

**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 Environment & Infrastructure (AMEC) for 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, December 2008 (QA Handbook)*. The questionnaires were provided to Mr. Kemp Howell, the Project Manager and Mr. Marcus Stewart, the Quality Assurance (QA) Manager for their initial review and submitted to other AMEC staff and the site operators (subcontractors) prior to the TSA. These questionnaires were completed by the RTI auditors during the audit process and include the responses from the AMEC management and staff and site operators. The questionnaires are attached as Appendices A, C, and E.

The RTI audit team consists of Mr. Jeff Nichol and Dr. James Flanagan. Mr. Nichol visited the two monitoring sites in North Carolina and also the Field Calibration Laboratory in Newberry, Florida. He conducted interviews with the AMEC management and staff and site operators on various aspects of the air monitoring program including such areas as network design, field operations, laboratory operations, data handling, and quality assurance and quality control procedures. Dr. Flanagan reviewed the ozone raw data records from these two sites 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 to AIRNow and AQS.

The findings listed below were based on a small sample set (two field site visits, a visit the Field Calibration Laboratory, and a remote review of the ozone data streams from these sites (discussed in Section 6)) overseen by AMEC. 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 (field (EPA-governed sites), laboratory, and data management reviews) performed by AMEC, RTI was extremely impressed with several aspects of the program such as:

- AMEC management structure that oversees the CASTNET program is precise and well organized,
- AMEC support staff are knowledgeable, cooperative, and supportive,
- Supportive communication link between Field Operations Laboratory and site operators is advantageous and valuable means of communication
- Use of consistent and current state of art instrumentation (Thermo 49i, Campbell CR3000, and mass flow controllers),
- Multiple calibration and verification checks conducted within the measurement system,
- Maintenance of written documentation (QAPP, SOPs, checklist, SSRF, field logbooks) instructing site operators, and
- The levels of NIST-traceable standards used in the program (Level II transfer standards, Level III onsite standard, and Level IV site analyzer).

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.

- Sites did not have an electronic or hard copy of the current Quality Assurance Project Plan (QAPP) or Field Standard Operating Procedures (SOPs),
- Site operators at each site could not provide any training records documenting their satisfactory completion of training for the ozone collection system,
- No evidence of a follow up training program for senior staff (site operators) of new instrumentation (Thermo 49i ozone analyzer), and
- Lack of a program to remove obsolete SOPs and checklists and a follow up program to confirm these documents have been removed from the monitoring sites

Section 1: Introduction

AMEC Environment & Infrastructure (AMEC) 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 International (RTI) performed technical systems audits (TSAs) of the ozone collection process and data and data management operated by AMEC. Two monitoring site located in North Carolina (NC) were visited as well as the Field Calibration Laboratory in Newberry, FL. This audit was based on measuring 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 two field sites CND125 located in Candor, NC and BFT142 located in Beaufort, NC and Field Calibration Laboratory located in Newberry, FL. Dr. James Flanagan remotely performed the evaluations of the management of the ozone data. Mr. Eric Poitras (RTI) observed the TSA conducted at the CND125 monitoring site. The key AMEC staff involved during the auditing process was:

- 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), and
- Mr. Michael Smith (Assistant Field Operations Manager).

The site operators that participated in the monitoring site TSAs were:

- Ms. Hazel Perry (CND125)
- Ms. Patricia Perry (CND125), and
- Mr. Nathan Hall (BFT142).

Sections 2, 3, 4, 5, 6, and 7 of this report discuss the general findings of the AMEC's ozone collection process; network management; field operations at the two sites; 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, pictures of the CND125 and BFT142 monitoring sites taken during the site visits, and copy of the Installation/Implementation Checklist for EPA Regulatory Ozone Monitoring.

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 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 submits the real time CASTNET hourly ozone data to [AIRNow](#) and also updates the data to the CASTNET website daily. In addition, AMEC submits the CASTNET ozone data to the Air Quality System (AQS) database.

During the visits to the two field sites, 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 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 8.0 dated October 2011 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 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, 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.

Findings

FINDING 1:

During the site visits to CND125 and BFT142, the site operators could not provide the RTI auditor an electronic or hard copy of the current QAPP or Field Operation SOPs.

Discussion:

Based on conversation (by phone) with Mr. Michael Smith, hard copies of the Field SOPs (CASTNET QAPP Appendix 1) and Health and Safety Plan (CASTNET QAPP Appendix 5) are sent to the site operators annually. Appendix 5 is sent with a signature approval form for the site operators to sign and date and send back to AMEC.

During the laboratory visit, Mr. Stewart gave the auditor a copy of a memorandum dated April 8, 2011 that was sent to site operators with an enclosed package that included:

- **A CD of the Health and Safety Plan, Site Operator Handbook, and SOP for ozone air monitoring**
- **Signature pages of acknowledgement for site operator to sign** for safety plan and destruction for obsolete SOPs.

He also provided a table showing the site operators and backup operators have signed and returned the signature pages to AMEC. The RTI auditor was also given a copy of each site operator's signature approval for the CND125 and BFT142.

RECOMMENDATION:

There seems to be some confusion based on the discussions with the site operators regarding the signature approval page that is returned to AMEC. The signature approval page is a good idea for documentation, but it does not solve the problem that the site operators do not have or could not provide the RTI auditor with the current quality documents (QAPP and field SOPs). RTI recommends that AMEC develop a reviewing mechanism that during the 6-month field calibration or the annual performance evaluation (PE) audit conducted by EPA subcontractor, EE&MS, the calibrator or auditor request to be shown (by the site operator) the current QAPP and field SOPs. This mechanism can be performed through a checklist that is signed and dated by the auditor/calibrator and site operators and submitted with the calibration/audit report to the AMEC (QA Manager) for the filing records of the calibration/audit.

FINDING 2:

Section 4 of the *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, December 2008 (QA Handbook)* discusses the need for a formalized training program. During the field site visits, the site operators at each site could not provide any training records documenting their satisfactory completion of training on the current ozone collection system or any evidence of a follow up training program for senior staff (site operators) of new instrumentation (Thermo 49i ozone analyzer).

Section 2.3 of the CASTNET QAPP states: *“A record of the training is established in the site logbook. If needed, refresher training is given during the biannual calibration and maintenance visits. Site operators received additional support and training during the Tuesday call to the FOM, during each biannual calibration visit, and through technical tips and informative articles provided by the CASTNET site operator newsletter, which is delivered electronically two to three times per year.”*

The SOP titled *“Site Selection Procedures, Site Installation, Initiation, and Operator Training”* states there is a training seminar onsite (neither of these site operators attended) and the Station Initiation Team performs follow up training with the site operator. Currently, there is no continual training when instrumentation changes or new site operators/backup operators begin conducting the field work.

This could lead to two problems. First, the site logbooks are either not maintained at the site due to storage space (BFT142) or are shipped to the AMEC Field Operations Laboratory when completely filled (the CND125 site had site logbooks onsite dated back to 2004). In either scenario, there is no permanent record maintained at the site to provide evidence for an auditor that the site operators were properly trained or were provided follow up training for any job deficiencies or new instrumentation brought online such as the Thermo 49i ozone analyzer. A second problem is not having the documentation at the AMEC Laboratory (QA Manager) that the site operators have received the necessary training and can provide evidence of the training to an auditor.

Discussion:

Based on conversation with the Mr. Mishoe and Mr. Smith, the site operators are given instructions during the initial site set up or when equipment change outs occur. When an issue or problem occurs at the site, the site operators contact Mr. Mishoe and Mr. Smith by telephone (each site has a phone line) and they provide technical assistance to the site operators and document the issues/problems and corrective action in the Call Log. But if the phone system is down the inexperienced site operators that are not properly trained are left to try and solve the problem on their own, or have gaps in data acquisition until Mr. Mishoe or Mr. Smith are reached.

Based on conversations with Mr. Stewart, in the CASTNET QAPP Appendix I, Section III, Subsection 6.14, the 6-month field technician is also supposed to assist with providing training information and explanations. At the CND125 site, the site operators stated they leave when the field technician (calibrator) arrives and at the BFT142 site the site operator wants to learn more and stays during the calibration.

There was a contrast in understanding the basic operations of the Thermo 49i ozone analyzer. At the CND125 monitoring site, the site operators had difficulty explaining the basic operations of the Thermo 49i ozone analyzer. The day-to-day operations seem to be functioning as long as there are no issues or problems. At the BFT142 site, the site operator was more knowledgeable of the Thermo 49i analyzer because he also participates in a NO_y study using the Thermo 42i oxides of nitrogen analyzer. At neither site could the site operator assist the RTI auditor to download any raw ozone data from the laptop. Downloading of electronic data is not part of the normal activities performed by the site operators, but it could be a useful particularly when being audited by a third party.

RECOMMENDATION:

AMEC needs to develop a mechanism (tracking system) to ensure that all site operators have been trained (training method and date trained); provide a certificate (electronic on the site operator's laptop or hard copy) of training completion that the site operator can maintain at the site; and a training record log (electronic or hard copy) maintained by the QA Manager. This mechanism can also be used to include follow up training. A training program will ensure that new staff are proficient and that existing staff are able to keep skills current, to learn of emerging technologies and capabilities. The training program should also include the requirements of field operators stated in the current QAPPs and SOPs. To assess capabilities of the site operators, a checklist could be prepared by the QA Manager addressing questions relating to the field operations at the site. During the 6-month calibration, the calibrator could discuss the checklist with the site operators and assess their field operation knowledge. The results of the checklist should be maintained as part of the site operator's training records. Any previous training performed on the phone by Mr. Mishoe or Mr. Smith can be added to the checklist. The overall training record package for the field operators should be maintained by the QA Manager, Mr. Stewart and available for internal and external review.

FINDING 3:

During the field site visits, the auditor found several obsolete checklists and field SOPs at each site. In some cases, the site operator identified these checklist/SOPs as the procedure that they followed for sample removal and documentation.

In Table 1-2 of the CASTNET QAPP, the RTI auditor could not determine who was responsible for the removal of obsolete documents from the monitoring sites. Section 1.7.6 of the QAPP discuss the updating, distribution, version control, and archiving, but there is no discussion for handling obsolete documents (field or in the laboratory).

Discussion:

During the laboratory visit, Mr. Stewart gave the auditor a copy of a memorandum dated April 8, 2011 that was sent to site operators with an enclosed package that included:

- A CD of the Health and Safety Plan, Site Operator Handbook, and SOP for ozone air monitoring
- Signature pages of acknowledgement for site operator to sign for safety plan and **destruction for obsolete SOPs.**

He also provided a table showing the site operators and backup operators have signed and returned the signature pages to AMEC. The RTI auditor was also given a copy of each site operator's signature approval for the CND125 and BFT142.

RECOMMENDATION:

Based on the discussion with Mr. Stewart, the site operator is given directions to remove and destroy obsolete documentation, but there seems to be some confusion based on conversations with the site operators of the two sites visited regarding the destruction of obsolete SOPs. RTI recommends that AMEC develop a reviewing mechanism that during the 6-month field calibration or the annual PE audit conducted by EE&MS, the calibrator or auditor should inspect that obsolete SOPs or checklists have been removed from the site. This mechanism can be part of the checklist discussed in Findings 1. Also, describe in the CASTNET QAPP, the process and who is responsible for removal of obsolete document at the monitoring sites and the AMEC laboratories.

Section 3: Network Management

AMEC along with subcontractor, Air Resources 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 the data from those sites to AMEC. AMEC oversees the EPA site, but AMEC 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”, Version 1.013 dated July 18, 2012 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 two field sites, CND125 in Candor, NC and BFT142 in Beaufort, NC. Based on 40 CFR Part 58, both sites are within siting criteria requirements and neither site has requested or received any waivers. At each site, 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 as a back-up data logging system.

FINDINGS

No problems or issues base on the review of the two visited sites and discussions with the AMEC management and QA Manager.

Section 4: Field Operations

AMEC oversees the EPA-governed CASTNET monitoring sites. During this TSA, RTI visited two field sites, CND125 in Candor, NC and BFT142 in Beaufort, NC. 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.

	CND125	BTF142
Site Location Address	136 Perry Drive Candor, NC 27229	100 Nelson Bay Road Beaufort, NC 28516
AQS Number	371239991	370319991
Site Operator Contact Information	Hazel Perry 136 Perry Drive Candor, NC 27229 910-572-1423	Nathan Hall 100 Nelson Bay Road Beaufort, NC 28516 252-726-6841 (w); 252-726-7353 (h); 252-808-5366 (c)
Backup Site Operator Contact Information	Patricia Perry 136 Perry Drive Candor, NC 27229 910-572-1423	Jeremy Braddy 100 Nelson Bay Road Beaufort, NC 28516 252-726-6841 (w); 252-342-2402 (h)
Site Ozone Analyzer (Manufacturer, S/N, EPA decal)	Thermo 49i S/N: 1105347306 Decal: 000728	Thermo 49i S/N: 1009241784 Decal: 000629
Transfer Standard Site Ozone Analyzer (Manufacturer, S/N, EPA Decal)	Thermo 49i S/N: 0929938240 EPA Decal: 000543	Thermo 49i S/N: 0622717857 EPA Decal: 000219
GPS Coordinates	N 35.2631° W 79.8365°	N 34.8848° W 76.6209°
Elevation	649 ft. (197.8 m)	7 ft. (2.15 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. Helen Reed and Ms. Ruby Wyrosdick review the SSRFs when they arrive at the Newberry laboratory.

At the EPA-governed sites, two forms (hard copy and electronic) of data streams are used for ozone collection process, but primarily only the electronic data is submitted to AIRNow and AQS. The site operator does enter some data from the PC200 computer 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 PC200 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 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 staff). The team uses a designed procedure during installation and initiation and follows a checklist (see Appendix F) to document all steps. EPA approval is acquired prior to installation and all initial certifications of equipment are maintained in the Calibration Folder on the site's laptop. Initial training is provided to the site operator by the Installation Team.

The site operators visit the site every Tuesday as stated in the Field SOPs. In some cases the site operator might visit more frequently if they are responsible for other networks at that monitoring site. Site operators report the 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. After collecting their filter packs and verifying the ozone collection process is working properly, the site operator calls the AMEC Laboratory by telephone and discusses the weekly sampling event with the Field Operations Manager or other AMEC staff and then submits sampled filter pack and SSRF to the AMEC Laboratory. The site operators do not send any ozone data to the AMEC Laboratory. This is all performed electronically through the data acquisition system (DAS).

Findings

FINDING 1:

There is an Installation/Implementation Checklist for EPA regulatory Ozone Monitoring (see Appendix F) that describes the steps for installing and implementing the ozone monitoring at the field site. But there are no place marks for the site operator's signature and date or are there any checklist statements showing training of the site operator.

As stated in the CASTNET Appendix 1 Field Standard Operating Procedures (Section 6.5.1 of Section I Site Selection Procedures, Subsection A Site Installation, Initiation, and Operator Training). *It is essential that the site operator(s) be onsite during the configuration and installation of the equipment. The system as a whole is covered in detail during installation. The site operator's assistance expedites the initiation process and provides valuable training. During such onsite assistance, the Station Initiation Team reviews all phases of training, with the site operator. Following training, the Station Initiation Team requires the site operator to perform all site tasks as though routine operations were underway.*

Discussion:

In recent years, there have been only a few new installations of CASTNET sites. Thus, there was no completed Installation/Implementation Checklist for EPA regulatory Ozone Monitoring to review during the audit; only the blank copy shown in Appendix F.

RECOMMENDATION:

If training of the site operator occurs during the installation/implementation process, a statement should be added to this checklist describing the training and place marks for the site operator's signature and date. The signature of the trainer and date training performed should also be included. All information regarding training should be added to the site operator's training record.

FINDING 2:

At the CND125 monitoring site, neither of the ozone analyzers was connected to the uninterruptable power supply and both desiccant canisters need to be replaced with desiccant. When the RTI auditor connected the uninterruptable power supply to a receptacle, there was no indication that the supply was working.

Discussion:

The site operator stated that she would advise the Field Calibration Laboratory that she needs more desiccant. Regarding the uninterruptable power supply, there was no discussion.

RECOMMENDATION:

RTI recommends for the AMEC staff at the Field Calibration Laboratory replace the uninterruptable power supply at this site. The RTI auditor followed up with the site operator's request for more desiccant from the Field Calibration Laboratory and the site operator has made the request.

Also Findings 1, 2, and 3 from Section 2 General Program

4.1 Candor, NC (CND125) Field Site

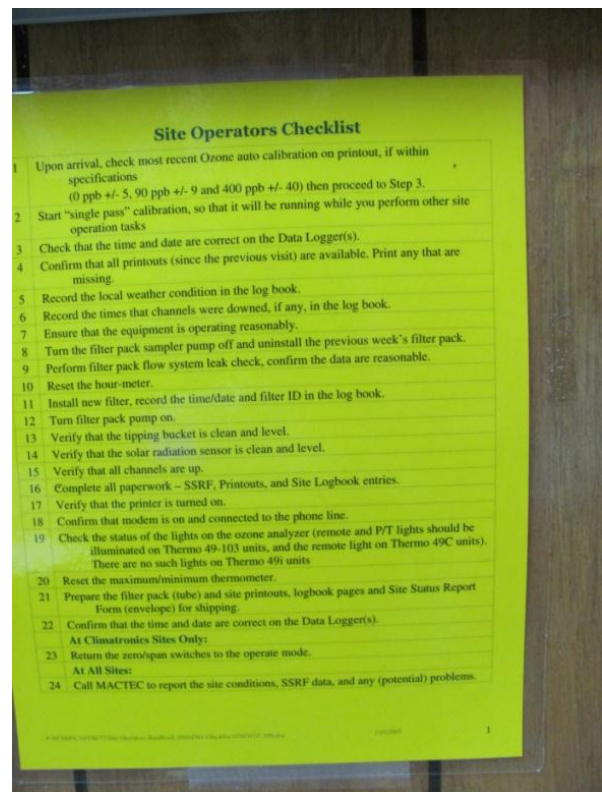
On August 21, 2012, Mr. Nichol and Mr. Poitras visited the CND125 site and met with Ms. Hazel Perry (Site Operator) and Ms. Patricia Perry (Backup Site Operator). The CND125 monitoring site is located on their property and has been in operation since September 1990. The site was a former National Atmospheric Deposition Program (NADP) 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 (see photo) with some variation. The site does not have a signed hard copy or access to an electronic version of the QAPP or Field SOPs. Site operators are operating the site based on past experience (both have been in the NADP and now CASTNET program). Site operators stated that they have not been to any training program in the past or recently. Both site operators were originally trained by Mr. David Kirk of AMEC fka ESE several years ago. Most training occurs by telephone conversations with Mr. Mishoe or Mr. Smith. Copies of SSRF are maintained in a 3-ring binder and the site had used logbooks dating back to 2004. Obsolete documents (SOPs and checklists) were present dating back to 2007.

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 Field Calibration Laboratory, which serves as the centralized maintenance and repair facility.

Site Description

There are two shelters at the site and four towers. The first shelter houses the ozone analyzers, desk, data logger system, and site operator's files and is in need of some repair (and has an insect invasion). The second shelter belongs to North Carolina Department of Natural



Resources (NC DENR) and houses the Xontech VOCs sampler. All items (equipment, towers, and shelters) at the site are listed in the table below. Items A and B are connected to this shelter for NC DENR. Natural grass covers the ground within the 30 meter circle from the primary shelter that houses the ozone analyzers. Beyond the 30 meter circle is taller natural grass and the closest tree grove (pine trees) to south of the site.

Candor Field Site (CND125) 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 (AirMoN ammonia sampler, wind direction and speed)	105	6.2	10
T2 Tower (ozone inlet, filter pack, temperature sensor)	XXX	XXX	10
T3 Tower (no samplers)	38	8.3	10
T4 Tower (wind direction and speed equipment)	315	16.3	10
A VOC inlet (primary and collocated) for NC DENR	305	12.7	4.0
B Temperature sensor for NC DENR	315	11.8	4.0
C Deactivated Andersen PAHs sampler for NC DENR	256	11.4	0.8
D Deactivated Tipping Bucket	105	23.2	0.3
E Thermo 2025 PM2.5 sampler for NC DENR	346	24.2	1.4

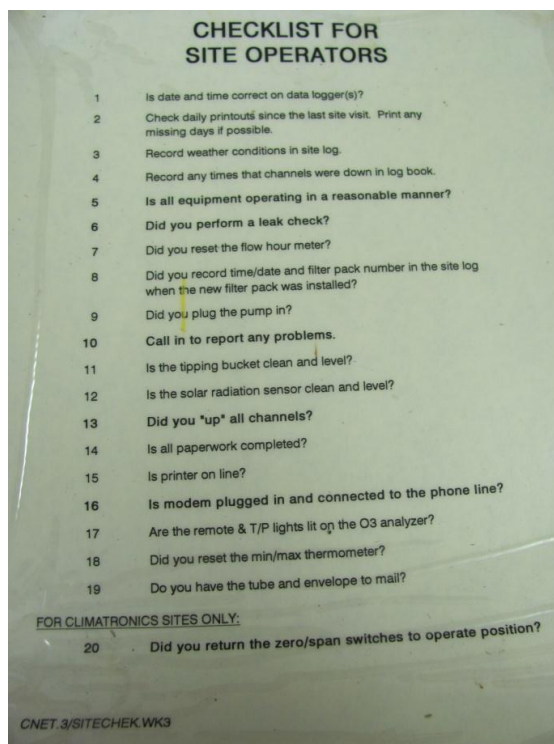
See Appendix A for responses to questionnaire and Appendix B for photos of the CND125 site.

