.
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, sensor calibration. 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?				5 mmHg, sensor calibration. Corrective Action: calibrate

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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?				250 mmHg, leaks are repaired or pump is replaced. Usually 200 mm Hg Above 230 mm Hg questioned Corrective action: replace tubing and check transducers
21. For the ozone loss test, what ozone certification detector is used? When was it last certified and by whom. Are records of the certifications maintained and where?				Level 2 transfer standard; on site computer and Amec Foster Wheeler server.
22. Is the flow rate checked on the ozone analyzers? If yes, what device is used? Is it certified? Last certification.	X			Device: BIOS Definer 220 (S/N 119098)
23. How are transfer standards tracked when shipped to sites? Where is this documented?				Inventory systems (and Fed Ex tracking number)
24. Does the CASTNET QA Manager conduct internal audits of the Calibration Lab?	X			Internal audits are conducted as part of the process.
25. If yes to Question 24, what is the frequency?				During every data reviewing process.
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 PED108? If so, check items (ozone analyzers and data acquisition system) against equipment found at site.	X			Auditor confirmed the EPA Property Number and Vendor S/N against numbers in database.
Additional Questions or Comments:				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	





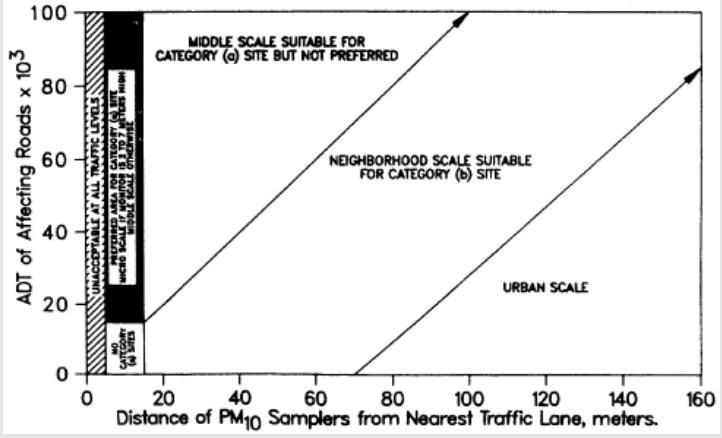
PART 5. Sampler Siting

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
A. Sampler Siting				
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		
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			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
f. Airflow must be unrestricted in an arc of 270 degrees around the sampler except for street canyon sites.	X			
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:				N 37.165° W 78.306
8. What is the elevation of the site (feet)?				148.7 ft. (45.3 m)
9. Nearest meteorological site?				Site has a temperature sensor on the 10 meter tower. A secondary source would be the radio station in Farmville (12 miles to the west).
Additional Questions or Comments:				

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**

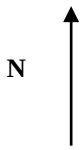
Figure 2. Acceptable Areas for PM_{10} Micro, Middle, Neighborhood, and Urban Samplers Except for Microscale Street Canyon Sites.



Prince Edward Field Site (PED108) Measurements
(Distance measurements and compass directions are from the ozone inlet on the 10-m tall tower)

Items	Compass Degrees	Distance (m)	Height (m)
A Shed	315	3.2	4.5
B Rain gauge	140	3.7	0.5
C NADP sampler	170	6.0	1
D Passive AMoN sampler	260	14.1	2
E Electric post	310	9.3	1.7

Site Drawing



E

A

Tower

B

D

C

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_3 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_3 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.

- 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.

- 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.

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

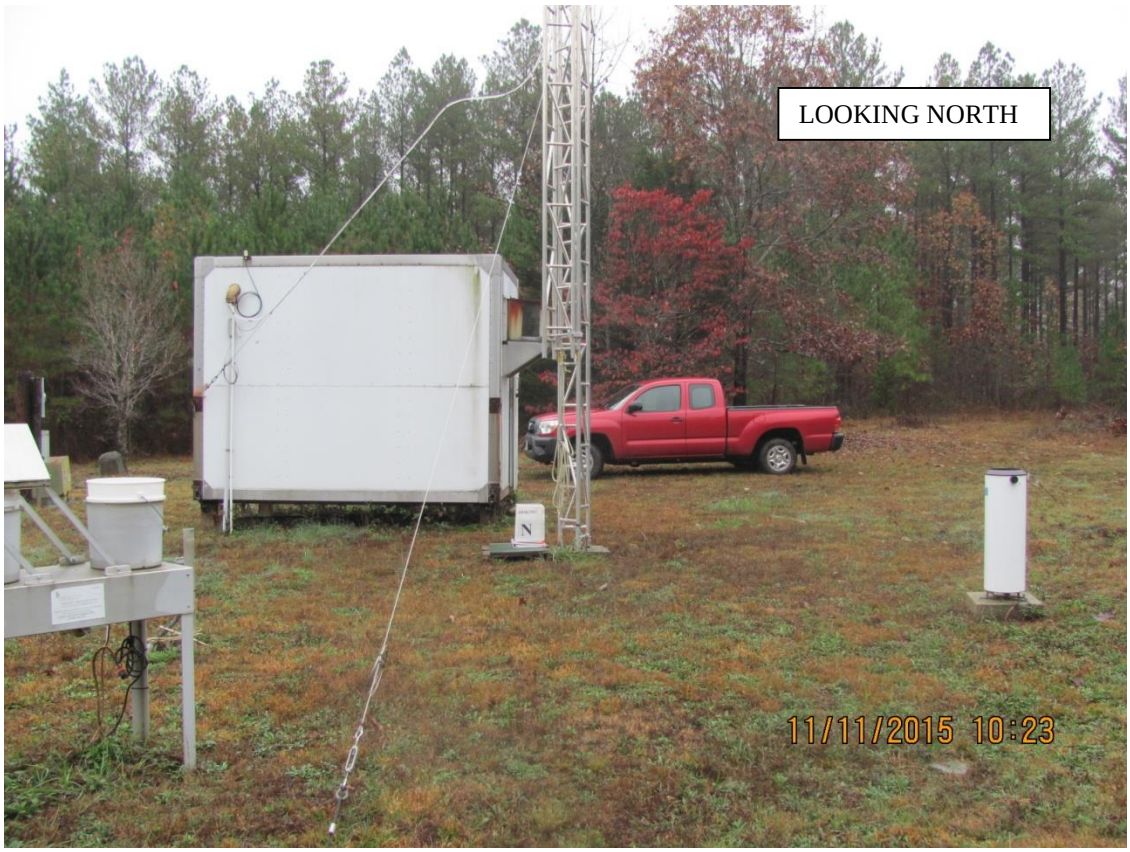
- Observe the data validation process using the iCASTNET software and other procedures and software – follow the SOP to the extent possible. Download electronic data and take screen shots, if possible, of O_3, shelter temp, ambient temp, flow, BP, RH, and other data that were downloaded or printed during 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.