4.2 Beaufort (BFT142) Field Site

On August 28, 2012, Mr. Nichol met with Mr. Nathan Hall (Site Operator) at the BFT142 monitoring site that is located on a farm in the middle of crop field. The BFT142 monitoring site has been in operation since December 1993 and is also a NADP site. Mr. Jeremy Braddy, the backup site operator, only operates the site during times where Mr. Hall is on vacation. 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 a checklist (see photo). The site does not have a signed hard copy or access to an electronic version of the QAPP or Field SOPs. The site operator stated that he received initial training, but very minimal follow up training especially when new instrumentation is placed at the site. Mr. Hall understands the basic operation of the ozone analyzers, the basic key strokes to review data, and the responses shown using the PC200 software. He is in the air and water monitoring field and has experience with air/water. He does contact the Field Calibration Laboratory (Mr. Mishoe or Mr. Smith) when he has problems and needs directions for maintenance and repair issues. Copies of SSRF are lying unorganized in a filing cabinet and Mr. Hall sends back all used logbooks to the AMEC Field Calibration Laboratory. Obsolete documents (2001 version of CASTNET SOPs for the meteorological instrumentation that did not include an ozone SOP) were present at 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 Field Calibration Laboratory, which serves as the centralized maintenance and repair facility.

Site Description

There is one shelter at the site that houses the two ozone analyzers, one oxide of nitrogen analyzer, desk (table), data logging system, and site operator’s filing cabinet. The shelter could use a good cleaning. There are several dead mosquitoes lying on the desk top and floor. All towers and field instrumentation are properly spaced. Natural grass covers the ground within the 30 meter square with a dirt (sand) roadway leading to the site. The site is surrounded in all directions by fields used for farming soybeans, winter wheat, and corn. No tree groves were within 400 meters of the field site.

Beaufort Field Site (BFT142) Measurements

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

Items	Compass	Distance (m)	Height (m)
	Degrees		
T1 Tower (ozone inlet, filter pack, temperature sensor)	XXX	XXX	10
T2 Tower (CASTNET annular denuders)	30	7.9	10
T3 Tower (CASTNET oxides of nitrogen inlet)	100	5.5	10
T4 Tower (meteorological instrumentation)	230	12.5	10
A NADP Aerometric Sampler	160	19.0	1.1
B NOAA Rain Gage	170	18.5	1.0
C Tipping Bucket	180	17.5	1.0

See Appendix C for responses to questionnaire and Appendix D for photos of the BFT142 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 II transfer standards, Level III site analyzer, tubing, pumps, etc.) to the site operators by Fed-Ex. 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 Laboratory maintain 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 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. Currently, there are five transfer standards and four laboratory-controlled standards used in the CASTNET ozone collection process and are listed in the table below. 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 server. Besides the ozone analyzers, the Field Calibration Laboratory also uses and tracks 15 flow meters (10 with current certification), 2 temperature sensors with current certifications, 3 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: MAC0736	July 10, 2012
2	Thermo 49i	S/N: 1030244811 EPA Decal: MAC000691	December 7, 2011
3	Thermo 49i	S/N: 1030244810 EPA Decal: MAC000679	July 10, 2012
4	Thermo 49i	S/N: 1030244813 EPA Decal: MAC000677	December 7, 2011
5	Thermo 49i	S/N: 1105347330 EPA Decal: MAC0747	June 27, 2011 <i>Only travel transfer standard out of certification. This was only used for the January calibrations, at which time it was in certification. Preparations are being made to have the unit recertified.</i>
Laboratory-Controlled Standards			
1	Thermo 49i-PS	S/N: 1022143674 EPA Decal: 000636	August 17, 2011
2	Thermo 49CPS	S/N: 62939337 EPA Decal: 000122	August 22, 2012
3	Thermo 49i-PS	S/N: 801827200 EPA Decal: 000380	April 3, 2012
4	AMEC Thermo 49CPS	S/N: 63110338 EPA Decal: 000582	March 27, 2012

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 staff.

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. Flanagan. The overall quantity and quality of CASTNET's project documentation was impressive, and the AMEC 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 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://epa.gov/castnet/javaweb/index.html> – 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 4, October 2011.
- EPA AQS system – This is the final repository of fully validated data for compliance and reporting purposes. AMEC uploads data to AQS as described in CASTNET SOP "Data Deliverables", Appendix A. *NOTE: Unlimited access to AQS requires an account, but subsets of the data are available to the general public through EPA sites such as AIRDATA described in the next bullet.*
- AIRDATA is publicly accessible EPA website through which both the daily maximum ozone running 8-hour averages as well as the AQI value are available. Both of these parameters are available within 1 day of the sampling date, and are consequently based on data that have not been fully validated. "Daily" files for the CND125 and BFT142 sites were downloaded from this AIRDATA for comparison with the hourly data. *NOTE: The AIRNOW website was identified as containing relevant CASTNET data late in the audit process. The auditor was never able to locate relevant ozone data for these two CASTNET sites at the public AIRNOW site, www.epa.gov/airnow.*

Information Gathering:

1. Downloaded relevant sections of the CASTNET QAPP and SOPs from the CASTNET website. (<http://epa.gov/castnet/javaweb/index.html>)
 - a. Quality Assurance Project Plan, Rev. 8, October, 2011.
 - b. QAPP Appendix 6: CASTNET Data Operations Standard Operating Procedures, October 2011.
 - Appendix 7 – DQO Planning Document.
2. Prepared and evaluated data management checklist based in part on QA Handbook, Volume 2, Appendix H. Completed checklist attached.
3. Collected datasets for the two sites, CND125 and BFT142, that were audited on 8/21 and 8/28, respectively. Other data for these and other CASTNET sites were also obtained from sources indicated.

- a. 5-minute data and hourly ozone and related data that had been acquired via the LoggerNet system were provided to RTI by AMEC. The hourly data had been averaged by the data logger, and some flags had been applied.
 - Candor data – CND125_Ozone_Data.zip – provided on 8/22/12
 - Beaufort data - BFT142_Ozone_Data.zip – provided on 8/29/12
- b. Data were downloaded from AQS – fully validated hourly data; stopped at end of June because of processing lag, so couldn't compare with later data, including data taken during the TSA. Example AQS data files were also provided by AMEC.
- c. Data downloaded from EPA's CASTNET site, operated by EPA/CAMD. These are hourly data, typically available within one day. Start at <http://epa.gov/castnet/javaweb/index.html>.
 - -> Download Data
 - -> CASTNET Data
 - -> "Continue"
 - -> Measurement (Raw Data)
 - Request data: indicate types, sites, and dates of data requested
 - Download spreadsheet containing data.

Available variables include Site ID, Date/Time, Ozone Conc., QA code, and Update Date.

Data Evaluation Activities:

1. Based on initial inspection of the CND125 raw 5-minute dataset, one suspicious data point was identified with a timestamp of 8/15/2012 8:15:00 PM. This information was provided to Mr. Nichol for follow-up during the on-site TSA (conducted on Sept. 13). Mr. Nichol was able to use this data point for observing how AMEC's data validation processes work, and for verifying that the outlier had been correctly documented. AMEC provided validation reports showing that this ozone outlier had been correctly identified during the next day's validation screening.
2. Data reports from the EPA/CAMD 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.
3. The 2:00 A.M. data in the files from EPA/CAMD and AQS were sometimes missing (indicating that the value had been invalidated), and sometimes not. The raw data files typically showed a data flag of "<" at 2:00 AM and occasionally at 3:00 AM.
4. Flags in the raw hourly data file provided by AMEC for CND125 covering 3/11 through 8/21 were examined in detail. Many "<" flags appeared for the 2:00 AM observations, as expected because regular zero/span/precision checks are programmed to run at this time. A few of the adjacent 3:00 AM ozone values were also flagged with "<". The measurement count values in the file for the CND125 site were consistently 3600 plus or minus 60. Variations of up to 60 were common, but no difference of more than 60 was observed. There was no observable relationship between the value in the "measurement count" field and any of the flags on the same row.
5. When these hourly ozone data were compared vs. data downloaded from the EPA/CAMD website or from AQS, it was observed that the times were consistently offset by one hour, with the raw data being one hour behind the data on the EPA/CAMD website. AMEC personnel indicated that this offset is applied to correct how the data logger reports the time for time-averaged monitoring data compared with EPA's method. Data comparison confirmed that the ozone data on the EPA/CAMD site had been truncated, rather than rounded, to the nearest integer (ppb), in accord with AQS requirements.

6. When the raw data for CND125 were joined on the EPA/CAMD data, the "<" flag in the former did not result in data invalidation, whereas the "B" and "C" flags in the raw file corresponded consistently to blank cells in the EPA/CAMD data.

Findings

FINDING 1:

There was difficulty locating the "AIRNow website" cited in various places in the CASTNET QAPP, for example, QAPP Sec. 2.5.2 states (emphasis added):

"... Each CASTNET site is polled hourly to retrieve hourly averages and status files. O3, meteorological, and flow data are reviewed daily by data operations personnel as part of the data validation process (Section 4.0). For sites with EPA supplied CR3000 data logger and 49i ozone analyzers, data are polled hourly with Campbell's LoggerNet and *uploaded to the EPA AIRNow Web site...*"

Based on this information, the auditor initially searched the public AIRNow website <http://airnow.gov/> which did not reveal any data for the two audited CASTNET sites. After an inquiry by RTI, AMEC provided the full address of the EPA FTP site to which these hourly data are uploaded: <ftp://upload.epa.gov/incoming/CASTNET/data> where data for the two audited sites were successfully located.

RECOMMENDATION:

Update the CASTNET QAPP and relevant SOPs to provide the specific EPA Internet address (es) to which the CASTNET data are being uploaded. It is also recommended that the QAPP and/or SOPs also identify the group(s) at EPA responsible for maintaining the site to which these data are being uploaded (e.g., AQS staff, CAMD staff, Air Now staff, etc.). Having the latter information could help future auditors and data users obtain potentially useful information about the data storage facility, such as SOPs and validation procedures, as well as contact information.

FINDING 2:

No major discrepancies in data were identified upon comparing data, other than the 1-hour offset that was easily explained.

RECOMMENDATION:

No action required.

FINDING 3:

The outlier in the data that occurred at CND125 on 8/15/12 was detected quickly and was properly documented.

RECOMMENDATION:

No action required.

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 servers; and records of e-mail transmittals.

The current CASTNET QAPP and supplementary SOPs are in their 8th revision and dated October 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.

The CASTNET website lists the entire current laboratory SOPs in Appendix 1 of the QAPP (October 2010). These SOPs are reviewed annually and were approved by the AMEC management on October 10, 2011. 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 laboratory 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 travelling and select bench ozone transfer standards are certified as Level II because they have been calibrated by a Level I 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 CND125 site, the last 6-month calibration prior to the TSA was conducted on July 24, 2012 and the last PE was performed on September 28, 2011. For the BFT142 site, the last 6-month calibration prior to the TSA was conducted on July 26, 2012 and the last PE was performed on October 7, 2011. The table below states the acceptance criteria for each of the assessments performed at the CASTNET monitoring sites.

Assessment	Acceptance Criteria
ZSP Checks	Zero value $\leq \pm 10$ ppb Precision/Span $\leq \pm 7\%$ between supplied and observed concentrations
6-Month Calibration Checks	All points within $\pm 2\%$ of full scale of the best fit straight line $\pm 5\%$ of actual for any value, $r^2 > 0.9950$, $0.9500 < \text{slope} < 1.050$ $-3.0 \text{ ppb} < \text{intercept} < 3.0 \text{ ppb}$
PE Audits	All points be within 15% of the supplied concentration

AMEC 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 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.

APPENDIX A

Candor (CND125) 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

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

Monitoring Site Technical Systems Audit Form

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This audit form was prepared by RTI International (RTI) to evaluate the technical systems for ozone measurements at the CASTNET air monitoring sites. This form will be used to evaluate the QA/QC documentation, network management, basic site operations (ozone specific), sample siting requirements, and data management at each of the two sites visited, Candor (CND125) and Beaufort (BFT142) in North Carolina. 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 8.0 dated October 1, 2011 with ten appendices. Several of these appendices or particular sections of the appendices will be used as a basis to prepare questionnaires for the TSA of the field sites (ozone activities), CASTNET Calibration Laboratory (ozone), and data management system for ozone reporting to EPA AQS and AIRNow. Those appendices are:

- Appendix 1 CASTNET Field SOPs
- Appendix 2 EPA Site Contact List
- Appendix 3 ARS SOPs
- Appendix 5 CASTNET Health and Safety Plan
- Appendix 6 CASTNET Data Operations SOPs, and
- Appendix 8 CASTNET Quality Management Plan.

Part 1. General Information

Monitoring Site Information

NAME/LOCATION OF MONITORING SITE: (Ozone): Candor

MONITORING SITE ADDRESS:

136 Perry Drive
Candor, NC 27229

MONITORING SITE AQS NUMBER: 371239991

CASTNET SITE NUMBER: CND125

MONITORING AGENCY AFFILIATION: CASTNET

NAME OF ANALYSIS/SUPPORT LABORATORY: AMEC Laboratory in Newberry, FL

AUDIT TEAM MEMBERS/AFFILIATIONS: Jeff Nichol (RTI auditor); Eric Poitras (RTI trainee)

AUDIT DATE: August 21, 2012 (site) and September 12/13, 2012 (lab)

PERSONNEL INTERVIEWED:

NAME	POSITION	PHONE/E-MAIL
Site		
Patricia Perry	Backup Site Operator	910-572-1423
Hazel Perry	Site Operator	910-572-1423
Field Calibration Laboratory		
Kevin Mishoe	Field Operations Manager	kevin.mishoe@amec.com 352-332-3318
Mike Smith	Assistant Field Operations Manager	michael.i.smith@amec.com 352-332-3318
Marcus Stewart	Quality Assurance Manager	marcus.stewart@amec.com 352-332-3318 (ext. 6099)
Chris Rogers	Data Management, Analysis, Interpretation and Reporting Manager	christopher.rogers@amec.com 904-391-3744
Kemp Howell	Project Manager	kemp.howell@amec.com 352-332-3318

OPERATIONAL AREAS THAT WERE OBSERVED:

(At site): Removal and placement of the filter pack and recording of the ozone data from the PC200 computer program on the Site Status Report Form (SSRF).

(At laboratory): Met with K. Mishoe, M. Smith, M. Stewart, K. Howell, and C. Rogers to discuss Field Laboratory operations and data management of the ozone collection, review, and reporting operations.

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 8.0 dated October 2011
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-Project Manager, William Imbur-Project Quality Assurance Supervisor, and Marcus Stewart-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 Services)
8. Has the CAMD Project Officer and QA Officer approved and signed the QAPP?	X			Date: February 22, 2011 (Lance McCluney-EPA Project Officer and Larry Kertcher-EPA QA Officer) and February 28, 2011 (John Ray NPS-Contracting Officer's technical representative)
9. Has the AMEC Project Officer and QA Manager and other network leads approved and signed the QAPP?	X			
10. Is the purpose of the QAPP clearly stated?	X			
11. Is the project organization clearly identified with their roles and responsibilities?	X			
12. Is the organizational chart in the QAPP up-to-date?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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		The site does not have a signed hard copy or access to an electronic version of the QAPP. See Question 33, regarding follow up to this question when the RTI auditor visited the Field Calibration Laboratory in Newberry, FL.
15. Has the approved QAPP been reviewed (or will be reviewed) on a periodic basis? Ask to see.	X			
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			
23. Is there an internal assessment program to determine conformity to quality assurance has been maintained? What assessments are performed?	X			The internal assessment program at the site for ozone collection includes: a daily ZSP check, a weekly multi-verification check on Sunday, a 6-month calibration, and an annual PE for the ozone analyzer. During the 6-month calibration and annual PE, a TSA is conducted that might involve the site operator. At Candor, the site operators are not involved with the 6-month calibration and annual PE. At the Field Operations Laboratory, PE reviews, TSAs, and internal audits are performed by the QA Manager.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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. 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.
28. 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			
29. Does the SOPs reflect, present and address specifications and operations that are in accordance with those applicable to the CASTNET program?	X			
30. Are the SOPs signed by management and QA staff?	X			
31. Are the SOPs available for review by auditor?	X			
32. Are the SOPs controlled documents?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
33. Are signed copies of the SOPs available to the field operator?	X			<p>Based on conversation (by phone) with Mr. Michael Smith, hard copies of the Field SOPs (CASTNET QAPP Appendix 1) and Health and Safety Plan (CASTNET QAPP Appendix 5) are sent to the site operators annually. Appendix 5 is sent with a signature approval form for the site operators to sign and date and send back to AMEC.</p> <p>During the laboratory visit, Mr. Stewart gave the auditor a copy of a memorandum dated April 8, 2011 that was sent to site operators with and enclosed package that included:</p> <ol style="list-style-type: none"> 1. A CD of the Health and Safety Plan, Site Operator Handbook, and SOP for ozone air monitoring 2. Signature pages of acknowledgement for site operator to sign for safety plan and destruction for obsolete SOPs. <p>He also provided a table showing both site operator and backup operator signed and returned the signature pages and copies of the signed pages.</p>
34. Does site operator have current up-to-date SOPs <u>onsite</u> ? Electronic or hard copies.		X		<p>The site operator showed the auditor several versions of short-cut guides (Site Operator's Checklist dated 11/9/2007 and Quick Start Instructions for the Site PC not dated) and a 1990 version of the National Atmospheric Deposition Program (NADP) SOPs. These obsolete documents need to be removed from the site and replaced with current SOPs.</p>

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
35. Are there deviations from the SOPs?			X	Unable to determine because the site operator stated they did not have a copy of the current SOPs. Site operator follows the Site Operator's Checklist with some slight variability.
36. If yes, have these deviations been documented and approved?			X	
37. Are documented deviations available for review?			X	
38. Has training been conducted for these SOPs?		X		Site operators are operating the site based on past experience (both have been in the NADP and now CASTNET program). Site operators stated that they have not been to any training program in the past or recently. Both site operators were originally trained by Mr. David Kirk of AMEC fka ESE several years ago. Most training occurs by telephone conversations with AMEC Field Operations Manager (Mr. Kevin Mishoe) or Mr. Michael Smith.
39. Is this training documented?		X		
40. Are the SOPs current and up-to-date and met the specifications presented in the CASTNET program?	X			Candor site needs a copy of the most recent (10/1/2011) field SOPs.
41. Have the SOPs been reviewed on a periodic basis?	X			
42. What are the frequency and the approach?				Annually by the QA Manager and project management team.
43. Is this review documented? (Review).	X			
44. Is there a CASTNET project work organizational chart available?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	

Additional Comments:

14. The site does not have a signed approved hard copy or access to an electronic version of the current CASTNET QAPP. Having a copy of the CASTNET QAPP on site could be beneficial to the site operators to provide them contact information, roles and responsibilities performed in the program, and the reasons for the QA/QC activities required at the site.
27. References in the reference section need to be reviewed and updated to the current EPA document. RTI recommends reviewing the references for each SOP and updating them to the current EPA document.
34. The site operator showed the auditor several versions of short-cut guides (Site Operator's Checklist dated 11/9/2007 and Quick Start Instructions for the Site PC not dated) and a 1990 version of the National Atmospheric Deposition Program (NADP) SOPs. They do not have a hard copy version of the current field SOPs or access to an electronic copy. The filter pack setup/removal and documentation process operated very smoothly, but there were some questions regarding the ozone analyzer operation, data readout and downloading, maintenance, and calibration processes that possibly a copy of the SOP could have assisted the site operator. Obsolete SOPs need to be removed from the site and replaced with current versions of the field SOPs. *(During the laboratory visit, Mr. Stewart gave the auditor a copy of a memorandum dated April 8, 2011 that was sent to site operators with and enclosed package that included:*
1. A CD of the Health and Safety Plan, Site Operator Handbook, and SOP for ozone air monitoring
 2. Signature pages of acknowledgement for site operator to sign for safety plan and destruction for obsolete SOPs.
- He also provided a table showing both site operator and backup operator signed and returned the signature pages and a copy of the signed pages.)*
38. Site operators are operating the site based on past experience (both have been in the NADP and now CASTNET program). Site operators stated that they have not been to any training program in the past or recently. Both site operators were originally trained by Mr. David Kirk of AMEC fka ESE several years ago. Most training occurs by telephone conversations with AMEC Field Operations Manager (Mr. Kevin Mishoe) or Mr. Michael Smith. Having Mr. Mishoe and Mr. Smith available for technical assistance by telephone is a great asset, but if the phone system is down the site operators that are not properly trained are left stranded. RTI recommends that during the ozone calibration process that occurs twice each year, have the field technician explain the basic operations of the sampler; reasons for the ZSP checks; basic troubleshooting steps; explain the data readout; and other key procedures that will help the site operators. Also have the field technician locate the documentation for the ozone analyzers (SOPs, operation manual, etc.) and follow up with Mr. Mishoe or Mr. Smith if any of these documentations is needed or the site operator needs a basic refresher course for the ozone collection process.

B. Organization and Responsibilities

1. Key staff that oversee CASTNET operations:		
a. CASTNET Project Manager		Name: Mr. Kemp Howell
b. CASTNET Quality Assurance Manager		Name: Mr. Marcus Stewart
c. CASTNET QC Coordinator		Name: None
d. CASTNET QA Auditor(s) 6-month calibration		Name: Phil Grenville (subcontractor for S & P Air Quality Services, Inc.)
e. CASTNET Field Operations Manager		Name: Mr. Kevin Mishoe

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
f. CASTNET Data Management, Analysis, Interpretation, and Reporting Manager				Name: Mr. Chris Rogers
g. CASTNET Lead for AQS entries				Name: Mr. Chris Rogers
2. Name of management responsible for (indicate which apply):				
a. Development of monitoring site,				Name: Mr. Kevin Mishoe
b. Coordinates field operations,				Name: Mr. Michael Smith
c. Logistical support of field operations,				Name: Mr. Michael Smith
d. Training monitoring site operators, and				Name: Mr. Kevin Mishoe/Mr. Michael Smith
e. Review of routine sampler data and quality control data.				Name: Mr. Chris Rogers
3. Name of AMEC staff responsible for (indicate which apply):				Subcontractors used but AMEC management oversees operations
a. Operation of samplers/monitors/equipment,				Name: Mr. Kevin Mishoe/Mr. Michael Smith
b. Calibration of samplers/monitors/equipment,				Name: Mr. Kevin Mishoe/Mr. Michael Smith
c. Maintenance of samplers/monitors/equipment,				Name: Mr. Kevin Mishoe/Mr. Michael Smith
d. Maintenance of monitoring site,				Name: Mr. Kevin Mishoe/Mr. Michael Smith
e. Operation of ozone monitor,				Name: Mr. Kevin Mishoe/Mr. Michael Smith
f. Calibration of ozone monitors, and				Name: Mr. Kevin Mishoe/Mr. Michael Smith
g. Maintenance of ozone monitor.				Name: Mr. Kevin Mishoe/Mr. Michael Smith
5. Is there someone who reviews the following completed forms:				
a. Field forms? Who?	X			Name: Ms. Helen Reed
b. Chain of Custody (COC) forms? Who?	X			Name: Ms. Ruby Wyrosdick
c. Review of electronic data from monitors? Who?	X			Name: Ms. Anna Karmazyn
d. Review of field logbooks (site, monitor). Who?	X			Name: Ms. Hazel and Patricia Perry, field technicians during calibration check. The logbooks have carbonless copies that are sent with the Site Status Report Form (SSRF).

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
6. Has the review of completed field and COC forms been done?	X			
7. 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.
8. Are there two levels of management separation between QA and QC operations? The QC operations can be performed by the site operator.	X			
9. 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			
10. Has an audit(s) been performed? If so, when?	X			Date: Performed twice a year and are documented on the site's laptop. The site did not have a copy of the most recent QA audit done in July 24, 2012. During the laboratory audit, the auditor was able to see the results of the audit on iForms.
11. Were there any findings during the audits in Question 10?	X			Cell frequency on the site, site transfer, and travel transfer was reading low; the lamp drive increased to solve the problem.
12. Are audits documented? How?	X			iForms on AMEC server.
13. Are the audit results available for review by staff and auditors? Ask to view audits from this program.	X			On server
14. Does the site operator conduct performance checks of the ozone monitor? Frequency?	X			The ZSP check is performed daily at 1:46 am initiated by the data logger. 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.)
15. What types of QC checks are conducted?				ZSP check daily at 1:46 am.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
16. Are the results of these checks available for review by staff and auditors? Ask to view check results from this program.	X			The RTI auditor was unable to get a direct data download. Arrangements were made with Mr. Smith for RTI to contact him when during the audit to assist in providing directions. RTI called several times but the phone line was busy and the auditor's cell phone did not have reception. The RTI auditor did contact Mr. Smith later in the day and Mr. Smith sent the hourly data. Results are stored electronically in the data tables.
17. Is there any internal auditing program for the ozone monitor?	X			6-month visits include calibration challenge (internal PE) and site conditions check among other check. Verify an automated multipoint every Sunday. This is not a calibration, just a supplemental check. The site operator is not responsible for it.
18. If yes to Question 17, who conducts the internal audit?				Subcontractors
19. What is the frequency and where are the results posted?				6 months on AMEC server
20. Is there a designated schedule for calibrations of the ozone monitor? Frequency?	X			Every 6 months.
21. Are the calibration checks available for review by staff and auditors? Ask to view calibration checks from this program.	X			The 6-month calibration checks are stored in iForms on the AMEC server and were viewable during the laboratory audit.
22. Are the staff that work at the site agency employees? How many?		X		Site operators are contracted by AMEC to collect samples.
23. Do any contractors work at the site? How many? Name?	X			There are two site operators, Ms. Hazel Perry and Ms. Patricia Perry.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
24. What steps are taken to ensure contract staff meets training and experience criteria?				Based on conversations with Mr. Stewart, in the QAPP Appendix I, section III, subsection 6.14, the 6-month field technician is also supposed to assist with providing training information and explanations. This is not occurring since the site operators leave when the field technician arrives.
25. Is this documentation maintained? Where?		X		There was no documentation that tracked training by the site operators.
26. Is there a written procedure for the QA audit, QC checks, calibration, or internal audits for the CASTNET program?				The procedure for conducting the QA check (Sunday multi-point verification and ZSP checks) is documented in the QAPP Appendix 1 Field SOP Section 3A-5. The 6-month calibration is documented in QAPP Appendix 1 Field SOP Section 3A.
a. QA audit?	X			Performed once a year on a fixed schedule by an EPA subcontractor.
b. QC checks?	X			ZSP checks are performed daily at 1:46 am and every Sunday a multi-point verification check.
c. Calibrations?	X			Every 6 months by a subcontractor.
d. Internal audits?			X	Some checks performed during 6-month visits.
27. Who is responsible for reviewing results from audits and checks to determine if data should be invalidated?				Ms. Anna Karmazyn performs the data validation and the QA Manager reviews and authorizes her decisions. Mr. Mishoe and Mr. Smith also have knowledge of the ZSP checks.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
28. How is the audit data (6-month) reviewed and what are the decisions (criteria) based on?				<p>The data is reviewed to determine if the analyzer is performing within the acceptance criteria listed below.</p> <p>All points within $\pm 2\%$ of full scale of the best fit straight line</p> <p>$\pm 5\%$ of actual for any value, $r^2 > 0.9950$, $0.9500 < \text{slope} < 1.050$ $-3.0 \text{ ppb} < \text{intercept} < 3.0 \text{ ppb}$</p>
29. Is this process documented? Where?	X			Relevant observations are documented in the site's logbook. The calibrator (AMEC staff conducting the audit) completes all documentation on iForms.
30. Are there corrective action steps in place?	X			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 server.
31. Where are these steps documented? Review examples of corrective action, if possible.	X			iForms
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?	X			The site operator stated that they received their initial training from Mr. David Kirk (AMEC fka ESE) from several years ago. They have not been to any formal training. Given instructions over the phone from AMEC staff in Newberry when problems or issues occur at the site.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
2. Is it fully implemented?		X		There is a concern that the site operators do not fully understand the operations of the ozone analyzers (Thermo 49i). The day-to-day operations seem to be functioning as long as there are no issues or problems.
3. Is this training documented in a training record?		X		No training documentation records maintained at the site. After discussions with Mr. Stewart during the laboratory audit, it was determined that AMEC does not maintain any training records for the site operators. An onsite training program should be developed and documentation should be completed and maintained. The onsite training could occur during the 6-month audits performed by the AMEC calibrator (auditor).
4. Is the training record available for review?		X		No training records found at this site. No training records maintained at the AMEC Laboratory.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
5. Is there a process of training, testing, and qualification for job responsibilities?		X		<p>The SOP Site Selection Procedures, Site Installation, Initiation, and Operator Training states there is a training seminar onsite (neither of these site operators attended) and the Station Initiation Team performs follow up training with the site operator. Currently, there is no continual training when instrumentation changes or new site operators/backup operators begin conducting the field work.</p> <p>In Section 6.14 of SOP for Field Calibration Manual (dated October 10, 2011) discussed site operator training and also states in the QAPP (Sections 1.6 and 2.3).</p>
6. Has the operator been trained in the particular hazards of the instruments/materials that they are using?	X			
7. Are personnel outfitted with any required safety equipment?	X			Hard hats when lowering the tower for filter pack setup/removal. No safety equipment required for monitoring the ozone analyzers.
8. Are personnel adequately trained regarding appropriate safety procedures?	X			
9. Are personnel adequately trained regarding cylinder handling?			X	No cylinders maintained at the sites.
10. Does the site use field data sheet (FDS) and Chain-of-Custody (COC) forms?	X			These are all on the Site Status Report Form (SSRF).
11. Are these forms being completed properly?	X			
12. Does sample ID's match the COC?	X			
<p>Additional Questions or Comments:</p> <p>1, 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 and AMEC is 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.</p>				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
D. Monitoring Site Housekeeping				
1. How long has this site been used for the CASTNET program?				This site has been operational since September 1990.
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		All maintenance entries are in the site's logbook.
11. If yes to question 10, check the O+M or instrument logs against the SOPs. Are these acceptable?			X	
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. The site operator uses a logbook (2- or 3-carbonless paper) and submits pages of the logbook with the SSRF to the AMEC Laboratory.
2. Are the following necessary documents for this project in the controlled document program:				
a. EPA approved QAPP for the CASTNET Program work?	X			
b. SOPs?	X			
3. Have the following necessary quality documents for this project been reviewed, approved and signed:				
a. QAPP – by the CAMD Project Officer and QA Officer and AMEC Project Officer and QA Manager	X			
b. SOPs – by the local CASTNET Program QA Manager	X			
4. Is distribution of the project documents controlled to prevent unauthorized copies from being made/distributed? If so, how?	X			QA documents are maintained on the CASTNET website in PDF format.
5. Are outdated controlled documents collected and disposed of?		X		At this site, the RTI auditor was given several outdated copies of SOPs, checklist, and manuals.
6. Is this documented?			X	
7. Are procedures in place if out-of-date documents are found? If so, briefly describe.		X		There is a procedure for removing obsolete documents (SOPs, checklist, etc.) from the field sites but it is up to the site operator to follow through.

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			The site operator showed the RTI auditor some site logbooks dated back to 2004.
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			During this audit by the RTI audit. When the 6-month ozone calibration occurs, the calibrator (auditor) also documents and reviews entries.
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:

7. During the laboratory visit, Mr. Stewart gave the auditor a copy of a memorandum dated April 8, 2011 that was sent to site operators with and enclosed package that included:
1. A CD of the Health and Safety Plan, Site Operator Handbook, and SOP for ozone air monitoring
 2. Signature pages of acknowledgement for site operator to sign for safety plan and destruction for obsolete SOPs.
- He also provided a table showing both site operator and backup operator signed and returned the signature pages and copies of the signed pages.

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.				
Hazel Perry (Site operator)				136 Perry Drive Candor, NC 27229 910-572-1423
Patricia Perry (Backup operator)				136 Perry Drive Candor, NC 27229 910-572-1423
2. Other than CASTNET, with what other networks is the site associated?				AMoN is collecting passive ammonia samples and NC Department of Environment and Natural Resources are collecting PM2.5 samples using an Thermo 2025 sampler and volatile organic compounds (VOCs) using and Xontech sampler.
3. What type of samples is collected at this site?				Filter pack and ozone
Additional Questions or Comments:				
B. Network Planning				
1. What is the date of the most recent network assessment? (mostly likely performed by EPA CAMD)				CASTNET Plan for Part 58 Compliance (Version 1.013) dated (July 18, 2012)
2. Is the annual network plan up-to-date?				X
3. Do you collect collocated samples?		X		Frequency: There are two sites that collect collocated samples based on the website listed above, but the CND125 site is not one of them.
4. What is the date of the current network plan?				Previous CASTNET Plan for Part 58 Compliance (Version 1.012) was dated April 2012.
5. Review the network plan includes the information required for each site.				
a. AQS Site ID Number	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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			suitable
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	
10. Where are the waivers documented and who gave approval?			X	No waivers
Additional Questions or Comments:				
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. Thermo 49i ozone analyzer (Site)				S/N: 1105347306 EPA Decal: 000728
b. Thermo 49i ozone analyzer (Transfer)				S/N: 0929938240 EPA Decal: 000543
c. Zero air System pump				S/N: 00814284 EPA Decal: 06868
2. Check for certification, validation, and calibration labels for samplers, monitors, and equipment.				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
a. Campbell Scientific CR3000 P/N 9661 Temperature probe for shelter temperature measurement. Calibration date on the CR3000 unit was May 19, 2009 (S/N 3816) - certified on 6-month calibration July 24, 2012.				S/N: 3816 on CR3000 panel EPA Decal : 000499
b. (VWR) Control Company Model 61161-324 temperature sensor (calibration date December 14, 2007).				S/N: 72710120
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 July 10, 2012) Waiting on hard copy paperwork from NIST.				S/N: 1105347329 MAC0736
b. Thermo 49i ozone analyzer (last calibrated December 7, 2011).				S/N: 1030244811 MAC000691
c. Thermo 49i ozone analyzer (last calibrated July 10, 2012). Waiting on hard copy paperwork from NIST.				S/N: 1030244810 MAC000679
d. Thermo 49i ozone analyzer (last calibrated December 7, 2011).				S/N: 1030244813 MAC000677
e. Thermo 49i ozone analyzer (last calibrated June 27, 2011) Only travel transfer standard out of certification.				S/N: 1105347330 MAC0747 Only travel transfer standard out of certification. This was only used for the January calibrations, at which time it was in certification.
Additional Questions or Comments:				
3e. The Thermo 49i ozone analyzer was last calibrated on June 27, 2011 and needs to be sent for certification.				

Part 4: Specific Sampling Criteria (Ozone Sampling)

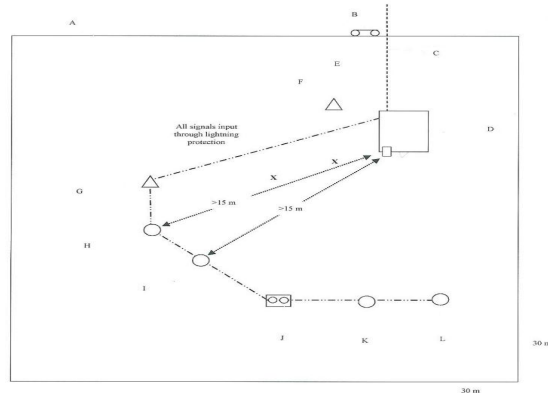
(There are four operations (site installation and initiation, site operations, field calibrations, and field operations) conducted at each site. The following sections will discuss each operation.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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		Team consists of the management of the field operations (Mr. Mishoe and Mr. Smith). Training records of their capabilities on the AMEC server.
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			Ozone Travel transfer standard (Thermo 49i) Temperature (Eutechnics last calibrated on April 5, 2012) Fluke (Fluke 8060A S/N 4140713 last calibrated on August 17, 2012) Flow (BIOS Definer 220 (S/N 119098) last calibrated on March 12, 2012)
3. The Site Installation, Initiation, and Operator Training SOP states that installation is subcontracted out. Does an AMEC staff member oversee all of the installation process?	X			
4. Is there a checklist the Field Installation Team updates during installation?	X			Reviewed blank checklist used.
5. If yes to Question 4, where is it maintained and can it be reviewed?				N/A
6. Does AMEC need to obtain EPA approval for CASTNET site location? Discuss steps in determining site.	X			
7. Does AMEC perform an acceptance test or burn-in of all instrumentation prior to install at the site?	X			At laboratory before taking to the field and at the site.
8. Are record maintained of this acceptance testing and where are these records maintained?	X			iForms spreadsheet
9. Are records maintained for the initial <u>onsite</u> equipment calibration?	X			iForms spreadsheet in Calibration Folder on the site's laptop.
10. If yes to Question 9, where is it maintained and can it be reviewed?				AMEC server
11. If calibration standards are used, can AMEC provide records of certification? Records maintained where.	X			Filing drawers near Field Calibration Laboratory.
12. 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.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
13. If yes to Question 12, where are these records maintained?				With licensed contractor
14. Who provides the training to the site operator?	X			Installation Team
15. Is there a checklist or confirmation documentation that the site operator has completed the training?		X		
16. If yes to Question 15, is this documentation maintained and where?		X		
17. Is the data acquisition system (DAS) validated during the initial installation? By whom? Records?	X			By Installation team
18. Are records maintained for the inventory of instrumentation installed at the site such as manufacturer, model number, AMEC Property Number, EPA decal, etc.?	X			
19. Who is responsible for maintaining the inventory records and where are they maintained?				The site was completely renovated in 2008 when the CR3000 data logger was installed (new instruments and cabling). These inventory records are available for inspection.
20. Does an AMEC management staff need to approve the site installation before sampling can begin?	X			
21. If yes to Question 20, is this documented and where?	X			iForms
<p>Additional Questions or Comments:</p> <p>15. There is an Installation/Implementation Checklist for EPA regulatory Ozone Monitoring that describes the steps for installing and implementing the ozone monitoring at the field site. But there are no place marks for the site operator's signature and date or are there any checklist statements showing training of the site operator. If training of the site operator occurs during the installation/implementation process, a statement should be added to this checklist describing the training and place marks for the site operator's signature and date. The signature of the trainer and date training performed should also be included.</p>				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	

Figure 1. Typical EPA Sponsored CASTNET Site Configuration



- A - Site Perimeter
- B - Shub Pole, Disconnect, Electric Meter
- C - 220 VAC/150 amp and Telephone Line (underground for at least the final 15 to 35 meters)
- D - 6' x 10' Aluminum Environmental Shelter (Temperature Controlled)
- E - Air Sampling Tower
- F - Approximate Position of Tower Tops when lowered
- G - Meteorological Tower
- H - 9-m Insect Rain Gauge (> 15m from shelter)
- I - Solar Radiation Sensor (> 15m from shelter)
- J - Wet/Dry Collection (optional)
- K - Hebert 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-approved SOP?	X			
2. On the average, how often do you visit the monitoring site per week?				Once on Tuesday.
3. Is ozone sampling conducted year round? If not, document the timeframe (NC should be from April to October).	X			
4. What is the frequency of sample collection during the peak season? (requirement = hourly)				hourly
5. Does the site measure ozone during the off season? If yes, what is the frequency of sample collection?	X			hourly
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?				Mr. Mishoe (All EPA-sponsored sites)
8. Who is the Field Operations Coordinator (FOC) for this site?				Mr. Smith (All EPA-sponsored sites)
9. Where does the site operator obtain local weather conditions? Alternate source?				From the temperature sensor on the 9-m tower.
10. What device does the site operator use to confirm shelter temperature? Are values recorded with 20 to 30 °C?	X			Temperature sensor connected to the Campbell CR3000 unit. Shelter temperature probe has traceable calibration. Hourly data are collected, polled, and stored.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
11. Is this device certified? Frequency?	X			Certified during the 6-month calibration of the ozone analyzer (July 24, 2012).
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 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 Laboratory.
14. Does the site operator perform a flow rate and leak check of the ozone monitor?		X		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 than during the 6-month calibration, but the site operator does perform a leak check.
15. What device (standard) does the site operator use to measure the flow rate?			X	
16. Is this standard certified? Review documentation.			X	
17. Where are these values (flow rate and leak checks) documented? Review previous entries if possible.				None. The site operator does not perform an independent flow rate check, but the site operator does perform a leak check and records the response of the SSRF and site logbook.
18. Is there any documentation on the FDS/COC forms for ozone sampling?	X			Data from the PC200 software is recorded 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.
19. How are telephone conversations documented between the site operator and AMEC Office?				Discussed and viewed the electronic records for the call-in communications.