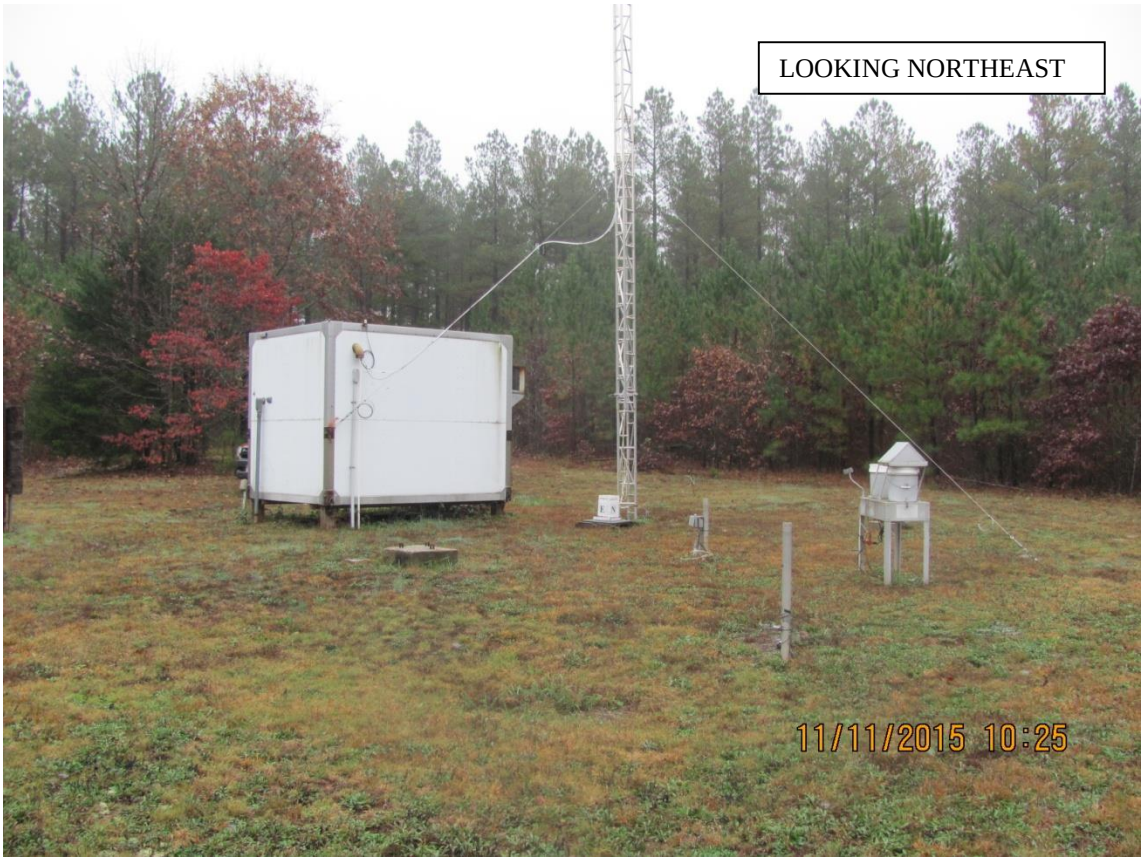
- Ask the data management staff to identify a few examples where they had to add data flags or change/invalidate data, as a result of higher level data validation. Record the reason for the change, and site IDs, dates and times of the data affected. Example data need not be for the two sites that had 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.