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.	X			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		There is an uninterruptable power supply, but neither ozone analyzer was connected. Also, after checking the supply, no indicator lights were working and the supply did not seem to working properly even though it was plugged in.
22. What instruments or devices are protected (electrically)?				Neither ozone analyzer was connected to the supply, but the site is equipped with lightning protection.
23. How are the ambient ozone sampling and zero, span, and precision check (ZSP) controlled?				Electronically
24. What device is used for the ZSP checks?				Manufacturer: Thermo Model: 49i Serial Number: 0929938240
25. What is the frequency of the ZSP checks?				Daily at 1:46 am
26. Are the ZSP checks documented? Where and how.	X			Electronic records on the site's laptop.
27. Are steps in place if ZSP checks fail? Review.	X			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.
28. How long does it take to conduct a ZSP? Time of Day.				Approximately 20 min starting shortly before 0200.
29. Can the results of the ZSP be reviewed at the site? Review, if possible.	X			During the site visit, the RTI auditor was unable to make contact with Mr. Smith for him to explain the process to view the ZSP check data. Mr. Smith sent RTI 1-min readings during the past ZSP checks dating back from March 11, 2012 to present.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
30. What is the height of the inlet for the ambient ozone sampling?				10 m
31. What is the supply line made of?				Teflon tubing
32. Does it connect to a manifold or designated supply line to the monitor?				Designated supply line to the analyzer.
33. Does the air stream flow through any filters before entering the ozone monitor?	X			A Teflon filter (outside) at the top of the tower and one (inside) prior to the analyzer.
34. What is the reporting measurement unit for the ozone measurement?				PPB
35. What device delivers zero air during the ZSP checks? List the device: manufacturer, model, and serial number.				The zero air supply consists of a compressor with reserve tank (S/N: 00814284; EPA Decal: 06868).
36. Does the air flow go through desiccant and carbon canisters from the zero air system during the ZSP checks?	X			Both desiccant canisters need to be replaced with desiccant.
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? (Note: Figure 9 has some typo issues.)				Zero air, 400 PPB ozone (span), and 90 PPB (precision check).
39. Are MQOs being met at the site for ZSP checks? (See Table 1 in SOP for MQOs.)	X			Zero ($\leq \pm 10$ PPB) and precision and span ($\leq \pm 7\%$ between supplied and observed concentrations).
40. What is the frequency of calibrations of the ozone monitors?				Every 6 months.
41. Who repairs the monitors if outside acceptance during the calibration?				The AMEC subcontractor that performs the 6-month calibration. If the analyzer is unable to be repaired onsite, the analyzer is sent back to the AMEC Laboratory.
42. What is the frequency of the replacing the two Savillex 47 mm Teflon filters? (outside is every other week and the inside is the first Tuesday of the month)				The outside Teflon filter is replaced every other week and the inside Teflon filter is replaced the first Tuesday of the month.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
43. What is the frequency of replacing the desiccant?				The desiccant is replaced when the blue desiccant changes to reddish or purple. Both desiccant canisters need to be replaced with desiccant.
44. Who is responsible for providing maintenance to the DAS?				The calibrator (auditor) during the 6-month calibration of the ozone analyzer.
45. Who does the site operator contact if there is a problem with the DAS?				The FOM (Mr. Mishoe) or Assistant FOM (Mr. Smith).
46. Discuss PC200 software and document site operator's knowledge of the software and entries that he/she would make.				The site operators are not too well versed in the operations of the ozone analyzer other than the recording values on the SSRF. Ms. Patricia Perry has run a manual ZSP check in the past at the direction of Mr. Smith (on phone). The site operators were unable to assist the RTI auditor in viewing or downloading ozone data during the audit.
47. Does the site operator follow the SOP for data entries in to the DAS?	X			For the entries to the SSRF.
48. Who is responsible for performing preventive maintenance?				The site operator with assistance from the AMEC Laboratory.
49. Is special training provided for site operator for performing preventive maintenance on the monitors/samplers/equipment? Briefly comment on background or courses.	X			Supposedly, the calibrator (auditor) of the 6-month calibration is to provide training. In discussions with the site operators, they do not feel that is happening. RTI recommends developing a checklist of training objectives and having the site operator sign and date that they have fully understand the training provided.
50. Is this training routinely reinforced?	X			Unable to determine after talking to the site operators.
51. What is the site's preventive maintenance schedule for the ozone measuring system?				Every six months during the calibration audit.

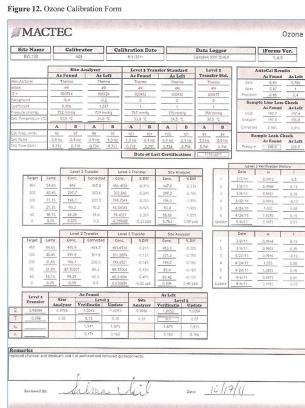
AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
52. If preventive maintenance is MINOR, it is performed at (check one or more): field station, headquarters facilities, or equipment is sent to manufacturer				Field station
53. If preventive maintenance is MAJOR, it is performed at (check one or more): field station, headquarters facilities, or equipment is sent to manufacturer				AMEC Laboratory or sent back to the manufacturer if laboratory is unable to perform the repair.
54. 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		
55. 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?		X		Lack of tools for any types of repair to the ozone analyzers.
56. 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		
57. 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		Normal loss of data is due to weather events, electricity failure or outage, and temperature control issues in the shelter.
58. Explain any situations where instrument down time was due to lack of preventive maintenance or unavailability of parts.				None.
<p>Additional Questions or Comments:</p> <p>21, 22. There is an uninterruptable power supply, but neither ozone analyzer was connected. Also, after checking the supply, no indicator lights were working and the supply did not seem to working properly even though it was plugged in.</p> <p>29. During the site visit, the RTI auditor was unable to make contact with Mr. Smith for him to explain the process to view the ZSP check data. Mr. Smith sent RTI 1-min readings during the past ZSP checks dating back from March 11, 2012 to present.</p> <p>36. Both desiccant canisters need to be replaced with desiccant.</p> <p>46. The site operators are not too well versed in the operations of the ozone analyzer other than the recording values on the SSRF. Ms. Patricia Perry has run a manual ZSP check in the past at the direction of Mr. Smith (on phone). The site operators were unable to assist the RTI auditor in viewing or downloading ozone data during the audit.</p>				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
4. Is "as found" data provided to the site operator after a PE is conducted? If so, review last few PEs.	X			
5. Has an AMEC site calibration been performed at this site? When and who performed the last calibration.	X			When: July 2012 Who: Phil Greenville (Subcontractor) S & P Air Quality Services, Inc.
6. Are the results of the calibration documented? If so, where and review if possible.	X			Where: iForms spreadsheet on AMEC server
7. What is the frequency of the AMEC site calibration?				6-months
8. Review iForm if possible to track entries made during calibration.				Reviewed
9. Is the transfer ozone monitor allowed time to stable? If yes, what amount of time is allowed?	X			20 minutes stabilization time and then a 5 minute reading
10. What device is used to provide air for the zero air check for the calibration?				Compressor
11. During the calibration are ozone calibration points taken over the range from 0 to 475 PPB?	X			
12. Is line loss test performed?	X			
13. What does a high line loss indicate (greater than 5%)?				Leak in system.
14. How is this issue resolved and documented?				Checked for leaks, replaced tubing, and re-test line loss test.
15. Is there criteria in place to determine if the ambient ozone or transfer ozone monitor used for ZSP checks need calibration?	X			
16. What is that criteria?				ZSP criteria: Zero value $\leq \pm 10$ ppb Precision/Span $\leq \pm 7\%$ between supplied and observed concentrations 6 month calibrations criteria: All points within $\pm 2\%$ of full scale of the best fit straight line $\pm 5\%$ of actual for any value, $r^2 > 0.9950$, $0.9500 < \text{slope} < 1.050$ $-3.0 \text{ ppb} < \text{intercept} < 3.0 \text{ ppb}$
17. Besides running different concentrations of ozone through the site's ozone analyzer, what other steps are performed for the ozone collection system?				Leak check and flow meter checks.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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).
20. Is there a checkout procedure for instrumentation taken from the Ozone Calibration Laboratory to the field sites during the 6-calibration?	X			
21. Are these checkout list maintained after the calibration? Where? (<i>Calibration Box Inventory and Spare Parts Inventory</i>)	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?				Calibrator with advice from Mr. Mishoe or Mr. Smith of the Field Calibration Laboratory.
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?				A replacement is requested immediately. The calibrator performs a calibration on the new analyzer. All records are maintained on the iForms.
25. If an analyzer fails the 6-calibration, is previous data collected from that site reviewed? By whom?	X			FOM and QA Officer review.
26. What steps are taken to confirm valid ozone data was collected? (<i>ZSP checks</i>)				ZSP checks are reviewed.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	

Additional Questions or Comments:



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

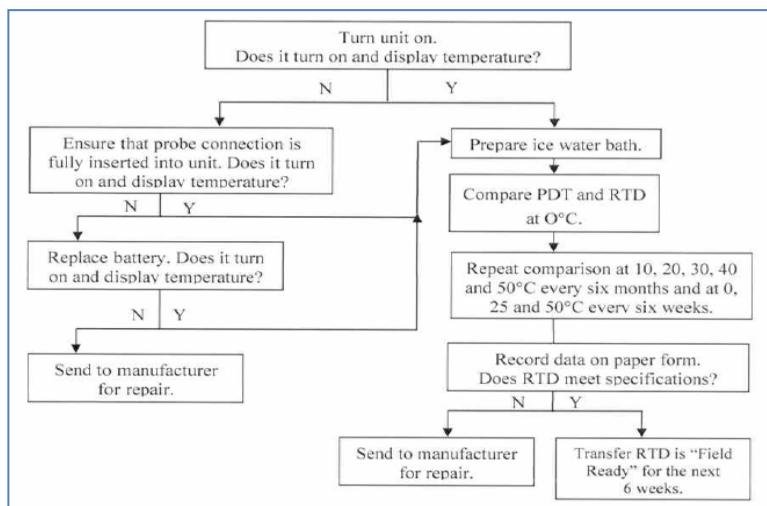
1. What is the minimum frequency of certifying the ozone transfer standards?				1 year.
2. Is this documented and are the documents available for reviewing?	X			
3. What is the frequency of calibration of the site's ozone transfer standards?				Every 6 months.
4. Is this documented and are the documents available for reviewing?	X			
5. Describe the traceability process of all ozone analyzers used in the CASTNET program? (Level I, II, and III)				Level II certified by NIST or EPA Regional Office, and Level III certified by AMEC with Level II analyzer.
6. How many sample concentrations are performed during the transfer standards certification? What values are normally run?				6 (0, 450 300, 200, 90, and 60)
7. How many sample runs are performed during the transfer standards certification?				Ten readings within a 5-min average reading for each point after a 20 minute stability time.
8. Where is this data maintained? Is it reviewable?	X			iForms
9. Describe the process of certifying the transfer standard?				Explained by Mr. Smith.
10. Is there a single-point accuracy criterion?	X			± 5%

AUDIT QUESTIONS	RESPONSE			COMMENTS				
	Y	N	NA					
11. Describe the calculations for the slope, intercept, and correlation coefficient? <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">RSD of six slopes \leq 3.7% Std. Dev. of 6 intercepts 1.5</td> <td style="width: 50%; text-align: center;">Transfer Standard Doc EPA 600/4-79-056 Section 6.6</td> </tr> <tr> <td style="text-align: center;">New slope = \pm 0.05 of previous and RSD of six slopes \leq 3.7% Std. Dev. of 6 intercepts 1.5</td> <td style="text-align: center;">1 recertification test that then gets added to most recent 5 tests. If does not meet acceptability certification fails</td> </tr> </table>	RSD of six slopes \leq 3.7% Std. Dev. of 6 intercepts 1.5	Transfer Standard Doc EPA 600/4-79-056 Section 6.6	New slope = \pm 0.05 of previous and RSD of six slopes \leq 3.7% Std. Dev. of 6 intercepts 1.5	1 recertification test that then gets added to most recent 5 tests. If does not meet acceptability certification fails	X			
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New slope = \pm 0.05 of previous and RSD of six slopes \leq 3.7% Std. Dev. of 6 intercepts 1.5	1 recertification test that then gets added to most recent 5 tests. If does not meet acceptability certification fails							
12. Who performs the certifications of the transfer ozone analyzers?				Level II certified by NIST or EPA Regional Office, and Level III certified by AMEC with Level II analyzer.				
13. Who gives final approval the transfer standard is acceptable?				AMEC (Mr. Mishoe)				
14. What are the acceptance limits? <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">RSD of six slopes \leq 3.7% Std. Dev. of 6 intercepts 1.5</td> <td style="width: 50%; text-align: center;">Transfer Standard Doc EPA 600/4-79-056 Section 6.6</td> </tr> <tr> <td style="text-align: center;">New slope = \pm 0.05 of previous and RSD of six slopes \leq 3.7% Std. Dev. of 6 intercepts 1.5</td> <td style="text-align: center;">1 recertification test that then gets added to most recent 5 tests. If does not meet acceptability certification fails</td> </tr> </table>	RSD of six slopes \leq 3.7% Std. Dev. of 6 intercepts 1.5	Transfer Standard Doc EPA 600/4-79-056 Section 6.6	New slope = \pm 0.05 of previous and RSD of six slopes \leq 3.7% Std. Dev. of 6 intercepts 1.5	1 recertification test that then gets added to most recent 5 tests. If does not meet acceptability certification fails				
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New slope = \pm 0.05 of previous and RSD of six slopes \leq 3.7% Std. Dev. of 6 intercepts 1.5	1 recertification test that then gets added to most recent 5 tests. If does not meet acceptability certification fails							

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
<p>15. What analyzer is used as the primary standard? Review documentation certificate.</p> <p>15 flow meters (10 within certification) 2 temperature sensors (2 within certification) 3 barometric pressure sensors (2 within certification) 9 voltage units (6 within certification)</p> <p>Maintained with Heidi Schwing in spreadsheet (Certification schedule) and AMEC database on server</p>				<p>Lab controls (4 ozone)</p> <p>Thermo 49i-PS (S/N 1022143674 EPA Decal: 000636) last certified on August 17, 2011 sent for recertification</p> <p>Thermo 49CPS (S/N 62939337 EPA Decal: 000122) last certified on August 22, 2012</p> <p>Thermo 49i-PS (S/N 801827200 EPA Decal: 000380) last certified on April 3, 2012</p> <p>AMEC Thermo 49CPS (S/N 63110338 EPA Decal: 000582) last certified on March 27, 2012</p> <p>Standards used in the Field Calibration Laboratory</p> <p>Temperature (Thermo Works P655P last calibration February 8, 2012)</p> <p>Barometric pressure (Omega DPG-4000-30C S/N 20171780 last calibrated on April 18, 2012)</p> <p>Flow (BIOS Definer 220 (S/N 119098) last calibrated on March 12, 2012.</p>
16. Is the certification of the transfer standards performed manually or automatic?				Automatic
17. Is there a maintenance and calibration schedule for the ozone analyzers? If yes, where is it maintained and review?	X			AMEC server
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?				<p>Limit: 2 °C</p> <p>Corrective Action: replace sensor</p> <p>Standard certificate information:</p>
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?				<p>Limit: 5 mm Hg</p> <p>Corrective Action: calibrate</p> <p>Standard certificate information:</p>

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?				Limit: 250 mm Hg 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?	X			Manufacturer: Level II Model: Thermo 49i Last certificate date: Records maintained:
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) Last certification: March 12, 2012.
23. How are transfer standards tracked when shipped to sites? Where is this documented?				Fed-Ex Heidi Schwing (temporary file in shipping room, general file in office).

Additional Questions or Comments:



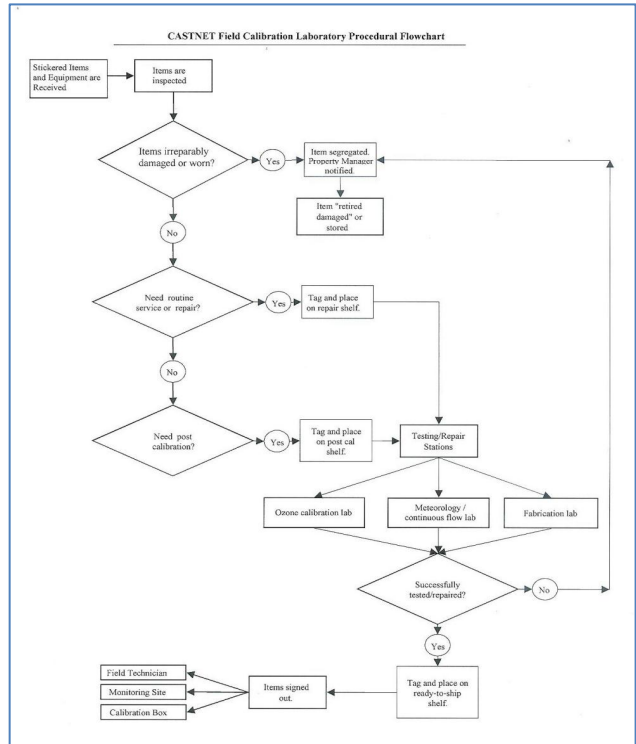
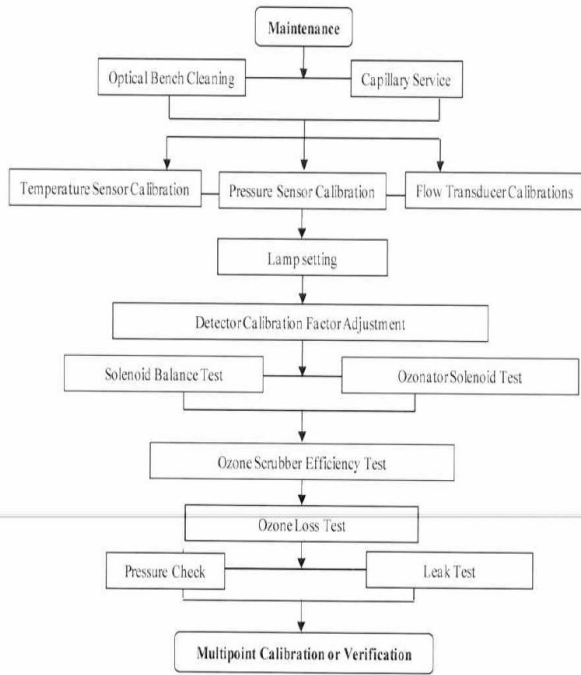
AUDIT QUESTIONS

RESPONSE

Y N NA

COMMENTS

Figure 2. Maintenance Overview

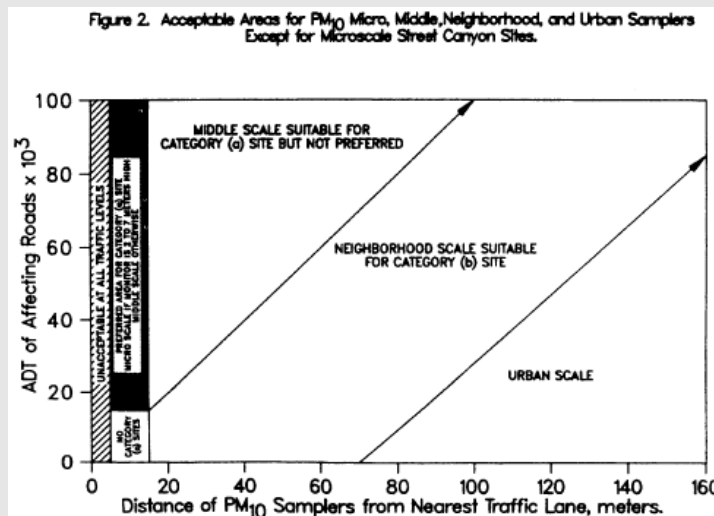


PART 5. Sampler Siting

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			Urban to regional
6. Sampler siting as stated in 40 CFR Part 58 Appendix E. Indicate Y/N to criteria for each sampler, and if no, specify why:				
a. The inlet probe must be between 2-15 m above ground level.	X			
b. The probe must be at least 1 m vertically or horizontally away from any supporting structure, wall, parapets, etc., and away from dusty or dirty areas. If the probe is located near the side of a building, it should be located on the windward side relative to the prevailing wind direction during the season of highest concentration potential for the pollutant being measured.	X			
c. Spaced properly from minor sources. (Away from direct flow of plumes, furnaces, etc.)	X			
d. The probe must have unrestricted airflow and located away from obstacles so that the distance from the monitoring path is at least twice the height the obstacle protrudes above the monitoring path.	X			
e. The monitoring path must be clear of all trees, brush, buildings, plumes, dust, or other optical obstructions, including potential obstructions that may move due to wind, human activity, growth of vegetation, etc.	X			
f. Airflow must be unrestricted in an arc of 270 degrees around the sampler except for street canyon sites.	X			
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			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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			
9. What are the GPS coordinates (latitude and longitude) for the field site:				N 35.2631° W 79.8365 °
10. What is the elevation of the site (feet)?				649 ft. (197.8 m)
11. Nearest meteorological site?				Site has a temperature sensor on the 10 meter tower.
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

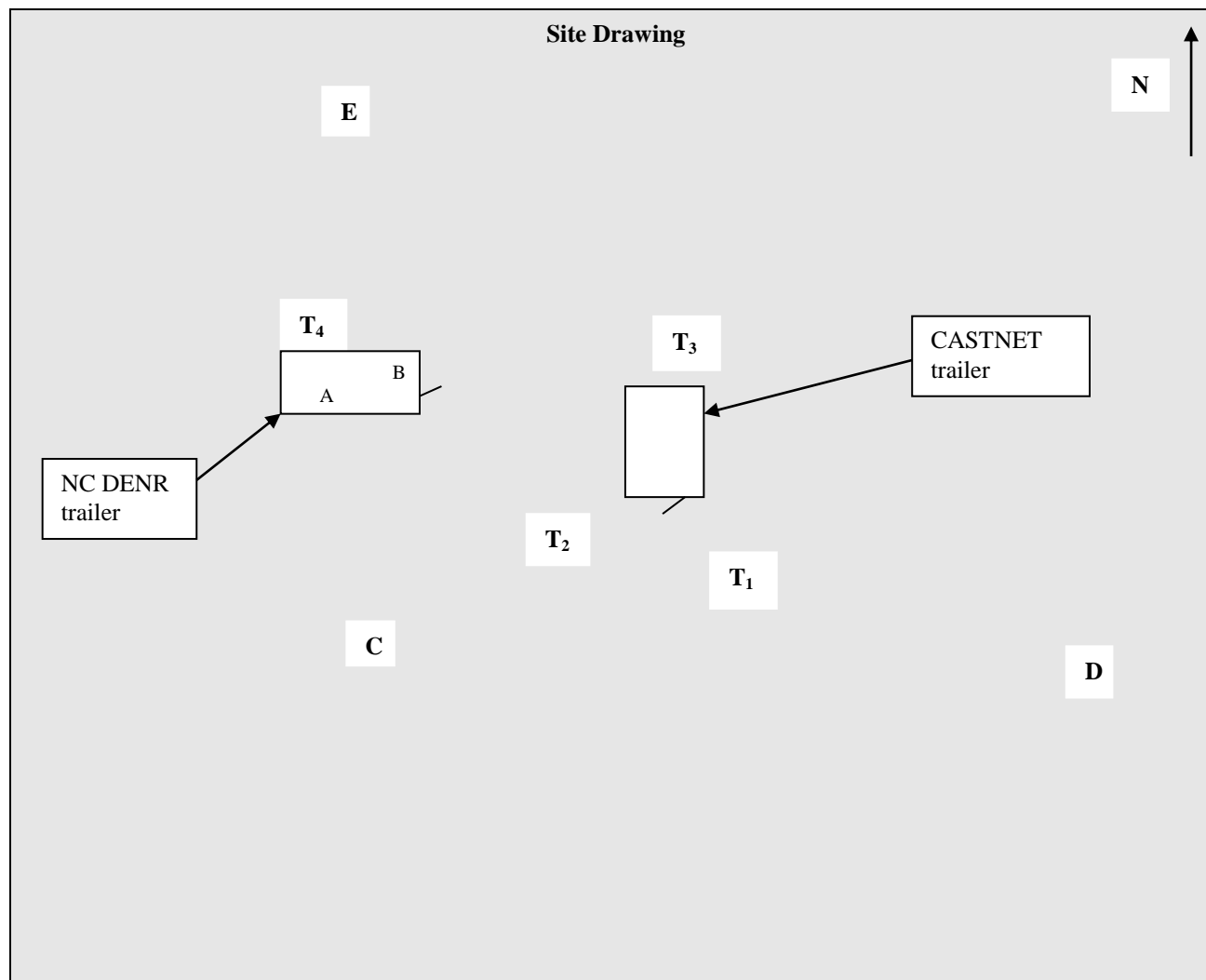


Candor Field Site (CND125) Measurements

(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 (AirMon ammonia sampler, wind direction and speed)	105	6.2	10
T2 Tower (ozone inlet, filter pack, temperature sensor)	XXX	XXX	10
T3 Tower (no samplers)	38	8.3	10
T4 Tower (wind direction and speed equipment)	315	16.3	10
A VOC inlet (primary and collocated) for NC DENR	305	12.7	4.0
B Temperature sensor for NC DENR	315	11.8	4.0
C Deactivated Andersen PAHs sampler for NC DENR	256	11.4	0.8
D Deactivated Tipping Bucket	105	23.2	0.3
E Thermo 2025 PM2.5 sampler for NC DENR	346	24.2	1.4

There are two shelters at the site. The first shelter houses the ozone analyzers, desk, data logger system, and site operator's files. The second shelter belongs to NC DENR and houses the Xontech VOCs sampler. Items A and B are connected to this shelter for NC DENR. Natural grass covers the ground within the 30 meter circle from the primary shelter that houses the ozone analyzers. Beyond the 30 meter circle is taller natural grass and the closest tree grove (pine trees) to south of the site.