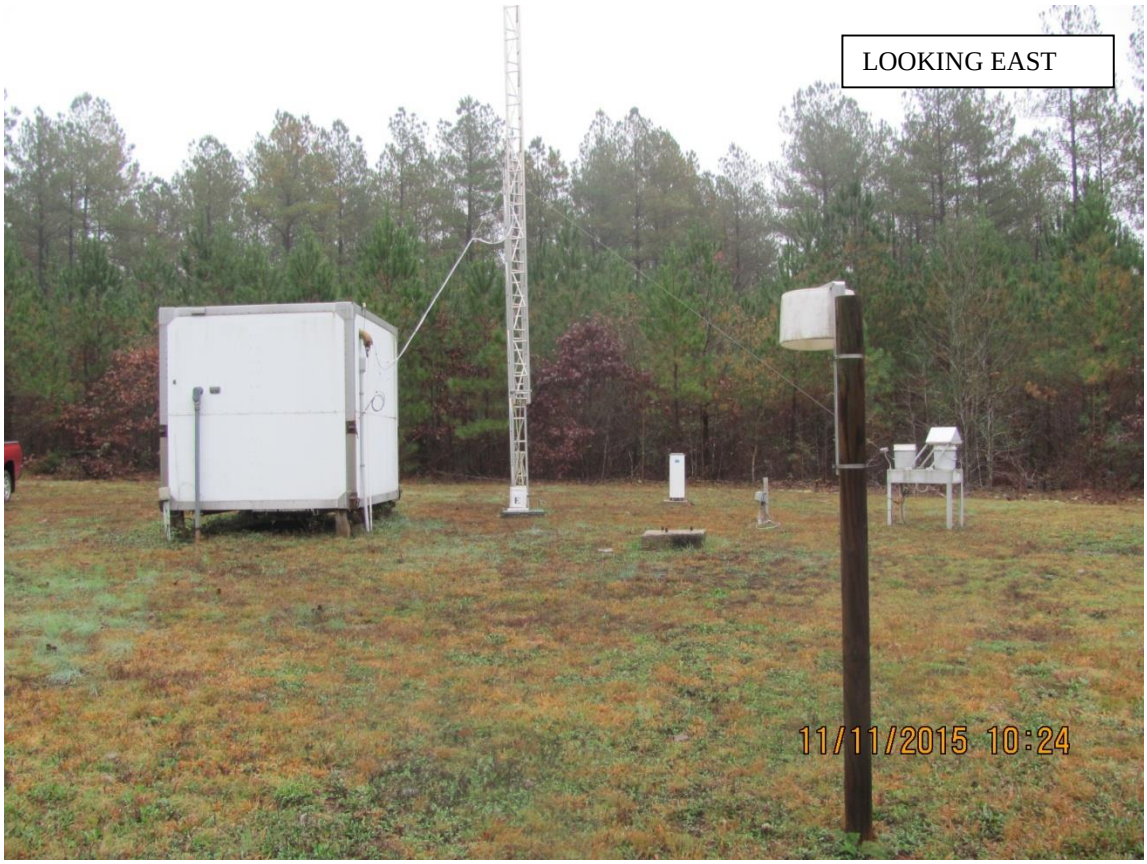
- Perform other records checking that you would normally do for a TSA. If you encounter any information that should have resulted in data flags or changes, make a note so that the data changes can be verified later in AQS.

APPENDIX B

Prince Edward (PED108) Site Photos

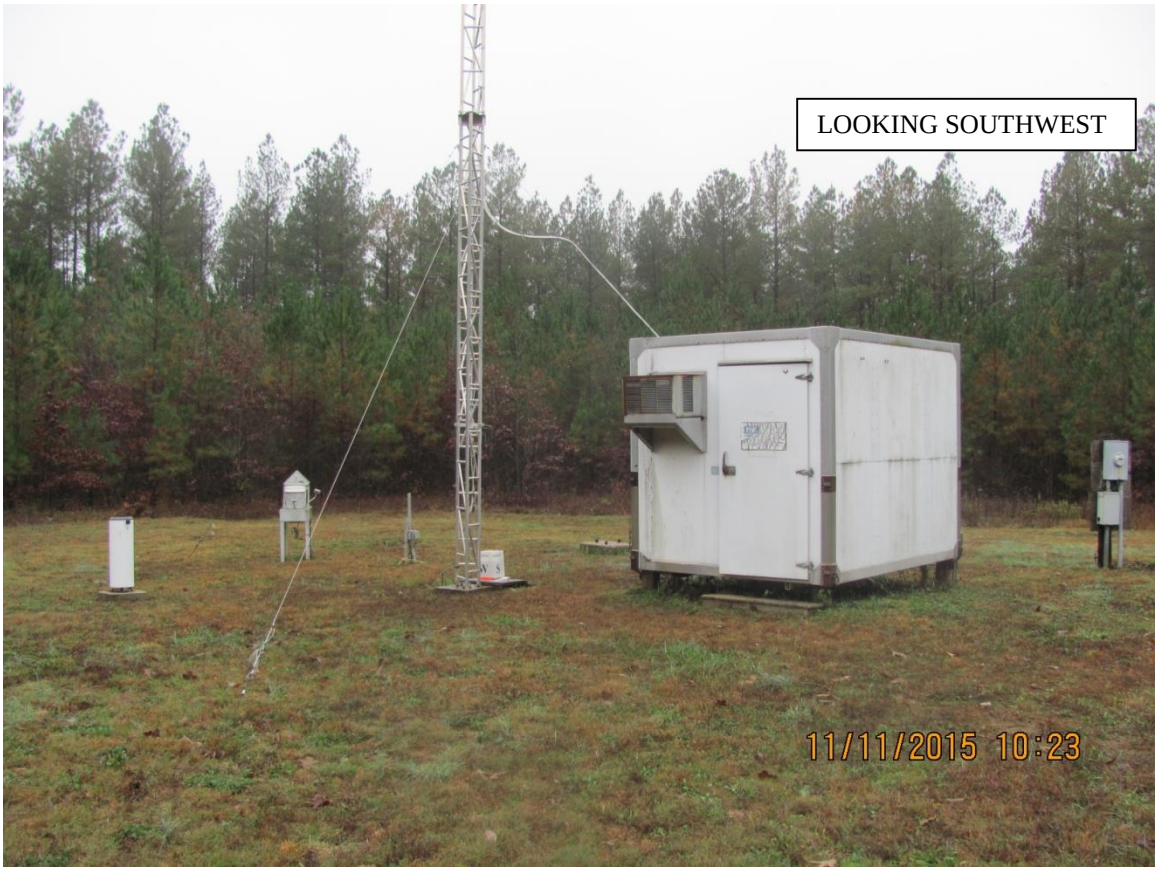

LOOKING NORTH
11/11/2015 10:23

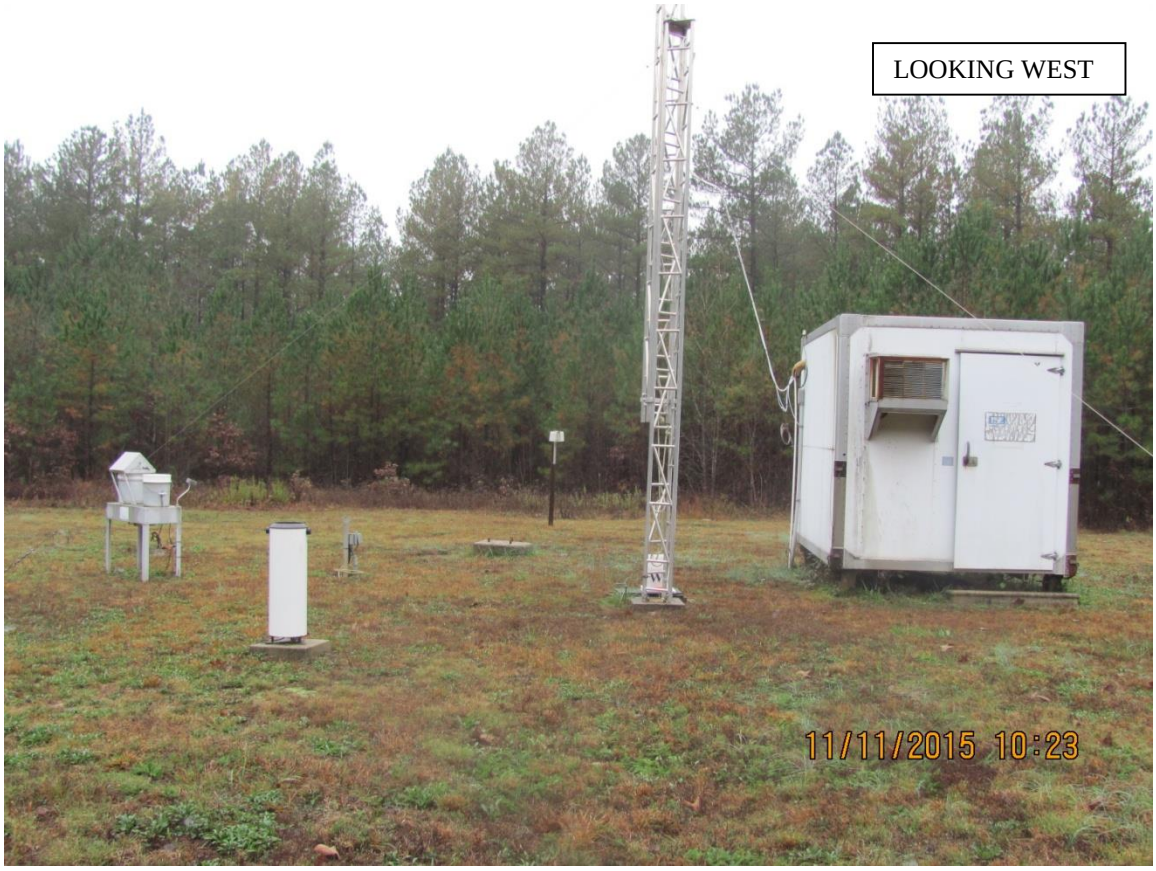

LOOKING NORTHEAST
11/11/2015 10:25

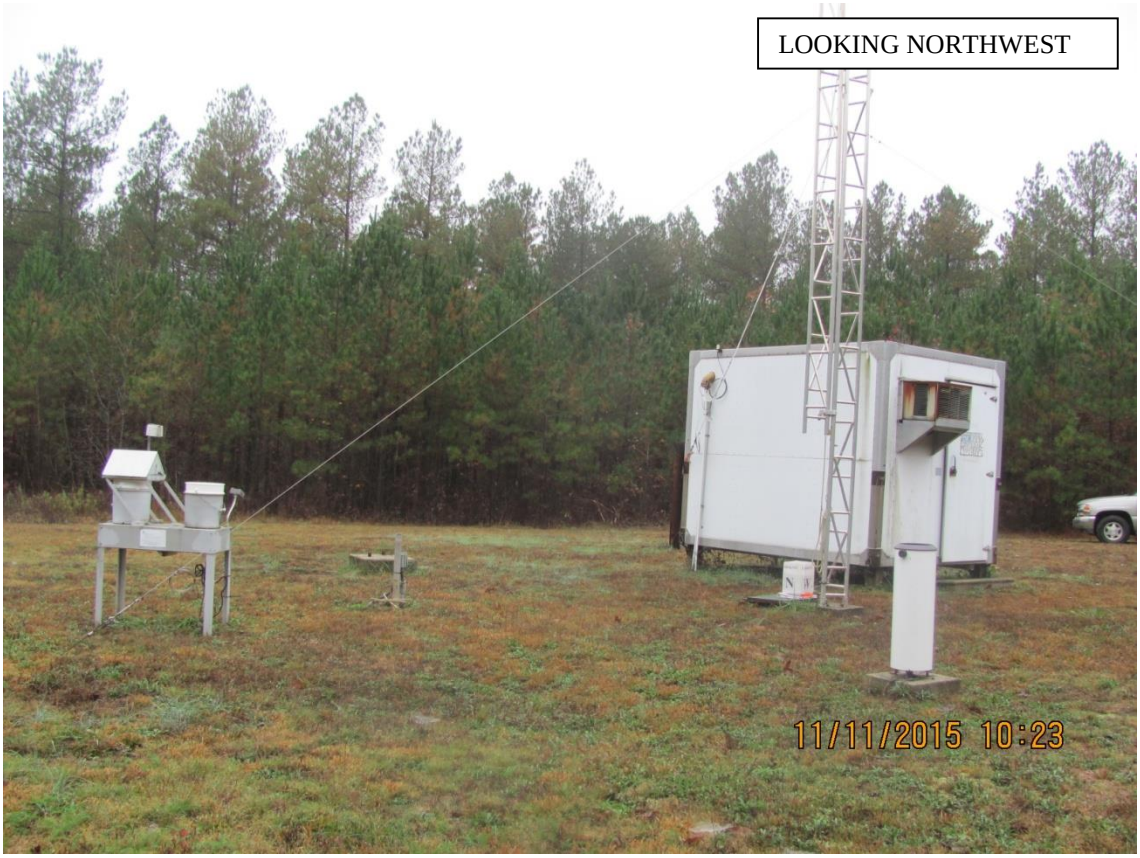

LOOKING EAST
11/11/2015 10:24


LOOKING SOUTHEAST
11/11/2015 10:24


LOOKING SOUTH
11/11/2015 10:24


LOOKING SOUTHWEST
11/11/2015 10:23


LOOKING WEST
11/11/2015 10:23


LOOKING NORTHWEST
11/11/2015 10:23

APPENDIX C

Data and Data Management Questionnaire

DATA AND DATA MANAGEMENT

Auditee Identification: **Amec Foster Wheeler Laboratory Facility**

Location of Audit: **Newberry, FL**

Audit Date: **November 10, 15, and 16, 2015 (on-site TSA); November 10 through December 7, 2015 (off-site data assessments)**

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

PERSONNEL INTERVIEWED:

NAME	POSITION	PHONE/E-MAIL
Chris Rogers	**Data Management, Analysis, Interpretation and Reporting Manager**	**Christopher.rogers@amecfw.com 904-391-3744**
Marcus Stewart	**QA Manager**	**Marcus.stewart@amecfw.com 352-332-3318**

Part 2. Data Review and Data Management

(Responses provided by AMEC Foster Wheeler personnel unless otherwise indicated)

	AUDIT QUESTIONS	RESPONSE Y	N	NA	COMMENTS AND REFERENCES
A. Data Handling/Review					
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?	X			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?	X			QAPP Figure 4-1.
3	Are procedures for data handling (e.g., data reduction, review, etc.) documented?	X			QAPP Section 4 and Appendix 6.
4	Does the field operator have the ability to change or alter any of the data? Have there been any situations where this was done?		X		The field operator cannot change data (values). They can download datalogger channels, which applies a flag to the data. This is done each week when a site visit is made and maintenance is performed. It applies a B flag provided the channel is down for more than 15 minutes of a given hour. The flag only shows up in the hourly data. If between 6 and 15 minutes are down, it gets a "<" flag and remains a valid hour. If less than 6 minutes are down, there is no flag. The measurements from when the channel is down are not included in the hourly average.
5	Are field operator comments included in any reports? How are these comments captured and utilized?	X			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). The narrative log is a book with duplicate pages and is different from the SSRF. 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 database
6	In what media (e.g., diskette, data cartridge, or telemetry) and formats does data arrive at the data processing location?				Telemetry. All but two sites use cellular modems, which provide sites with internet access. The other two use dial-up modem connections. Recommendation: Would be good to note this exception for the two sites in Figure 4-1 of the QAPP.

	AUDIT QUESTIONS	RESPONSE Y	N	NA	COMMENTS AND REFERENCES
7	How often are data received at the processing location from the field sites and laboratory?				Sites are polled hourly at a minimum.
8	What all data constitute part of the ozone collection system for the CASTNET? For example, is the shelter temperature considered part of the ozone collection system? Which of these are electronically recorded, and which are recorded in hard copies?				Ozone concentrations (hourly and one minute), shelter temperature (hourly), housekeeping data from the analyzer and site transfer standard (15 minute moving to 5 minute). They are all recorded electronically and retrieved via polling.