Part 6. Data Management (Site)

Data to gather at the field monitoring sites:

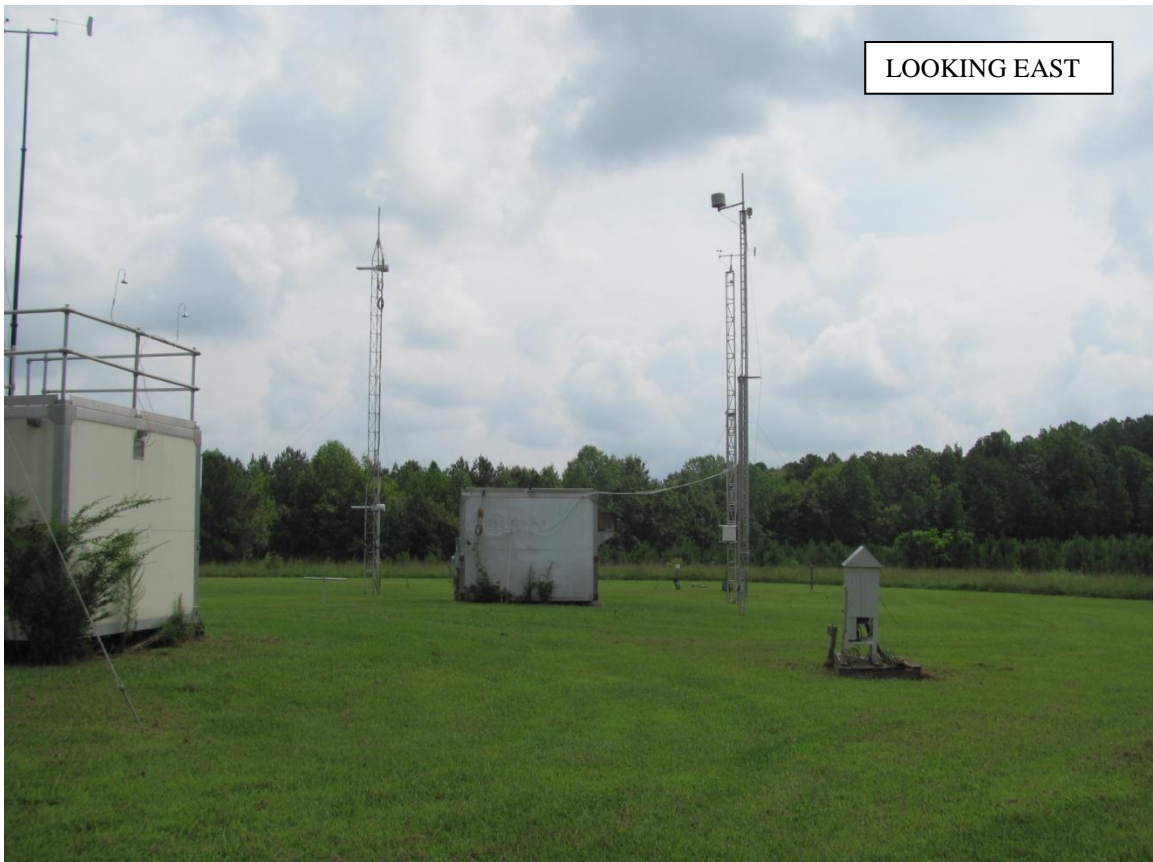
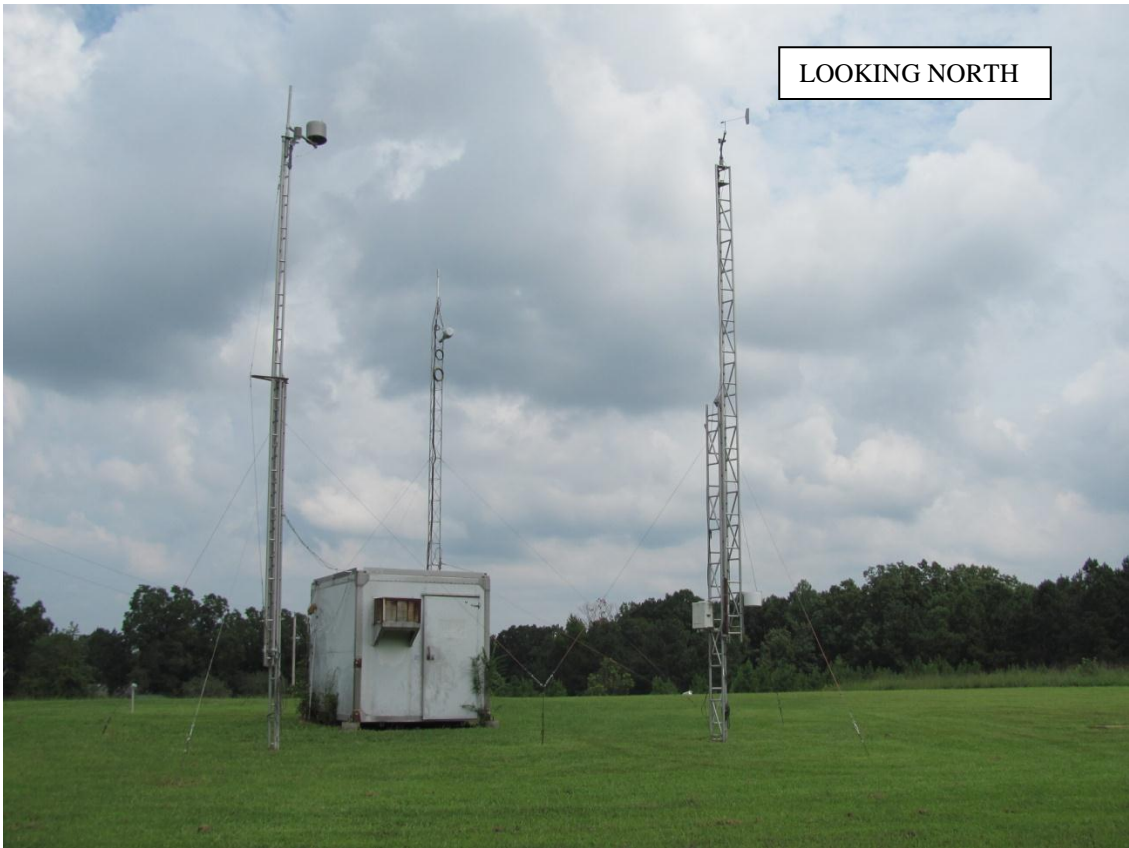
- Download or print data from Ozone instrument, if possible. Include time and O₃ ppb data at a minimum, but include other information such as ambient temperature, BP, RH, shelter temperature, flow rate, etc., if available. Include a zero-span check if available. Later, the times and O₃ results will be 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 O₃, 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.

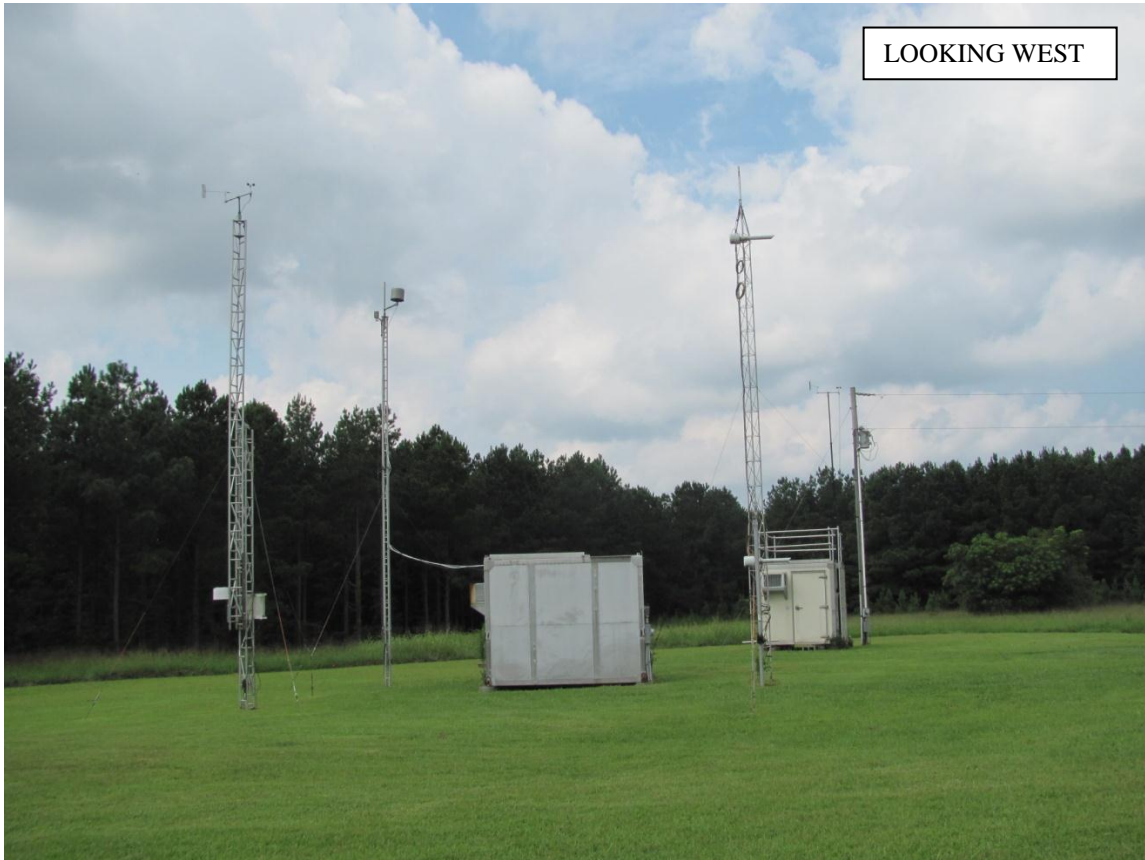
APPENDIX B

Candor (CND125) Site Photos

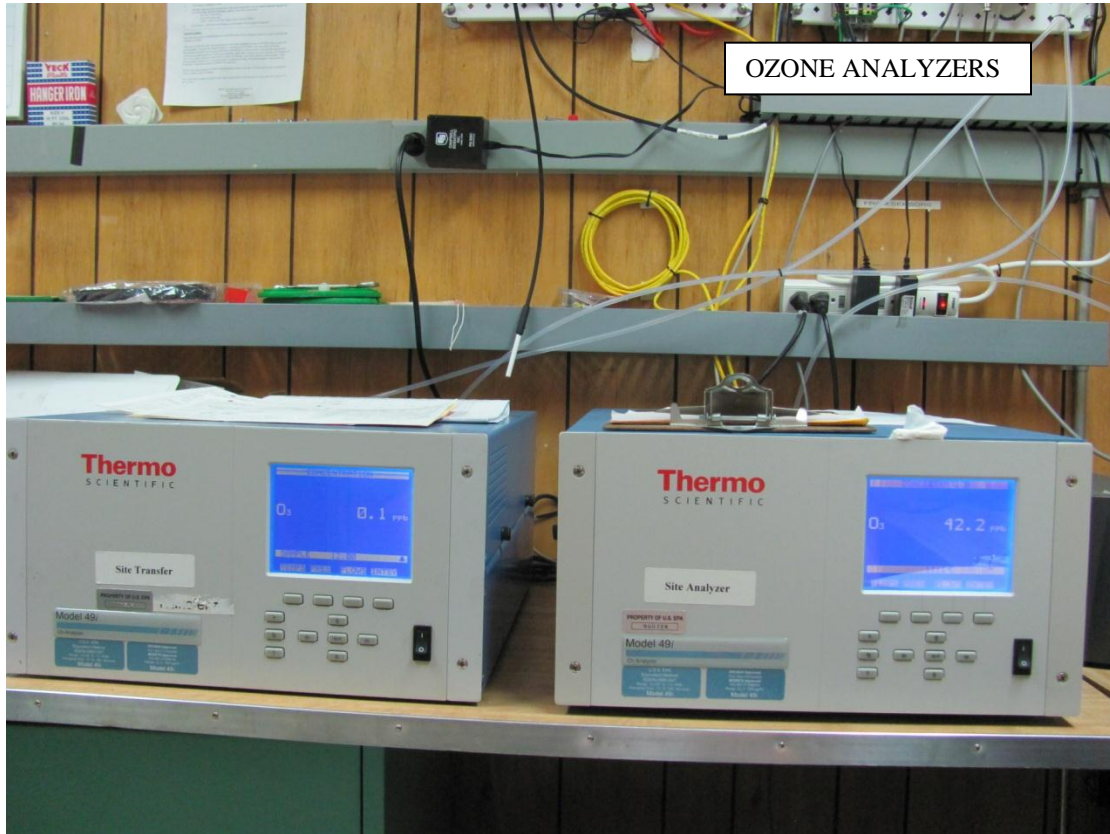




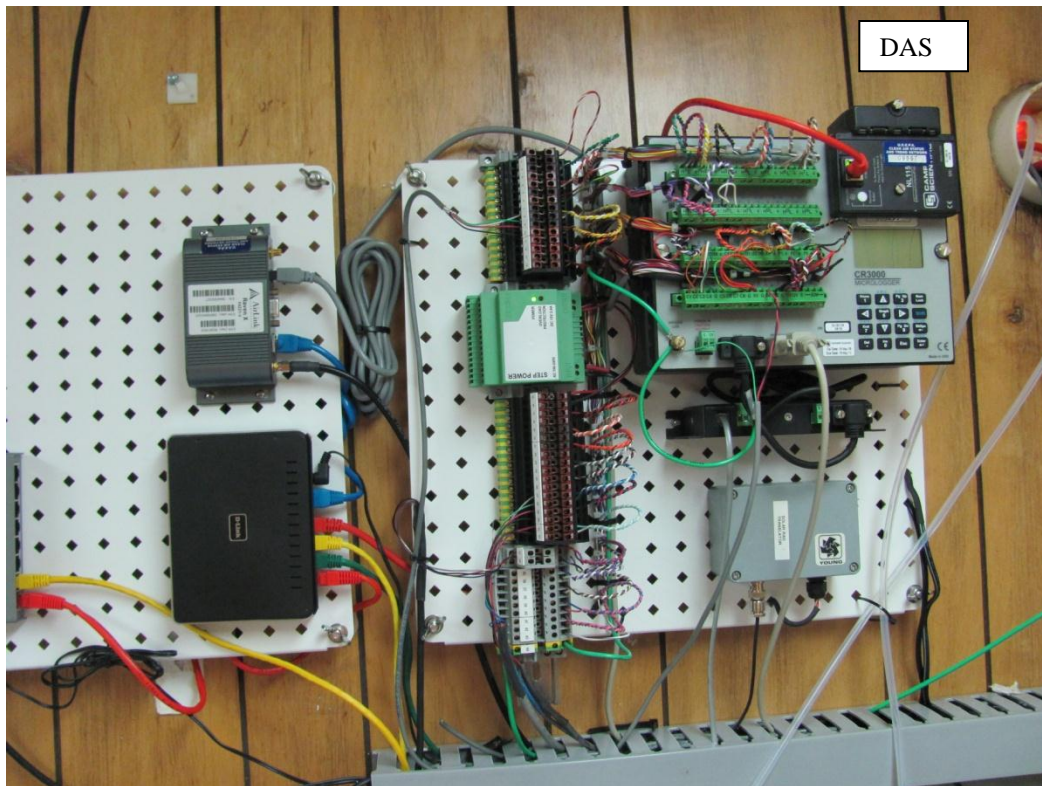
LOOKING SOUTH



LOOKING WEST



OZONE ANALYZERS



DAS

APPENDIX C

Beaufort (BFT142) Field Site Questionnaire

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

**Monitoring Site
Technical Systems Audit Form**



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

Table of Contents

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

Monitoring Site Technical Systems Audit Form

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3	Network Management.....	19
4	Specific Sampling Criteria (Ozone Sampling).....	22
5	Sampler Siting.....	39
6	Data Management.....	42

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 each of the two sites visited, Candor (CND125) and Beaufort (BFT142) in North Carolina. 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 8.0 dated October 1, 2011 with ten appendices. Several of these appendices or particular sections of the appendices will be used as a basis to prepare questionnaires for the TSA of the field sites (ozone activities), CASTNET Calibration Laboratory (ozone), and data management system for ozone reporting to EPA AQS and AIRNow. Those appendices are:

- Appendix 1 CASTNET Field SOPs
- Appendix 2 EPA Site Contact List
- Appendix 3 ARS SOPs
- Appendix 5 CASTNET Health and Safety Plan
- Appendix 6 CASTNET Data Operations SOPs, and
- Appendix 8 CASTNET Quality Management Plan.

Part 1. General Information

Monitoring Site Information

NAME/LOCATION OF MONITORING SITE: (Ozone): Beaufort

MONITORING SITE ADDRESS: 100 Nelson Bay Road, Beaufort, FL 28516

MONITORING SITE AQS NUMBER: 370319991 CASTNET SITE NUMBER: BFT142

MONITORING AGENCY AFFILIATION: CASTNET

NAME OF ANALYSIS/SUPPORT LABORATORY: AMEC Laboratory in Newberry, FL

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

AUDIT DATE: August 28, 2012

PERSONNEL INTERVIEWED:

NAME	POSITION	PHONE/E-MAIL
Site		
Nathan Hall	Site Operator	252-726-6841 (w); 252-726-7353 (h); 252-808-5366 (c) nshall@email.unc.edu
Jeremy Braddy	Backup Site Operator	252-726-6841 (w); 252-726-7353 (h); jbraddy@unc.edu
Field Calibration Laboratory		
Kevin Mishoe	Field Operations Manager	kevin.mishoe@amec.com 352-332-3318
Mike Smith	Assistant Field Operations Manager	michael.j.smith@amec.com 352-332-3318
Marcus Stewart	Quality Assurance Manager	marcus.stewart@amec.com 352-332-3318 (ext. 6099)
Chris Rogers	Data Management, Analysis, Interpretation and Reporting Manager	christopher.rogers@amec.com 904-391-3744
Kemp Howell	Project Manager	kemp.howell@amec.com 352-332-3318

OPERATIONAL AREAS THAT WERE OBSERVED: (At Site): Removal and placement of the filter pack and recording of the ozone data from the PC200 computer program on the Site Status Report Form (SSRF).