9	What parts of the data retrieval process are automatic and what parts are manual?				All are automated except for field operator comments.
10	What is the finest resolution of the data actually being collected by the ozone monitor (1-sec, 5 min etc.)? What time resolution data is transferred to the data logger?				10 sec measurements by analyzer. Data logger records 10-sec values during QC checks, 1 minute during ambient monitoring (both are polled).
11	How long is the raw data collected by the instrument stored on the instrument?				No data are actually stored on the instrument. Data are stored for varying lengths of time (depending on temporal resolution, etc.) on the data logger. Multiple months of hourly data and QC checks are stored on the data logger. For higher temporal resolution data (1 min or housekeeping, for example), approximately 1 week of data are stored.
12	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			There is an electronic transaction log that records all changes. In addition, data validators use a hardcopy form to document changes.
13	How are 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.
14	Describe the data QC checks applied to ensure that data transfer is accurate.				During development and deployment of the importing program, the txt files and database records were compared and results were documented verifying that there were no differences and QA signed off on package.
15	For manual data entry, is a double-key entry system used?	X			No missing monitoring data are manually entered. Calibration results and field form entries (on the SSRF) are double entered.
16	Are precision and accuracy data gathered and reported to AQS?	X			

	AUDIT QUESTIONS	RESPONSE Y	N	NA	COMMENTS AND REFERENCES
17	Are there any typical post-processing calculations done to any of the data (STP corrections, modifications for humidity levels, etc.)?		X		
18	How frequently are collected and calculated data stored? Where and how are they stored?				They are 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 ever necessary.
Additional Comments:					
B. Hardware and Software					
19	What hardware components are used in each step of the data handling procedure from acquisition to submission?				Polling server (approx. 1 year old), USB modem, SQL Server (approx. 2 years old), workstations (various ages but updated and maintained by Amec Foster Wheeler IT)
20	When were the hardware systems last updated? Are these systems under warranty? Are there periodic checks / maintenance of the hardware systems?	X			See above for updates. Servers are currently under warranty. Depending on age of workstation, some are under warranty if newer than 3 years old. Amec Foster Wheeler handles all updates of servers and workstations and regularly pushes patches/updates as appropriate.
21	Would documentation regarding the latest semi-annual check of the data acquisition system (DAS) be available for review?	X			Documented in CASTNET iForm.
22	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 8.2 Appendix 6 (Data Management System Application User Manual) and iCASTNET data review tools: QAPP 8.2 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 4, Date is 10/30/14. For the latter, original author is Christopher Rogers (assisted by Jeannette Muzslay), Rev is 1, and date is 10/30/14.

	AUDIT QUESTIONS	RESPONSE Y	N	NA	COMMENTS AND REFERENCES
23	How often are software updates/changes made and by whom? What determines the need for the changes? How thoroughly are internal programs tested, and by whom? Any recent upgrades or changes to the CDMSA? If so, how was it tested?				iCASTNET is continually under development by Jeannette Muzlsay and Ramesh Seerangan. CDMSA is updated very rarely by Christopher Rogers. iCASTNET is replacing the CDMSA functionality and adding or improving tools. Users provide input based on initial design and deployment. Software is tested thoroughly based on QAPP 8.2 Appendix 6 (Software Management Plan) by DMAIRM (Christopher Rogers), QA Manager (Marcus Stewart) and by end users where appropriate. The CDMSA has had extremely minor updates to the site contact list report in October 2015 (by Christopher Rogers). They were verified by Marcus Stewart (documented in email).
24	What are the current software versions? Are these consistent with the information in the QAPP?	X			Current version of CDMSA is 6.9.3 (October 2015). The QAPP is consistent with this version. iCASTNET has evolved since QAPP 8.2, but the contents of the QAPP are still accurate. It is admittedly always a challenge to keep hardcopy documentation up with software development.
25	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			Described in main body of QAPP and in Appendix 6 (Database Backups). Doraiswamy: Procedures described in multiple locations – Appendix 6 Hardware Plan and Software Plan sections, QAPP section on back and restoration (page 9 of 47)
26	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			It has been some time since the current metadata editor went into production mode and no changes have been made in many years. Comparisons were documented at the time it went through testing and was deployed. Ongoing data validation procedures verify performance in accordance with elements in QA Handbook Table 14-3.
27	What software packages are used to automatically review the data? Who are the approved users of the different packages?				To automatically review the data, we use automated email reports which get delivered to any employee that needs them 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.
28	Does any software package have the capability of automatically changing the data? Or automatically assign validation flags?	X			Yes, but only for preliminary (Level 1) data that are sent hourly to AIRNow and daily to EPA. These flags for outliers (P flag) are not maintained in the final Level 3 data that are submitted to AQS.

	AUDIT QUESTIONS	RESPONSE Y	N	NA	COMMENTS AND REFERENCES
29	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. Doraiswamy: On-site auditor Jeff Nichol spoke to Anna and observed data validation procedures.
Additional Comments:					
C. Data Validation and Correction					
30	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
31	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), 30 years in field
32	Are data validation criteria established and documented? Does the documentation include specific range limits for values such as flow rates, calibration results, or range tests for ambient measurements? Does the documentation describe the action to be taken when limits are exceeded (e.g., flags, modifies, deletes, etc.)?	X			All in QAPP and Appendices.
33	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.
34	If an ozone data point is collected at intervals of 5 minutes (or 1 minute or 1 sec) and averaged for the hour, 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 datalogger). >90% gets no flag (null).

	AUDIT QUESTIONS	RESPONSE Y	N	NA	COMMENTS AND REFERENCES
35	Do any of the project documents describe the process for making changes to data that have already been posted on AQS or on the AMEC Foster Wheeler website? Provide references.		X		No data are posted on the Amec Foster Wheeler website. Amec Foster Wheeler personnel rely on AQS documentation maintained by EPA. Use of the tool that prepares files for submittal is described in QAPP 8.2 Appendix 6 (Data Deliverables Appendix A). Recommendation: The AQS links in the QAPP and the SOPs are now outdated. Please update as part of QAPP revision.
36	Examine a few recent examples of actions that were taken when data had to be flagged: • Identify the flagging criteria and SOP or other document where these are defined • RTI will examine the AQS and/or the CASTNET website database to verify that the data records were appropriately flagged.				VIN140 2015-07-07 03:00 - 2015-07-10 08:00 (pump out) MCK131 2015-07-03 04:00 - MCK131 2015-07-04 01:00 (QC check failure) In both cases, data were invalidated (ozone flag set to "I"). Doraiswamy: Data were downloaded for VIN140 for the time period from 2015-07-06 00:00 to 2015-07-11 23:00 from both AQS and the CASTNET website. Above mentioned periods were all invalidated in AQS with the flags "AN" and "AS". The CASTNET dataset available on the CASTNET website are censored, and invalid data and their associated flags are not presented. The dataset on the CASTNET website had only the level 3 QA indicator. From the "UPDATE_DATE" time stamp found in the dataset downloaded from CASTNET website, records invalidated with "AS" were performed on 8/27/2015. The flag "AS" is a generic flag for all QA failures and is consistent with the data being invalidated. A more relevant flag such as "AN" may have been appropriate. Likewise, data were downloaded for MCK131 site for the time period from 2015-07-02 00 to 2015-07-05 23:00 from both AQS and CASTNET websites. The above-noted time periods were invalidated in AQS with codes "AN" and "AS". From the "UPDATE_DATE" time stamp found in the dataset downloaded from CASTNET website, records invalidated with "AS" were performed on 8/27/2015. The flag "AS" is consistent with the QC check failure cause noted above.

AUDIT QUESTIONS		RESPONSE			COMMENTS AND REFERENCES
		Y	N	NA	
37	In the past year, were there instances of power loss? Please identify relevant dates if applicable. In such events, did the data have to be corrected? RTI will request raw data from one of these events to examine data traceability.	X			CDR119 select hours between 2015-08-17 01:00 and 2015-08-31 01:00 No data have had to be corrected because of power failures in the past year.
38	When correcting, changing, deleting or invalidating data values in AQS, please address the authority under which the changes must be made. List the name and position of the individual(s) with signature authority for approving such changes. Is it possible for unauthorized personnel being allowed to change data values in AQS? How is this avoided?		X		Christopher Rogers (DMAIRM) is the only person at Amec Foster Wheeler 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.
39	Are corrected data resubmitted to the issuing group for cross-checking prior to release? [i.e., who within the program organization must be consulted before posting corrected data to AQS?]	X			See above. Marcus Stewart (QA Manager) approves all changes to validated data.
40	Are regular data summary reports issued by the organization? 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: www.epa.gov/castnet. The Data Quarterly Reports are delivered electronically to EPA but not currently posted.
41	Are there any instances where a non-documented database or program would be used in the validation process?		X		
42	Is any original/raw data over-written if it is altered?		X		Doraiswamy: All levels of data are maintained. Raw data is preserved without any alteration.
43	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 are maintained on the polling server in txt files and in the raw data SQL Server database. All validation levels are archived.