(At laboratory): Met with K. Mishoe, M. Smith, M. Stewart, K. Howell, and C. Rogers to discuss Field Laboratory operations and data management of the ozone collection, review, and reporting operations.

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 8.0 dated October 2011
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 Services)
8. Has the CAMD Project Officer and QA Officer approved and signed the QAPP?	X			Date: February 22, 2011 (Lance McCluney-EPA Project Officer and Larry Kertcher-EPA QA Officer) and February 28, 2011 (John Ray NPS-Contracting Officer's technical representative)
9. Has the AMEC Project Officer and QA Manager and other network leads approved and signed the QAPP?	X			
10. Is the purpose of the QAPP clearly stated?	X			
11. Is the project organization clearly identified with their roles and responsibilities?	X			
12. Is the organizational chart in the QAPP up-to-date?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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 <u>onsite</u> and available to the field operator(s)?		X		The site does not have a signed hard copy or access to an electronic version of the QAPP. See Question 33, regarding follow up to this question when the RTI auditor visited the Field Calibration Laboratory in Newberry, FL.
15. Has the approved QAPP been reviewed (or will be reviewed) on a periodic basis? Ask to see.	X			
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			
23. Is there an internal assessment program to determine conformity to quality assurance has been maintained? What assessments are performed?	X			The internal assessment program at the site for ozone collection includes: a daily ZSP check, a weekly multi-verification check on Sunday, a 6-month calibration, and an annual PE for the ozone analyzer. During the 6-month calibration and annual PE, a TSA is conducted that might involve the site operator. At Beaufort, the site operator is involved with the 6-month calibration and annual PE. At the Field Operations Laboratory, PE reviews, TSAs, and internal audits are performed by the QA Manager.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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. 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.
28. Does the format of the SOPs follow the guidelines outlined in the EPA Guidance Documents (EPA QA/G-6)? If not, describe what significant information is missing?	X			
29. Does the SOPs reflect, present and address specifications and operations that are in accordance with those applicable to the CASTNET program?	X			
30. Are the SOPs signed by management and QA staff?	X			
31. Are the SOPs available for review by auditor?	X			
32. Are the SOPs controlled documents?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
33. Are signed copies of the SOPs available to the field operator?	X			<p>Based on conversation (by phone) with Mr. Michael Smith, hard copies of the Field SOPs (CASTNET QAPP Appendix 1) and Health and Safety Plan (CASTNET QAPP Appendix 5) are sent to the site operators annually. Appendix 5 is sent with a signature approval form for the site operators to sign and date and send back to AMEC.</p> <p>During the laboratory visit, Mr. Stewart gave the auditor a copy of a memorandum dated April 8, 2011 that was sent to site operators with and enclosed package that included:</p> <ol style="list-style-type: none"> 1. A CD of the Health and Safety Plan, Site Operator Handbook, and SOP for ozone air monitoring 2. Signature pages of acknowledgement for site operator to sign for safety plan and destruction for obsolete SOPs <p>He also provided a table showing both site operator and backup operator signed and returned the signature pages and copies of the signed pages.</p>
34. Does site operator have current up-to-date SOPs onsite? Electronic or hard copies.		X		<p>The site operator showed the auditor two short-cut guides (Site Operator's Checklist that was not dated and a Quick Start Instructions for the Site PC not dated). He also had a 2001 version of CASTNET SOPs for the meteorological instrumentation that did not include an ozone SOP. He had a complete set of SOPs for the National Atmospheric Deposition Program (NADP) network). These obsolete documents need to be removed from the site and replaced with current SOPs.</p>

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
35. Are there deviations from the SOPs?		X		
36. If yes, have these deviations been documented and approved?			X	
37. Are documented deviations available for review?			X	
38. Has training been conducted for these SOPs?		X		Site operator is performing operations at the site based on past experience (since 1998). Mr. Hall stated that he has not been to any training program in the past or recently. He stated that he is present during the 6-month ozone calibrations and has observed operations. Has also been instructed to perform different operation at the site based on telephone conversations with AMEC Field Operations Manager (Mr. Kevin Mishoe) or Mr. Michael Smith.
39. Is this training documented?		X		
40. Are the SOPs current and up-to-date and met the specifications presented in the CASTNET program?	X			Beaufort site needs a copy of the most recent (10/1/2011) field SOPs.
41. Have the SOPs been reviewed on a periodic basis?	X			
42. What are the frequency and the approach?				Annually by the QA Manager and project management team.
43. Is this review documented? (Review).	X			
44. Is there a CASTNET project work organizational chart available?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	

Additional Comments:

14. The site does not have a signed approved hard copy or access to an electronic version of the current CASTNET QAPP. Having a copy of the CASTNET QAPP on site could be beneficial to the site operators to provide them contact information, roles and responsibilities performed in the program, and the reasons for the QA/QC activities required at the site.
27. References in the reference section need to be reviewed and updated to the current EPA document. RTI recommends reviewing the references for each SOP and updating them to the current EPA document.
34. The site operator showed the auditor two short-cut guides (Site Operator's Checklist that was not dated 11/9/2007 and a Quick Start Instructions for the Site PC not dated). He also had a 2001 version of CASTNET SOPs for the meteorological instrumentation that did not include an ozone SOP. He had a complete set of SOPs for the National Atmospheric Deposition Program (NADP) network). These obsolete documents need to be removed from the site and replaced with current SOPs. *(During the laboratory visit, Mr. Stewart gave the auditor a copy of a memorandum dated April 8, 2011 that was sent to site operators with and enclosed package that included:*
1. A CD of the Health and Safety Plan, Site Operator Handbook, and SOP for ozone air monitoring
 2. Signature pages of acknowledgement for site operator to sign for safety plan and destruction for obsolete SOPs.
- He also provided a table showing both site operator and backup operator signed and returned the signature pages and a copy of the signed pages.)*
38. Site operator is performing operations at the site based on past experience (since 1998). Mr. Hall stated that he has not been to any training program in the past or recently. He stated that he is present during the 6-month ozone calibrations and has observed operations. Has also been instructed to perform different operation at the site based on telephone conversations with AMEC Field Operations Manager (Mr. Kevin Mishoe) or Mr. Michael Smith. Having Mr. Mishoe and Mr. Smith available for technical assistance by telephone is a great asset, but if the phone system is down the site operators that are not properly trained are left stranded. RTI recommends that during the ozone calibration process that occurs twice each year, have the field technician explain the basic operations of the sampler; reasons for the ZSP checks; basic troubleshooting steps; explain the data readout; and other key procedures that will help the site operators. Also have the field technician locate the documentation for the ozone analyzers (SOPs, operation manual, etc.) and follow up with Mr. Mishoe or Mr. Smith if any of these documentations is needed or the site operator needs a basic refresher course for the ozone collection process.

B. Organization and Responsibilities

1. Key staff that oversee CASTNET operations:		
a. CASTNET Project Manager		Name: Mr. Kemp Howell
b. CASTNET Quality Assurance Manager		Name: Mr. Marcus Stewart
c. CASTNET QC Coordinator		Name: None
d. CASTNET QA Auditor(s) 6-month calibration		Name: Phil Grenville (subcontractor for S & P Air Quality Services, Inc.)
e. CASTNET Field Operations Manager		Name: Mr. Kevin Mishoe
f. CASTNET Data Management, Analysis, Interpretation, and Reporting Manager		Name: Mr. Chris Rogers

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
g. CASTNET Lead for AQS entries				Name: Mr. Chris Rogers
2. Name of management responsible for (indicate which apply):				
a. Development of monitoring site,				Name: Mr. Kevin Mishoe
b. Coordinates field operations,				Name: Mr. Michael Smith
c. Logistical support of field operations,				Name: Mr. Michael Smith
d. Training monitoring site operators, and				Name: Mr. Kevin Mishoe/Mr. Michael Smith
e. Review of routine sampler data and quality control data.				Name: Mr. Chris Rogers
3. Name of AMEC staff responsible for (indicate which apply):				Subcontractors used but AMEC management oversees operations
a. Operation of samplers/monitors/equipment,				Name: Mr. Kevin Mishoe/Mr. Michael Smith
b. Calibration of samplers/monitors/equipment,				Name: Mr. Kevin Mishoe/Mr. Michael Smith
c. Maintenance of samplers/monitors/equipment,				Name: Mr. Kevin Mishoe/Mr. Michael Smith
d. Maintenance of monitoring site,				Name: Mr. Kevin Mishoe/Mr. Michael Smith
e. Operation of ozone monitor,				Name: Mr. Kevin Mishoe/Mr. Michael Smith
f. Calibration of ozone monitors, and				Name: Mr. Kevin Mishoe/Mr. Michael Smith
g. Maintenance of ozone monitor.				Name: Mr. Kevin Mishoe/Mr. Michael Smith
5. Is there someone who reviews the following completed forms:				
a. Field forms? Who?	X			Name: Ms. Helen Reed
b. Chain of Custody (COC) forms? Who?	X			Name: Ms. Ruby Wyrosdick
c. Review of electronic data from monitors? Who?	X			Name: Ms. Anna Karmazyn

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
d. Review of field logbooks (site, monitor). Who?	X			Name: Mr. Hall and field technicians during calibration check. The logbooks have carbonless copies that are sent with the Site Status Report Form (SSRF). Mr. Jeremy Braddy (backup site operator) does operate the site but rarely. Mr. Hall said only during times where he is on vacation that Mr. Braddy operates the site.
6. Has the review of completed field and COC forms been done?	X			
7. 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.
8. Are there two levels of management separation between QA and QC operations? The QC operations can be performed by the site operator.	X			
9. 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			The QA auditor (calibrator) uses his own standards. Certificates of these standards are placed in a folder (Certs Folder) on the site's laptop. The auditor was able to review these certificates during the audit.
10. Has an audit(s) been performed? If so, when?	X			Date: The site had its last 6-month calibration on July 26, 2012. The results of the audit are in a folder on the desktop of the site's laptop.
11. Were there any findings during the audits in Question 10?		X		All samplers were with acceptance criteria. The standards and certification dates are listed on the audit spreadsheet (report).

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
12. Are audits documented? How?	X			Results are placed in a folder on the site's laptop. The site operator also said that he has hard copies that are filed in a filing cabinet. We could not find the July 26, 2012 audit report. Based on discussions with the QA Manager, Provision of hard copies ceased upon completion of Campbell CR3000 site upgrades. These upgrades included new sensors, Raven modems, cabling and site laptops equipped with PC200 software.
13. Are the audit results available for review by staff and auditors? Ask to view audits from this program.	X			Electronic version on the site's laptop.
14. Does the site operator conduct performance checks of the ozone monitor? Frequency?	X			The ZSP check is performed daily at 1:46 am initiated by the data logger. 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.)
15. What types of QC checks are conducted?				ZSP check daily at 1:46 am.
16. Are the results of these checks available for review by staff and auditors? Ask to view check results from this program.	X			The RTI auditor sent an e-mail to Mr. Smith on August 29 requesting the 5-min and 1-hr total ozone data results as well as the 1-min averages when the ZSP checks were conducted.
17. Is there any internal auditing program for the ozone monitor?	X			6-month visits include calibration challenge (internal PE) and site conditions check among other check. Verify an automated multipoint every Sunday. This is not a calibration, just a supplemental check. The site operator is not responsible for it.
18. If yes to Question 17, who conducts the internal audit?				Subcontractors
19. What is the frequency and where are the results posted?				6 months on AMEC server

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
20. Is there a designated schedule for calibrations of the ozone monitor? Frequency?	X			Every 6 months.
21. Are the calibration checks available for review by staff and auditors? Ask to view calibration checks from this program.	X			The 6-month calibration checks are stored in iForms on the AMEC server and were viewable during the laboratory audit.
22. Are the staff that work at the site agency employees? How many?		X		Site operators are contracted by AMEC to collect samples.
23. Do any contractors work at the site? How many? Name?	X			There are two site operators, Mr. Hall and seldom used backup Mr. Braddy.
24. What steps are taken to ensure contract staff meets training and experience criteria?				Based on conversations with Mr. Stewart, in the QAPP Appendix I, section III, subsection 6.14, the 6-month field technician is also supposed to assist with providing training information and explanations. This is not occurring since the site operators leave when the field technician arrives.
25. Is this documentation maintained? Where?		X		There was no documentation that tracked training by the site operators.
26. Is there a written procedure for the QA audit, QC checks, calibration, or internal audits for the CASTNET program?				The procedure for conducting the QA check (Sunday multi-point verification and ZSP checks) is documented in the QAPP Appendix 1 Field SOP Section 3A-5. The 6-month calibration is documented in QAPP Appendix 1 Field SOP Section 3A.
a. QA audit?	X			Performed once a year on a fixed schedule by an EPA subcontractor.
b. QC checks?	X			ZSP checks are performed daily at 1:46 am and every Sunday a multi-point verification check.
c. Calibrations?	X			Every 6 months by a subcontractor.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
d. Internal audits?			X	Some checks performed during 6-month visits.
27. Who is responsible for reviewing results from audits and checks to determine if data should be invalidated?				Ms. Anna Karmazyn performs the data validation and the QA Manager reviews and authorizes her decisions. Mr. Mishoe and Mr. Smith also have knowledge of the ZSP checks.
28. How is the audit data reviewed and what are the decisions (criteria) based on?				<p>The data is reviewed to determine if the analyzer is performing within the acceptance criteria listed below.</p> <p>All points within $\pm 2\%$ of full scale of the best fit straight line</p> <p>$\pm 5\%$ of actual for any value, $r^2 > 0.9950$, $0.9500 < \text{slope} < 1.050$ $-3.0 \text{ ppb} < \text{intercept} < 3.0 \text{ ppb}$</p>
29. Is this process documented? Where?	X			Relevant observations are documented in the site's logbook. The calibrator (AMEC staff conducting the audit) completes all documentation and iForms.
30. Are there corrective action steps in place?	X			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 server.
31. Where are these steps documented? Review examples of corrective action, if possible.				iForms
Additional Questions or Comments:				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
C. Training, Safety and Chain-of-Custody				
1. Have the monitoring site operators been trained in the sampling procedures? If so, when?	X			The site operator stated that he received initial training, but very minimal follow up training especially when new instrumentation is placed at the site. He does stay when the 6-month calibrations are performed and has been receiving some training (when he asks questions). Generally, training or issues are handled by telephone communication with AMEC staff in Newberry.
2. Is it fully implemented?	X			Mr. Hall understands the key strokes and values obtained on the screen from the data logger. He is in the air and water monitoring field and has experience with air/water. He could still warrant follow up training when the 6-month calibration are performed.
3. Is this training documented in a training record?		X		No training documentation records maintained at the site. After discussions with Mr. Stewart during the laboratory audit, it was determined that AMEC does not maintain any training records for the site operators. An onsite training program should be developed and documentation should be completed and maintained. The onsite training could occur during the 6-month audits performed by the AMEC calibrator (auditor).
4. Is the training record available for review?		X		No training records found at this site. No training records maintained at the AMEC Laboratory.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
5. Is there a process of training, testing, and qualification for job responsibilities?				<p>The SOP Site Selection Procedures, Site Installation, Initiation, and Operator Training states there is a training seminar onsite (neither of these site operators attended) and the Station Initiation Team performs follow up training with the site operator. Currently, there is no continual training when instrumentation changes or new site operators/backup operators begin conducting the field work.</p> <p>In Section 6.14 of SOP for Field Calibration Manual (dated October 10, 2011) discussed site operator training and also states in the QAPP (Sections 1.6 and 2.3).</p> <p>The site was set up prior to Mr. Hall becoming the site operator. He does recall going through the process described above.</p>
6. Has the operator been trained in the particular hazards of the instruments/materials that they are using?	X			
7. Are personnel outfitted with any required safety equipment?	X			No safety equipment required for monitoring the ozone analyzers.
8. Are personnel adequately trained regarding appropriate safety procedures?	X			
9. Are personnel adequately trained regarding cylinder handling?			X	No cylinders maintained at the sites.
10. Does the site use field data sheet (FDS) and Chain-of-Custody (COC) forms?	X			These are all on the Site Status Report Form (SSRF).
11. Are these forms being completed properly?	X			
12. Does sample ID's match the COC?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
Additional Questions or Comments:				
1, 2, 3. For the ozone collection system, Mr. Hall seem to understand the basic day-to-day operations, the results posted on the data logger screen, and understand most of the key strokes of the sampler. He has participated in the 6-month calibration process so he has been gaining more training through observation and asking questions. There are no posted training records for the site operators at the site. The site operators are hired contractors to AMEC and AMEC is 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.				
D. Monitoring Site Housekeeping				
1. How long has this site been used for the CASTNET program?				This site has been operational since December 1993.
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		All maintenance entries are in the site's logbook.
11. If yes to question 10, check the O+M or instrument logs against the SOPs. Are these acceptable?			X	
Additional Questions or Comments:				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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. The site operator uses a logbook (2- or 3-carbonless paper) and submits pages of the logbook with the SSRF to the AMEC Laboratory.
2. Are the following necessary documents for this project in the controlled document program:				
a. EPA approved QAPP for the CASTNET Program work?	X			
b. SOPs?	X			
3. Have the following necessary quality documents for this project been reviewed, approved and signed:				
a. QAPP – by the CAMD Project Officer and QA Officer and MACTEC Project Officer and QA Manager	X			
b. SOPs – by the local CASTNET Program QA Manager	X			
4. Is distribution of the project documents controlled to prevent unauthorized copies from being made/distributed? If so, how?	X			QA documents are maintained on the CASTNET website in PDF format.
5. Are outdated controlled documents collected and disposed of?		X		At this site, the RTI auditor was given several outdated copies of SOPs, checklist, and manuals.
6. Is this documented?			X	

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
7. Are procedures in place if out-of-date documents are found? If so, briefly describe.		X		There is a procedure for removing obsolete documents (SOPs, checklist, etc.) from the field sites but it is up to the site operator to follow through.
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		The site operator stated that old version of the site logbooks are taken back to AMEC when a field technician visits the site.
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			(Only the current logbook is on site.) During this audit by the RTI audit. When the 6-month ozone calibration occurs, the calibrator (auditor) also documents and reviews entries.
14. Are logbooks/forms stored? How?	X			Old site logbooks are taken back to AMEC and the SSRFs are maintained in a 3-ring binder.
Additional Questions or Comments:				
<p>7. During the laboratory visit, Mr. Stewart gave the auditor a copy of a memorandum dated April 8, 2011 that was sent to site operators with and enclosed package that included:</p> <ol style="list-style-type: none"> 1. A CD of the Health and Safety Plan, Site Operator Handbook, and SOP for ozone air monitoring 2. Signature pages of acknowledgement for site operator to sign for safety plan and destruction for obsolete SOPs. <p>He also provided a table showing both site operator and backup operator signed and returned the signature pages and copies of the signed pages.</p>				

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.				
Nathan Hall (Site operator)				100 Nelson Bay Road Beaufort, NC 28516 252-726-6841 (w); 252-726-7353 (h); 252-808-5366 (c)
Jeremy Braddy (Backup operator)				100 Nelson Bay Road Beaufort, NC 28516 252-726-6841 (w); 252-342-2402 (h)
2. Other than CASTNET, with other networks is the site associated?				NADP CASTNET annular denuders CASTNET oxides of nitrogen
3. What type of samples is collected at this site?				Filter pack and ozone
Additional Questions or Comments:				
B. Network Planning				
1. What is the date of the most recent network assessment? (mostly likely performed by EPA CAMD)				CASTNET Plan for Part 58 Compliance (Version 1.013) dated (July 18, 2012)
2. Is the annual network plan up-to-date?				See here - http://epa.gov/castnet/javaweb/ozone/Part58Summary.pdf
3. Do you collect collocated samples?				Frequency: There are two sites that collect collocated samples based on the website listed above, but the BFT142 site is not one of them.
4. What is the date of the current network plan?				Previous CASTNET Plan for Part 58 Compliance (Version 1.012) was dated April 2012.
5. Review the network plan includes the information required for each site.				
a. AQS Site ID Number	X			
b. Street Address and geographic coordinates	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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			suitable
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?				
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	
10. Where are the waivers documented and who gave approval?			X	No waivers.
Additional Questions or Comments:				
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. Thermo 49i ozone analyzer (Site)				S/N: 1009241784 EPA Decal: 000629
b. Thermo 49i ozone analyzer (Transfer)				S/N: 0622717857 EPA Decal: 000219
c. Thermo 42i Oxides of Nitrogen analyzer (Transfer)				S/N: 114046312 EPA Decal: 000748
d. Zero air System pump (Werther Instruments)				S/N: 00812893 EPA Decal: 06897
2. Check for certification, validation, and calibration labels for samplers, monitors, and equipment.				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
a. Campbell Scientific CR3000 Temperature probe for shelter temperature measurement. Calibration date on the CR3000 unit was May 19, 2009 (S/N 3815) – certified during the 6-month calibration July 26, 2012.				S/N: 3815 on CR3000 panel EPA Decal: 000498
b. Scott Marrin gas blend used for the oxides of nitrogen analyzer weekly verification check (Blend consist of CO - 61.4 PPMV; NO - 2.889 PPMV; SO ₂ - 2.982 PPMV; NO ₂ - <0.014 PPMV; NO _x - 2.889 PPMV) Expiration date: October 5, 2012				Cylinder #: CA01888
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 July 10, 2012) Waiting on hard copy paperwork from NIST.				S/N: 1105347329 MAC0736
b. Thermo 49i ozone analyzer (last calibrated December 7, 2011).				S/N: 1030244811 MAC0691
c. Thermo 49i ozone analyzer (last calibrated July 10, 2012). Waiting on hard copy paperwork from NIST.				S/N: 1030244810 MAC0679
d. Thermo 49i ozone analyzer (last calibrated December 7, 2011).				S/N: 1030244813 MAC0677
e. Thermo 49i ozone analyzer (last calibrated June 27, 2011) Only travel transfer standard out of certification.				S/N: 1105347330 MAC0747 Only travel transfer standard out of certification. This was only used for the January calibrations, at which time it was in certification.
Additional Questions or Comments: 3e. The Thermo 49i ozone analyzer was last calibrated on June 27, 2011 and needs to be sent for certification.				

Part 4: Specific Sampling Criteria (Ozone Sampling)

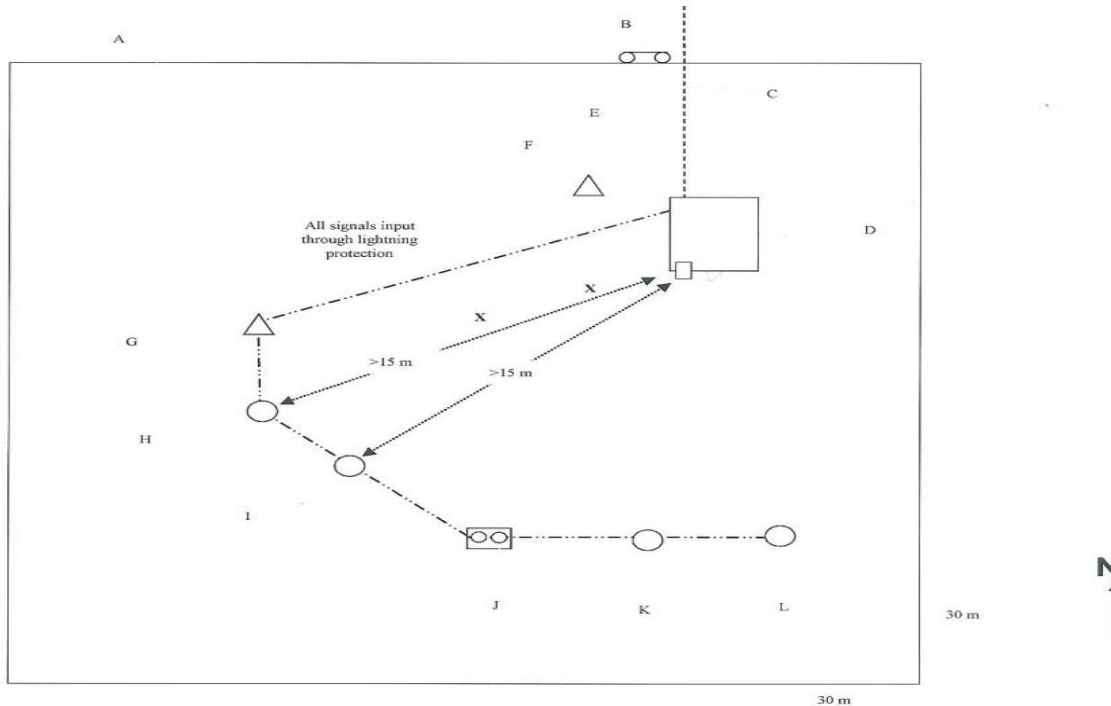
(There are four operations (site installation and initiation, site operations, field calibrations, and field operations) conducted at each site. The following sections will discuss each operation.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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		Team consists of the management of the field operations (Mr. Mishoe and Mr. Smith). Training records of their capabilities on the AMEC server.
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			Ozone Travel transfer standard (Thermo 49i Temperature (Eutechnics last calibrated on April 5, 2012) Fluke (Fluke 8060A S/N 4140713 last calibrated on August 17, 2012) Flow (BIOS Definer 220 (S/N 119098) last calibrated on March 12, 2012)
3. The Site Installation, Initiation, and Operator Training SOP states that installation is subcontracted out. Does an AMEC staff member oversee all of the installation process?	X			
4. Is there a checklist the Field Installation Team updates during installation?	X			Reviewed blank checklist used.
5. If yes to Question 4, where is it maintained and can it be reviewed?				N/A
6. Does AMEC need to obtain EPA approval for CASTNET site location? Discuss steps in determining site.	X			
7. Does AMEC perform an acceptance test or burn-in of all instrumentation prior to install at the site?	X			At laboratory before taking to the field and at the site.
8. Are record maintained of this acceptance testing and where are these records maintained?	X			iForms spreadsheet
9. Are records maintained for the initial <u>onsite</u> equipment calibration?	X			iForms spreadsheet in Calibration Folder on the site's laptop.
10. If yes to Question 9, where is it maintained and can it be reviewed?				AMEC server
11. If calibration standards are used, can AMEC provide records of certification? Records maintained where.	X			Filing drawers near Field Calibration Laboratory.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
12. 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.
13. If yes to Question 12, where are these records maintained?				With licensed contractor
14. Who provides the training to the site operator?	X			Installation Team
15. Is there a checklist or confirmation documentation that the site operator has completed the training?		X		
16. If yes to Question 15, is this documentation maintained and where?		X		
17. Is the data acquisition system (DAS) validated during the initial installation? By whom? Records?	X			By Installation team
18. Are records maintained for the inventory of instrumentation installed at the site such as manufacturer, model number, AMEC Property Number, EPA decal, etc.?	X			
19. Who is responsible for maintaining the inventory records and where are they maintained?				Records from site upgrade where all EQ was replaced are available. Additionally, current site records are maintained online.
20. Does an AMEC management staff need to approve the site installation before sampling can begin?	X			
21. If yes to Question 20, is this documented and where?	X			iForms
<p>Additional Questions or Comments:</p> <p>15. There is an Installation/Implementation Checklist for EPA regulatory Ozone Monitoring that describes the steps for installing and implementing the ozone monitoring at the field site. But there are no place marks for the site operator's signature and date or are there any checklist statements showing training of the site operator. If training of the site operator occurs during the installation/implementation process, a statement should be added to this checklist describing the training and place marks for the site operator's signature and date. The signature of the trainer and date training performed should also be included.</p>				

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-approved SOP?	X			
2. On the average, how often do you visit the monitoring site per week?				Twice a week.
3. Is ozone sampling conducted year round? If not, document the timeframe (NC should be from April to October).	X			
4. What is the frequency of sample collection during the peak season? (requirement = hourly)				hourly
5. Does the site measure ozone during the off season? If yes, what is the frequency of sample collection?	X			hourly
6. Does the site operator follow the SOP for the weekly site visit? Any deviations?	X			No current SOPs for ozone collection.
7. Who is the Field Operations Manager (FOM) for this site?				Mr. Mishoe (All EPA-sponsored sites)

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
8. Who is the Field Operations Coordinator (FOC) for this site?				Mr. Smith (All EPA-sponsored sites)
9. Where does the site operator obtain local weather conditions? Alternate source?				From the temperature sensor on the 9-m tower. This site also has meteorological instrumentation.
10. What device does the site operator use to confirm shelter temperature? Are values recorded with 20 to 30 °C?	X			Temperature sensor connected to the Campbell CR3000 unit. Shelter temperature probe has traceable calibration. Hourly data are collected, polled, and stored.
11. Is this device certified? Frequency?	X			Certified during the 6-month calibration of the ozone analyzer (July 26, 2012).
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 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 Laboratory.
14. Does the site operator perform a flow rate and leak check of the ozone monitor?		X		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 than during the 6-month calibration, but the site operator does perform a leak check.
15. What device (standard) does the site operator use to measure the flow rate?			X	
16. Is this standard certified? Review documentation.			X	
17. Where are these values (flow rate and leak checks) documented? Review previous entries if possible.				None. The site operator does not perform an independent flow rate check, but the site operator does perform a leak check and records the response of the SSRF and site logbook.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
18. Is there any documentation on the FDS/COC forms for ozone sampling?	X			Data from the PC200 software is recorded 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.
19. How are telephone conversations documented between the site operator and AMEC Office				Discussed and viewed the electronic records for the call-in communications.
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.	X			DAS setup is as described in the SOP (photo taken).
21. Do you use uninterruptable power supplies or backup power sources at the site?	X			There is an uninterruptable power supply and the site ozone analyzer is connected.
22. What instruments or devices are protected (electrically)?				Site ozone analyzer and also lightning protection.
23. How are the ambient ozone sampling and zero, span, and precision check (ZSP) controlled?				Electronically
24. What device is used for the ZSP checks?				Manufacturer: Thermo Model: 49i Serial Number: 0622717857
25. What is the frequency of the ZSP checks?				Daily at 1:46 am
26. Are the ZSP checks documented? Where and how.	X			Electronic records on the site's laptop.
27. Are steps in place if ZSP checks fail? Review.	X			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.
28. How long does it take to conduct a ZSP? Time of Day.				Approximately 20 min starting shortly before 0200.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
29. Can the results of the ZSP be reviewed at the site? Review, if possible.	X			During the site visit, the RTI auditor was unable to make contact with Mr. Smith for him to explain the process to view the ZSP check data. Mr. Smith sent RTI 1-min readings during the past ZSP checks dating back from January 19, 2012 to present.
30. What is the height of the inlet for the ambient ozone sampling?				10 m
31. What is the supply line made of?				Teflon tubing
32. Does it connect to a manifold or designated supply line to the monitor?				Designated supply line to the analyzer.
33. Does the air stream flow through any filters before entering the ozone monitor?	X			A Teflon filter (outside) at the top of the tower. There is no inside filter.
34. What is the reporting measurement unit for the ozone measurement?				PPB
35. What device delivers zero air during the ZSP checks? List the device: manufacturer, model, and serial number.				The zero air supply consists of a compressor with reserve tank (S/N: 00812893; EPA Decal: 06897).
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? (Note: Figure 9 has some typo issues.)				Zero air, 400 PPB ozone (span), and 90 PPB (precision check).
39. Are MQOs being met at the site for ZSP checks? (See Table 1 in SOP for MQOs.)	X			Zero ($\leq \pm 10$ PPB) and precision and span ($\leq \pm 7\%$ between supplied and observed concentrations).
40. What is the frequency of calibrations of the ozone monitors?				Every 6 months.
41. Who repairs the monitors if outside acceptance during the calibration?				The AMEC subcontractor that performs the 6-month calibration. If the analyzer is unable to be repaired onsite, the analyzer is sent back to the AMEC Laboratory.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
42. What is the frequency of the replacing the two Savillex 47 mm Teflon filters? (outside is every other week and the inside is the first Tuesday of the month)				The outside Teflon filter is replaced every other week. There is no inside Teflon filter.
43. What is the frequency of replacing the desiccant?				The desiccant is replaced when the blue desiccant changes to reddish or purple.
44. Who is responsible for providing maintenance to the DAS?				The calibrator (auditor) during the 6-month calibration of the ozone analyzer.
45. Who does the site operator contact if there is a problem with the DAS?				The FOM (Mr. Mishoe) or Assistant FOM (Mr. Smith).
46. Discuss PC200 software and document site operator's knowledge of the software and entries that he/she would make.				The site operator understands the basic operation of the ozone analyzers, the basic key strokes to review data, and the responses shown using the PC200 software. The values from the display screen are transcribed to the SSRF. Mr. Hall has performed manual ZSP checks in the past at the direction of Mr. Smith (on phone). Mr. Hall was able to show the RTI auditor different functions of the PC200 software (reviewing trace gas for oxides of nitrogen analyzer) and also was able to assist on downloading calibration and certification data from the desktop of the laptop.
47. Does the site operator follow the SOP for data entries in to the DAS?	X			For the entries to the SSRF.
48. Who is responsible for performing preventive maintenance?				The site operator with assistance from the AMEC Laboratory.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
49. Is special training provided for site operator for performing preventive maintenance on the monitors/samplers/equipment? Briefly comment on background or courses.	X			Supposedly, the calibrator (auditor) of the 6-month calibration is to provide training. In discussions with the site operators, they do not feel that is happening. RTI recommends developing a checklist of training objectives and having the site operator sign and date that they have fully understand the training provided.
50. Is this training routinely reinforced?	X			
51. What is the site's preventive maintenance schedule for the ozone measuring system?				Every six months during the calibration audit.
52. 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
53. If preventive maintenance is MAJOR, it is performed at (check one or more): field station, headquarters facilities, or equipment is sent to manufacturer				AMEC Laboratory or sent back to the manufacturer if laboratory is unable to perform the repair.
54. 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		
55. 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?	X			The RTI auditor could not find the Thermo 49i operator's manual at the site.
56. 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		
57. 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		
58. Explain any situations where instrument down time was due to lack of preventive maintenance or unavailability of parts.				The only possible downtime is due to weather events such as hurricanes or tropical storms.
Additional Questions or Comments:				
29. During the site visit, the RTI auditor was unable to make contact with Mr. Smith for him to explain the process to view the ZSP check data. Mr. Smith sent RTI 1-min readings during the past ZSP checks dating back from January 19, 2012 to present.				

AUDIT QUESTIONS

RESPONSE

Y N NA

COMMENTS

Table 1. Ozone Measurement Quality Objectives

Type of check	Measurement Criteria	Corrective Action*		Multi-Point Calibration Criteria
		Field	Data	
Zero	$\leq \pm 10$ 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	$\leq \pm 7$ 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 only if all analyzer responses are in a 2 percent of full scale range.				
Shelter temperature acceptable range: 20 – 30 degrees C (± 2 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

Figure 1. Ozone Calibration Sample Line Configuration (1 of 2)

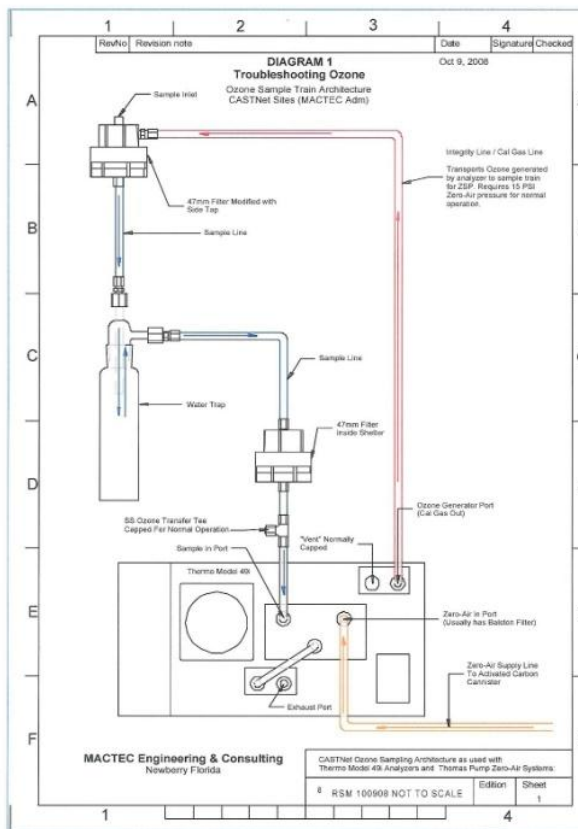
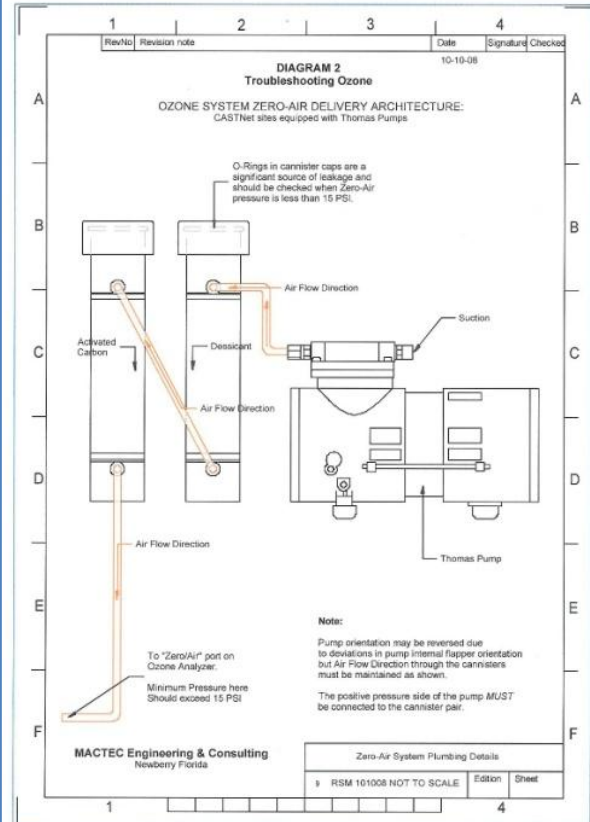


Figure 1. Ozone Calibration Sample Line Configuration (2 of 2)



AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
C. Field Calibrations Procedure				
1. Has a biannual TSA been conducted at the site? When and who performed the last TSA.	X			When: Every other year and the last TSA was October 7, 2011 and scheduled for October 2013. Who: EE & MS
2. Has a biannual performance evaluation (PE) been conducted at the site? When and who performed the last PE.	X			When: Every year and the last PE was October 7, 2011 scheduled for November 2012. Who: EE & MS
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			
5. Has an AMEC site calibration been performed at this site? When and who performed the last calibration.	X			When: July 2012 Who: Phil Greenville (Subcontractor) S & P Air Quality Services, Inc.
6. Are the results of the calibration documented? If so, where and review if possible.	X			Where: iForms spreadsheet on AMEC server
7. What is the frequency of the AMEC site calibration?				6-months
8. Review iForm if possible to track entries made during calibration.				Reviewed
9. Is the transfer ozone monitor allowed time to stable? If yes, what amount of time is allowed?	X			20 minutes stabilization time and then a 5 minute reading for each point
10. What device is used to provide air for the zero air check for the calibration?				Compressor
11. During the calibration are ozone calibration points taken over the range from 0 to 475 PPB?	X			
12. Is line loss test performed?	X			
13. What does a high line loss indicate (greater than 5%)?				Leak in system.
14. How is this issue resolved and documented?				Checked for leaks, replaced tubing, and re-test line loss test.
15. Is there criteria in place to determine if the ambient ozone or transfer ozone monitor used for ZSP checks need calibration?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
16. What is that criteria?				<p>ZSP criteria:</p> <p>Zero value $\leq \pm 10$ ppb</p> <p>Precision/Span $\leq \pm 7\%$ between supplied and observed concentrations</p> <p>6 month calibrations criteria:</p> <p>All points within $\pm 2\%$ of full scale of the best fit straight line</p> <p>$\pm 5\%$ of actual for any value, $r^2 > 0.9950$, $0.9500 < \text{slope} < 1.050$ $-3.0 \text{ ppb} < \text{intercept} < 3.0 \text{ ppb}$</p>
17. Besides running different concentrations of ozone through the site's ozone analyzer, what other steps are performed for the ozone collection system?				Leak check and flow meter checks.
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).
20. Is there a checkout procedure for instrumentation taken from the Ozone Calibration Laboratory to the field sites during the 6-calibration?	X			
21. Are these checkout list maintained after the calibration? Where? (<i>Calibration Box Inventory and Spare Parts Inventory</i>)	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.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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?				Calibrator with advice from Mr. Mishoe or Mr. Smith of the Field Calibration Laboratory.
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?				A replacement is requested immediately. The calibrator performs a calibration on the new analyzer. All records are maintained on the iForms.
25. If an analyzer fails the 6-calibration, is previous data collected from that site reviewed? By whom?	X			FOM and QA Officer review.
26. What steps are taken to confirm valid ozone data was collected? (<i>ZSP checks</i>)				ZSP checks are reviewed.
Additional Questions or Comments:				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	

Figure 12. Ozone Calibration Form

Ozone

Site Name	Calibrator	Calibration Date	Data Logger	iForms Ver.
BVL130	AQS	9/6/2011	Campbell 3000 (B-4)4	1.4.0

	Site Analyzer		Level 3 Transfer Standard		Level 2 Transfer Std.		AutoCal Results		
	As Found	As Left	As Found	As Left	As Found	As Left	As Found	As Left	
Manufacturer	Thermo	Thermo	Thermo	Thermo	Thermo		Zero	-0.94	0.766
Model	49i	49i	49i	49i	49i		Span	-0.87	1
ID #	000724	000724	000432	000432	000677		Precision	-0.68	0.9
Background	0.4	-0.2	0	0	0		Sample Line Loss Check		
Coefficient	0.996	1.037	1	1	1		As Found	As Left	
Pressure (mmHg)	722 mmHg	729 mmHg	767 mmHg	770 mmHg	759 mmHg		Inlet	197.7	197.4
Cell Temperature (°C)	33.5 °C	31.0 °C	33.8 °C	34.5 °C	30.5 °C		Analyzer	191.8	195.8
	A	B	A	B	A	B	Corrected	1.98%	0.81%
Cell Freq. (kHz)	95	97	95	97	101	101	Sample Leak Check		
Cell Noise	0.9 Hz	0.9 Hz	0.9 Hz	0.9 Hz	0.9 Hz	0.9 Hz	As Found	As Left	
Cell Flow (lpm)	0.712	0.718	0.734	0.723	0.739	0.741	Pressure	248.3	209.7
	A	B	A	B	A	B			

Date of Last Certification: 1/10/2011

Level 2 Transfer				Level 3 Transfer			Site Analyzer	
Target	Lamp	Conc.	Corrected	Conc.	% Diff	Conc.	% Diff	
450	54.6%	449	457.8	456.4035	-0.31%	447.6	-2.23%	
300	40.4%	297.7	303.6	302.846	-0.24%	297.2	-2.10%	
200	31.1%	196.1	200.0	199.7044	-0.18%	196.1	-1.95%	
90	21.3%	90.3	92.2	92.04345	-0.12%	90.4	-1.90%	
60	18.1%	58.35	59.6	59.4037	-0.30%	58.66	-1.95%	
0	0.0%	0.073	0.2	-0.055882	-0.23 ppb	0.763	0.59 ppb	

Level 2 Transfer				Level 3 Transfer			Site Analyzer	
Target	Lamp	Conc.	Corrected	Conc.	% Diff	Conc.	% Diff	
450	54.6%	445.9	454.7	453.6914	-0.21%	453.3	-0.30%	
300	40.4%	295.8	301.6	301.2879	-0.12%	301.2	-0.15%	
200	31.1%	196.1	200.0	199.6521	-0.18%	199.7	-0.16%	
90	21.0%	87.70001	89.5	89.37064	-0.15%	89.4	-0.12%	
60	18.1%	59.25	60.5	60.21594	-0.47%	60.42	-0.13%	
0	0.0%	-0.05	0.0	-0.030689	-0.02 ppb	0.506	0.46 ppb	

Level 3 Verification History			
Date	m	t	
1	3/7/11	0.9915	0.3
2	3/8/11	0.9944	0.13
3	3/9/11	0.9901	0.35
4	3/22/11	0.9916	-0.13
5	4/24/11	1.033	0.08
6	4/24/11	1.0253	0.15
Update	9/6/11	0.9973	0.01

Level 2 Transfer	Site Analyzer	As Found		As Left			
		Verification	Update	Verification	Update		
W	0.98094	0.9768	1.0043	1.0053	0.9966	1.0053	1.0059
T	-0.098	0.55	0.15	0.10	0.31	0.1	0.07
S ₁			1.94%	1.87%		1.87%	1.83%
S ₂			0.171	0.190		0.160	0.166

Remarks
replaced charcoal and desiccant; and 1 at pot head and removed quickconnects.

Reviewed By: *Delma Chil* Date: 10/17/11

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

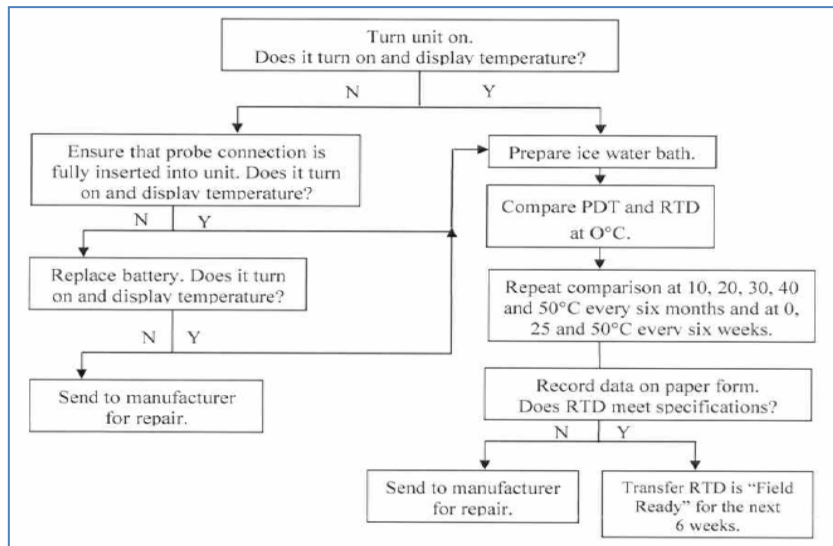
1. What is the minimum frequency of certifying the ozone transfer standards?		1 year.
2. Is this documented and are the documents available for reviewing?	X	
3. What is the frequency of calibration of the ozone transfer standards?		Every 6 months.
4. Is this documented and are the documents available for reviewing?	X	

AUDIT QUESTIONS	RESPONSE			COMMENTS			
	Y	N	NA				
5. Describe the traceability process of all ozone analyzers used in the CASTNET program? (Level I, II, and III)				Level II certified by NIST or EPA Regional Office, and Level III certified by AMEC with Level II analyzer.			
6. How many sample concentrations are performed during the transfer standards certification? What values are normally run?				6 (0, 450 300, 200, 90, and 60)			
7. How many sample runs are performed during the transfer standards certification?				Ten readings within a 5-min average reading for each point after a 20 minute stability time.			
8. Where is this data maintained? Is it reviewable?	X			iForms			
9. Describe the process of certifying the transfer standard?				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? <table border="1"> <tr> <td>RSD of six slopes ≤ 3.7% Std. Dev. of 6 intercepts 1.5</td> <td>Transfer Standard Doc EPA 600/4-79-056 Section 6.6</td> </tr> <tr> <td>New slope = ± 0.05 of previous and RSD of six slopes ≤ 3.7% Std. Dev. of 6 intercepts 1.5</td> <td>1 recertification test that then gets added to most recent 5 tests. If does not meet acceptability certification fails</td> </tr> </table>	RSD of six slopes ≤ 3.7% Std. Dev. of 6 intercepts 1.5	Transfer Standard Doc EPA 600/4-79-056 Section 6.6	New slope = ± 0.05 of previous and RSD of six slopes ≤ 3.7% Std. Dev. of 6 intercepts 1.5	1 recertification test that then gets added to most recent 5 tests. If does not meet acceptability certification fails			
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New slope = ± 0.05 of previous and RSD of six slopes ≤ 3.7% Std. Dev. of 6 intercepts 1.5	1 recertification test that then gets added to most recent 5 tests. If does not meet acceptability certification fails						
12. Who performs the certifications of the transfer ozone analyzers?				Level II certified by NIST or EPA Regional Office, and Level III certified by AMEC with Level II analyzer.			
13. Who gives final approval the transfer standard is acceptable?				AMEC (Mr. Mishoe)			
14. What are the acceptance limits? <table border="1"> <tr> <td>RSD of six slopes ≤ 3.7% Std. Dev. of 6 intercepts 1.5</td> <td>Transfer Standard Doc EPA 600/4-79-056 Section 6.6</td> </tr> <tr> <td>New slope = ± 0.05 of previous and RSD of six slopes ≤ 3.7% Std. Dev. of 6 intercepts 1.5</td> <td>1 recertification test that then gets added to most recent 5 tests. If does not meet acceptability certification fails</td> </tr> </table>	RSD of six slopes ≤ 3.7% Std. Dev. of 6 intercepts 1.5	Transfer Standard Doc EPA 600/4-79-056 Section 6.6	New slope = ± 0.05 of previous and RSD of six slopes ≤ 3.7% Std. Dev. of 6 intercepts 1.5	1 recertification test that then gets added to most recent 5 tests. If does not meet acceptability certification fails			
RSD of six slopes ≤ 3.7% Std. Dev. of 6 intercepts 1.5	Transfer Standard Doc EPA 600/4-79-056 Section 6.6						
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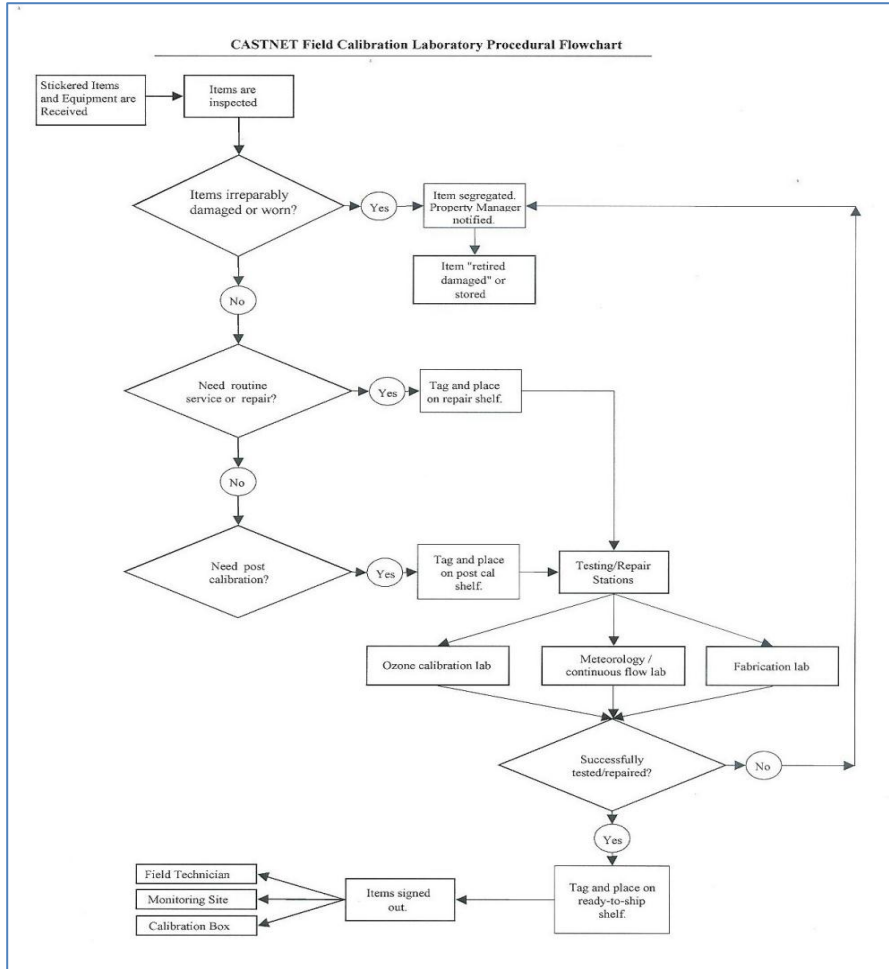
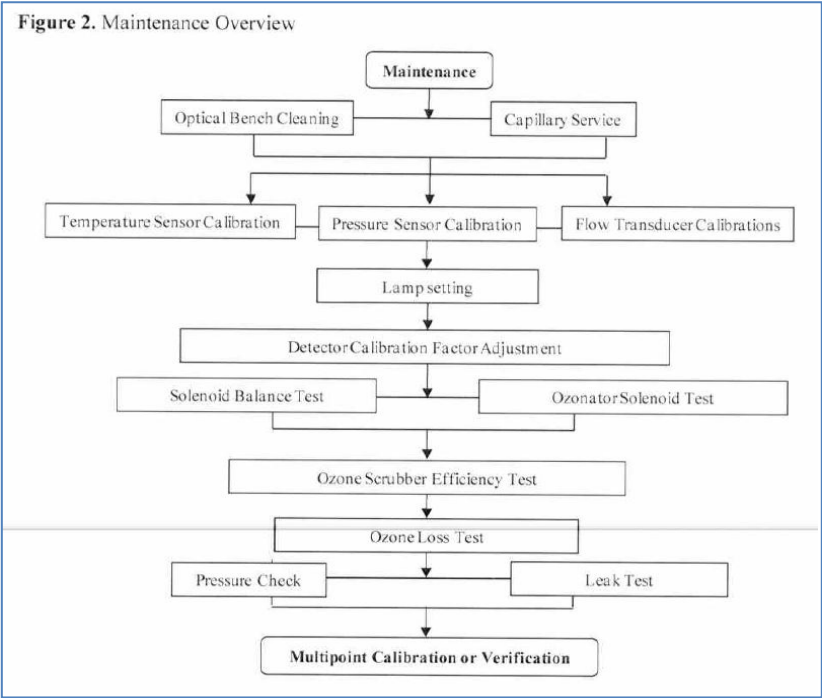
AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
<p>15. What analyzer is used as the primary standard? Review documentation certificate.</p> <p>15 flow meters (10 within certification) 2 temperature sensors (2 within certification) 3 barometric pressure sensors (2 within certification) 9 voltage units (6 within certification)</p> <p>Maintained with Heidi Schwing in spreadsheet (Certification schedule) and AMEC database on server</p>				<p>Lab controls (4 ozone)</p> <p>Thermo 49i-PS (S/N 1022143674 EPA Decal: 000636) last certified on August 17, 2011 sent for recertification</p> <p>Thermo 49CPS (S/N 62939337 EPA Decal: 000122) last certified on August 22, 2012</p> <p>Thermo 49i-PS (S/N 801827200 EPA Decal: 000380) last certified on April 3, 2012</p> <p>AMEC Thermo 49CPS (S/N 63110338 EPA Decal: 000582) last certified on March 27, 2012</p> <p>Standards used in the Field Calibration Laboratory</p> <p>Temperature (ThermoWorks P655P last calibration February 8, 2012)</p> <p>Barometric pressure (Omega DPG-4000-30C S/N 20171780 last calibrated on April 18, 2012)</p> <p>Flow (BIOS Definer 220 (S/N 119098) last calibrated on March 12, 2012.</p>
16. Is the certification of the transfer standards performed manually or automatic?				Automatic
17. Is there a maintenance and calibration schedule for the ozone analyzers? If yes, where is it maintained and review?	X			AMEC server
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?				<p>Limit: 2 °C</p> <p>Corrective Action: replace sensor</p> <p>Standard certificate information:</p>
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?				<p>Limit: 5 mm Hg</p> <p>Corrective Action: calibrate</p> <p>Standard certificate information:</p>

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?				Limit: 250 mm Hg 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?	X			Manufacturer: Level II Model: Thermo 49i Last certificate date: Records maintained:
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) Last certification: March 12, 2012.
23. How are transfer standards tracked when shipped to sites? Where is this documented?				Fed-Ex Heidi Schwing (temporary file in shipping room, general file in office).

Additional Questions or Comments:



AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	

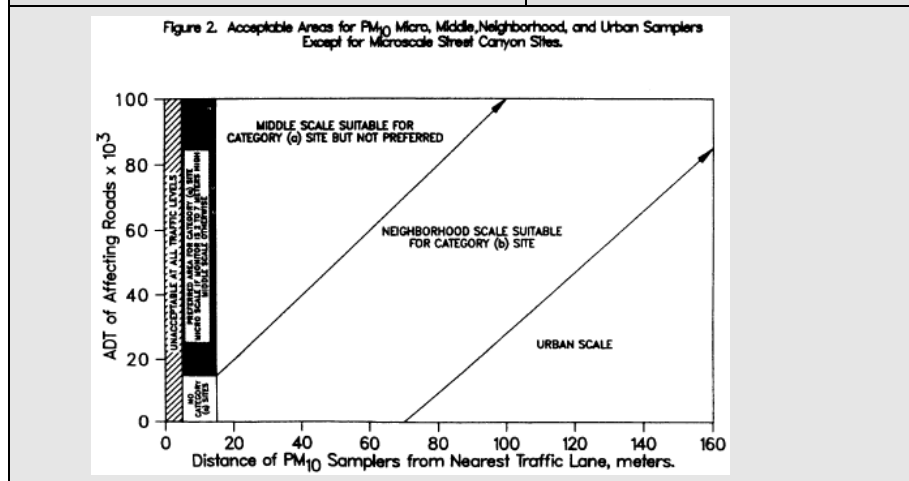


PART 5. Sampler Siting

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			Urban to regional
6. Sampler siting as stated in 40 CFR Part 58 Appendix E. Indicate Y/N to criteria for each sampler, and if no, specify why:				
a. The inlet probe must be between 2-15 m above ground level.	X			
b. The probe must be at least 1 m vertically or horizontally away from any supporting structure, wall, parapets, etc., and away from dusty or dirty areas. If the probe is located near the side of a building, it should be located on the windward side relative to the prevailing wind direction during the season of highest concentration potential for the pollutant being measured.	X			
c. Spaced properly from minor sources. (Away from direct flow of plumes, furnaces, etc.)	X			
d. The probe must have unrestricted airflow and located away from obstacles so that the distance from the monitoring path is at least twice the height the obstacle protrudes above the monitoring path.	X			
e. The monitoring path must be clear of all trees, brush, buildings, plumes, dust, or other optical obstructions, including potential obstructions that may move due to wind, human activity, growth of vegetation, etc.	X			
f. Airflow must be unrestricted in an arc of 270 degrees around the sampler except for street canyon sites.	X			
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			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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			
9. What are the GPS coordinates (latitude and longitude) for the field site:				N 34.8848° W 76.6209 °
10. What is the elevation of the site (feet)?				7 ft. (2.15 m)
11. Nearest meteorological site?				Site has a temperature sensor on the 10 meter tower. During the last 6-month calibration, all of the meteorological instrument were evaluated and working properly.
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

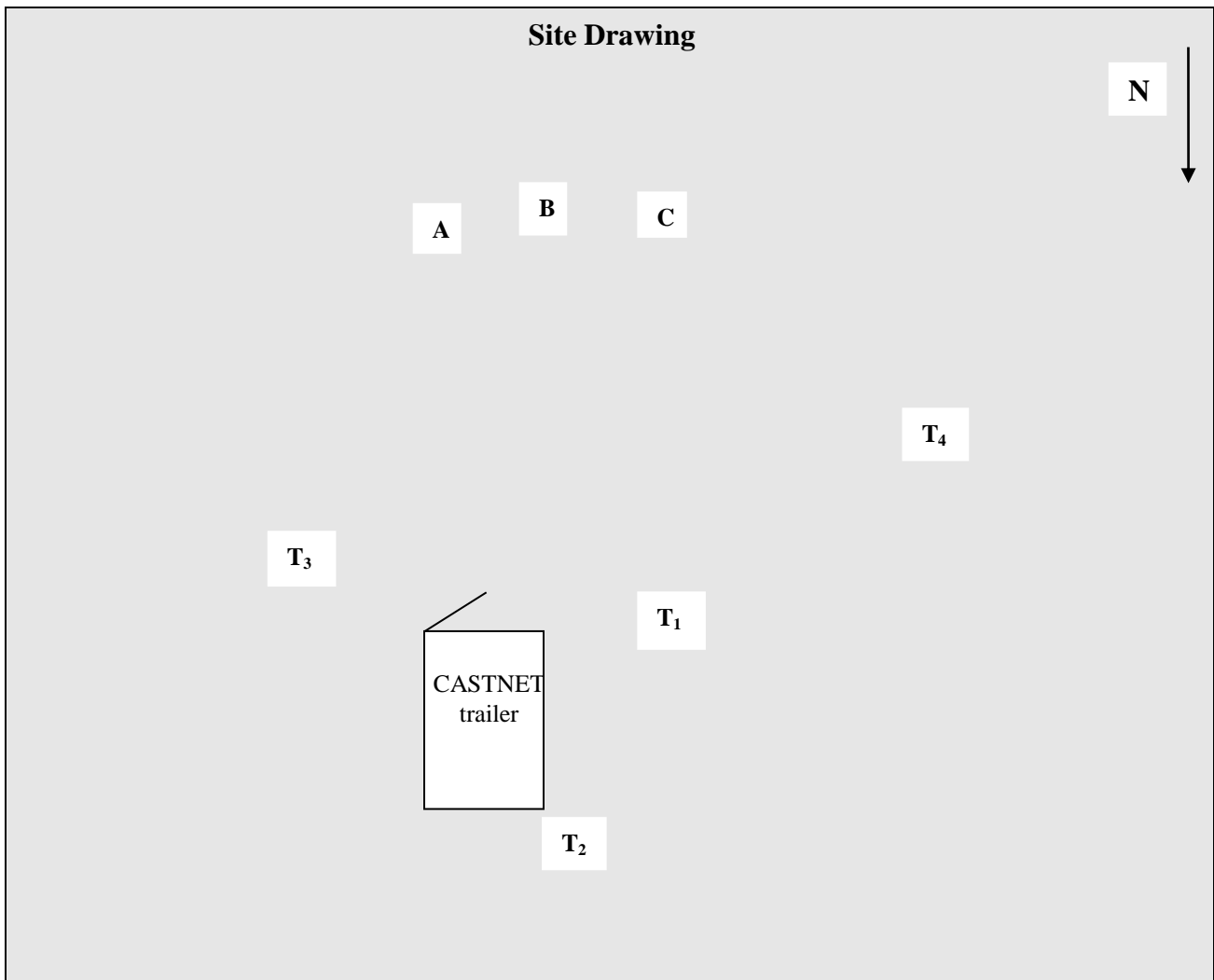


Beaufort Field Site (BFT142) Measurements

(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
T2 Tower (CASTNET annular denuders)	30	7.9	10
T3 Tower (CASTNET oxides of nitrogen inlet)	100	5.5	10
T4 Tower (meteorological instrumentation)	230	12.5	10
A NADP Aerometric Sampler	160	19.0	1.1
B NOAA Rain Gage	170	18.5	1.0
C Tipping Bucket	180	17.5	1.0

There is one shelter at the site that houses the two ozone analyzers, one oxide of nitrogen analyzer, desk (table), data logging system, and site operator's filing cabinet. All towers and field instrumentation are properly spaced. N Natural grass covers the ground within the 30 meter square with a dirt (sand) roadway leading to the site. The site is surrounded in all directions by field used for farming soybeans, winter wheat, and corn. No tree groves were within 400 meters of the field site.



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 O₃ 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 O₃ 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 O₃, 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 D

Beaufort (BFT142) Site Photos



LOOKING NORTH



LOOKING NORTHEAST