	AUDIT QUESTIONS	RESPONSE Y	N	NA	COMMENTS AND REFERENCES
44	Please provide an example of the documentation of Level 3 validation in electronic and in hard copy forms, for review.				See Attachment 1 (hardcopy form) and Attachment 2 (electronic record). Doraiswamy: The attachments provided an example of the VIN140 pump-out issue noted in Q36. Both the electronic and hardcopy notes and data flags match. The date of this review (8/27/15) matches on both the hard copy and electronic logs, as well as the "UPDATE_DATE" field in the dataset downloaded from CASTNET website.
Additional Comments:					
D. Data Processing/Reporting					
45	How often are data submitted to AQS and the CASTNET website?				Monthly
46	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			All data (including everything mentioned) are maintained permanently.
47	Are concentrations of pollutants (other than PM2.5) corrected to EPA standard temperature and pressure conditions (i.e., 298°K, 760 mm Hg) before input to AQS?			NA	
48	Are audits (internal or external) on data reduction procedures performed? If yes, at what frequency?	X			Internal audits are performed on a monthly basis. The QA Manager, Marcus Stewart, audits the data validation and all data reduction techniques every month once Level 3 data validation is completed for a specific group of sites.
49	Are data precision and accuracy checked each time they are calculated, recorded, or transcribed to ensure that incorrect values are not submitted to EPA?			NA	Programs are verified initially and upon change. Calculations made by established programs are not double-checked each time.
50	When was the last calibration performed? Was there any significant drift or change in slope observed?				They are ongoing 10 months out of the year. Each site is visited twice per year. All recent site visit calibration results have been passing.
Additional Comments:					

	AUDIT QUESTIONS	RESPONSE Y	N	NA	COMMENTS AND REFERENCES
E. Internal Reporting					
51	Are internal reports prepared and submitted as a result of the audits required under 40 CFR 58, Appendix A? List Report Titles and Frequency.				PE for all CASTNET sites are performed by a single, separate contractor who works on a different contract and reports to EPA. PE reports are reviewed and if necessary acted upon (including resolution of any safety issues identified). PE failures (rare) are addressed by the QA Manager in the relevant QA Quarterly Report.
52	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. Amec Foster Wheeler is only involved in a support role as requested by EPA.
53	Does either the audit or precision check reports include a discussion of corrective actions initiated based on audit.				See above.
54	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. Amec Foster Wheeler prepares quarterly QA reports and an annual QA report that are submitted to EPA and are available on the EPA CASTNET website.
Additional Comments:					

Part 3. Detailed Questions and Data Requests

(Responses provided by AMEC Foster Wheeler personnel unless otherwise indicated)

	AUDIT QUESTIONS	RESPONSE Y	N	NA	COMMENTS AND REFERENCES
Request to see raw data from the PE108 site for 3 time periods: a) **May 7-8, 2015 or June 10-11, 2015** b) **September 16-17, 2015** *c)* **2 consecutive days near an event with power failure over the past 12 months (if present); or 2 consecutive days in Jan/Feb 2015 (before the Feb calibration)**					
55	Download or print hourly data from Ozone instrument. Include time and O_3 ppb data at a minimum, plus other information such as ambient temperature, pressure, RH, shelter temperature, flow rate, etc., if available. Include a zero/span/precision check if available. Auditor will compare the data obtained at the site vs. the data reported in The				See Attachment3_ozone_data.xlsx Pressure and RH are not measured at PED108. Doraiswamy: Data for PED108 site were obtained from Chris Rogers for 3 periods: - 1/30/2015-1/31/2015 - 5/7/2015-5/8/2015 - 9/16/2015-9/17/2015

	AUDIT QUESTIONS	RESPONSE Y	N	NA	COMMENTS AND REFERENCES
	CASTNET website and AQS. Identify any discrepancies and follow-up with AMEC Foster Wheeler staff.				Data were also downloaded from AQS and CASTNET for the same time periods. Hourly ozone concentrations from AQS, CASTNET and data from Amec Foster Wheeler all agreed perfectly for the above time periods, after truncating the Amec Foster Wheeler data in ppb to a whole number. Periods of invalidations also agreed between the hourly datasets. Data were also downloaded from AirNow. The AirNow data had to be converted from UTC to Eastern time zone to align the time periods with AQS/CASTNET datasets. Upon comparison, it was found that the AirNow data was about 0 to 1 ppb different from the AQS data and the raw data. There was no specific pattern. For some records, the data agreed if the raw data was rounded up, while for the other records the agreement was only when the data was truncated.
56	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 compare it with raw data obtained from AMEC Foster Wheeler. • Are there any discrepancies in ozone concentration between the monitor readout and downloaded or printed data? • If any data flags are appended to the data by the instrument, later trace them to records on AQS and on the CASTNET website.				Happy to assist with this after the site visit. Doraiswamy: The onsite auditor, Jeff Nichol, obtained data from the data logger for 1-min, 5-min and 1-hr data for the PED108 site. The hourly data were compared between the raw data obtained onsite and the data obtained from CASTNET website for time period from 9/13/2015 to 9/30/2015. 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): 9/26/2015 7:00:00 PM to 9/26/2015 11:00:00 PM. The CASTNET data has missing data for that time period with a QA code of "X". The qa_code was "1" for records surrounding the above missing hours. Response from Chris Rogers: The "X" is the qa_code for a placeholder record. It shows that there was a break in polling. The break this time lasted from 2015-09-26 20:43 through 2015-09-28 09:39. So the daily submittal was made before those final 5 hours were polled. They were caught up in the EPA database when all of September was submitted at the end of November. Doraiswamy: Data from the CASTNET website were re-downloaded on Dec 6, 2015, and the missing hours from

	AUDIT QUESTIONS	RESPONSE Y	N	NA	COMMENTS AND REFERENCES
					9/26/2015 7:00 PM to 9/26/2015 11:00 PM had valid ozone data that were reasonable in comparison to the data for the adjacent time periods and agreed with the raw hourly data. Data for other hours in September 2015 agreed exactly with the previously downloaded values. The qa_code was now updated to "2", indicative of the level-2 validation.
57	Obtain the highest time-resolution (1-sec, 1-min, 5-min etc.) data recorded by the instrument/data logger directly from the instrument or from AMEC Foster Wheeler. 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.)				Happy to assist with this during the lab visit. Doraiswamy: 1-min raw data was provided by Chris Rogers for PED108 for the same time periods in Q55. The 1-min data were converted to hourly averages. Data from hours 01:46 to 02:14 am day were deleted due to the daily precision/span/zero (p/s/z) checks. Actual inspection of the data shows that the checks may last a few minutes after 2:14 am, and may start a minute or two after 1:46 am on some days. However, in order to resemble automated processing performed by the CASTNET system, this procedure was used. 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 Chris Rogers in Q55. Hourly data were typically within 0.01 to 0.05 ppb. Since the CASTNET system calculates hourly averages directly from the 1-sec data, and due to possible differences in the data removed for the p/s/z checks, the data audit was focused on the final truncated data in ppb that is of interest. Differences of 1 ppb were observed for certain records; however, the CASTNET/AQS data were invalidated for some records with flag "B". For these invalid records, the differences were not a concern, as this comparison does not account for data eliminations resulting from QC checks. However the 1/31/2015 23:00 record showed a difference of 1 ppb in the truncated data and did not have any flags associated with that record. Follow-up with Chris Rogers indicated that the raw value for the last data point 2/1/2015 00:00 provided previously was not correct.

	AUDIT QUESTIONS	RESPONSE Y	N	NA	COMMENTS AND REFERENCES
					Replacing with the correct value, yielded identical value for the hourly average.
58	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: • Check that the raw data records reflect the data gap at the correct time. • Do the correct flags appear in the hourly data records?				Doraiswamy: No interruptions were observed during the onsite audit.
59	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.			NA	Not applicable. We do not make any validation decisions based on PE audit results.
60	Auditor will observe the data validation process with the iCASTNET software and will follow the steps in the SOP. Were any deviations from the data processing and validation SOPs observed? Note any significant deviations that should be reflected in a revised SOP.				Data are validated currently using the CDMSA. Editor tools in iCASTNET are still being completed and tested. 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.
61	While on-site, the auditor will observe the 3 levels of security with the data logger.				Doraiswamy: The 3-levels of datalogger security were not observed on-site due to confusion as to what it referred to. This sentence in the QAPP needs to be clarified. Discussions with Marcus Stewart indicated that this is supposed to refer to the 3 levels of data validation. Chris Rogers did note that there are 3-levels of data validation and 3-levels of datalogger security. Recommendation: This sentence needs to be rephrased and clarified.
62	While on-site, the auditor will review the calibration records including the checks with the ozone transfer standard, annual verification of the NIST reference photometer and the certification documents.				The certifications for the ozone transfer standards and primary standards were documented. The standards were within the certification period and two standards were in the process of being certified.
63	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.				Updates are delivered via Oracle to Oracle data transfer as documented in QAPP Appendix 6 (Data Deliverable). Basically, these updates are included in a future monthly submittal and processed along with the regular data submittal.

	AUDIT QUESTIONS	RESPONSE Y	N	NA	COMMENTS AND REFERENCES
	Record the reasons for the changes, site IDs, dates and times of the data affected. (Example data need not come from the site(s) audited for the field TSA.) Answer the following questions: • 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? • Have data already in AQS ever had to be changed or updated? Is the process for making changes to AQS data documented?				Yes, the process is documented in the Appendix A of the above SOP and described in the AQS documentation. It has happened on occasion.
64	Based on the four data sources (AMEC Foster Wheeler raw data; AQS; AIRNow; CASTNET web site) determine the following: • Do all identifiers and flags from the three sources agree? If not, prepare a table or crosswalk of discrepancies or apparent correspondences. • Do hourly concentration averages computed from 5-min or 1-minute data sources agree? • Do hourly averages posted on AQS and the CASTNET website agrees as to both concentration and time?				Please see response to questions 55 and 57.
65	Review AMEC Foster Wheeler's validation records for a past issue. How are outliers identified and marked invalid by the validation process? - Was the outlier correctly identified? - Was the correct data flag applied?				Outliers are identified using an hourly spike screening tool.
66	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.	X			In general, site operators are not contacted about outliers. Housekeeping data are collected routinely for review by Amec Foster Wheeler technical staff and operators may or may not have the expertise to assist.
67	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)	X			We only validate hourly data. We do not remove underlying time periods and recalculate the hourly average.
Additional Comments:					

AUDIT QUESTIONS		RESPONSE Y	N	NA	COMMENTS AND REFERENCES
In the following questions RTI will download previous data from AQS and the AMEC web site and compare hourly data over several months and sites.					
68	Do the hourly data received directly from AMEC Foster Wheeler agree with the corresponding data downloaded from the EPA data sources (AQS, AIRNow, and the CASTNET website operated by EPA/CAMD)?	X			Please see response to questions 55 and 57.
69	Do time stamps agree?	X			Yes, they agree after offsetting the raw data to assign the average to the beginning of the hour.
Additional Comments: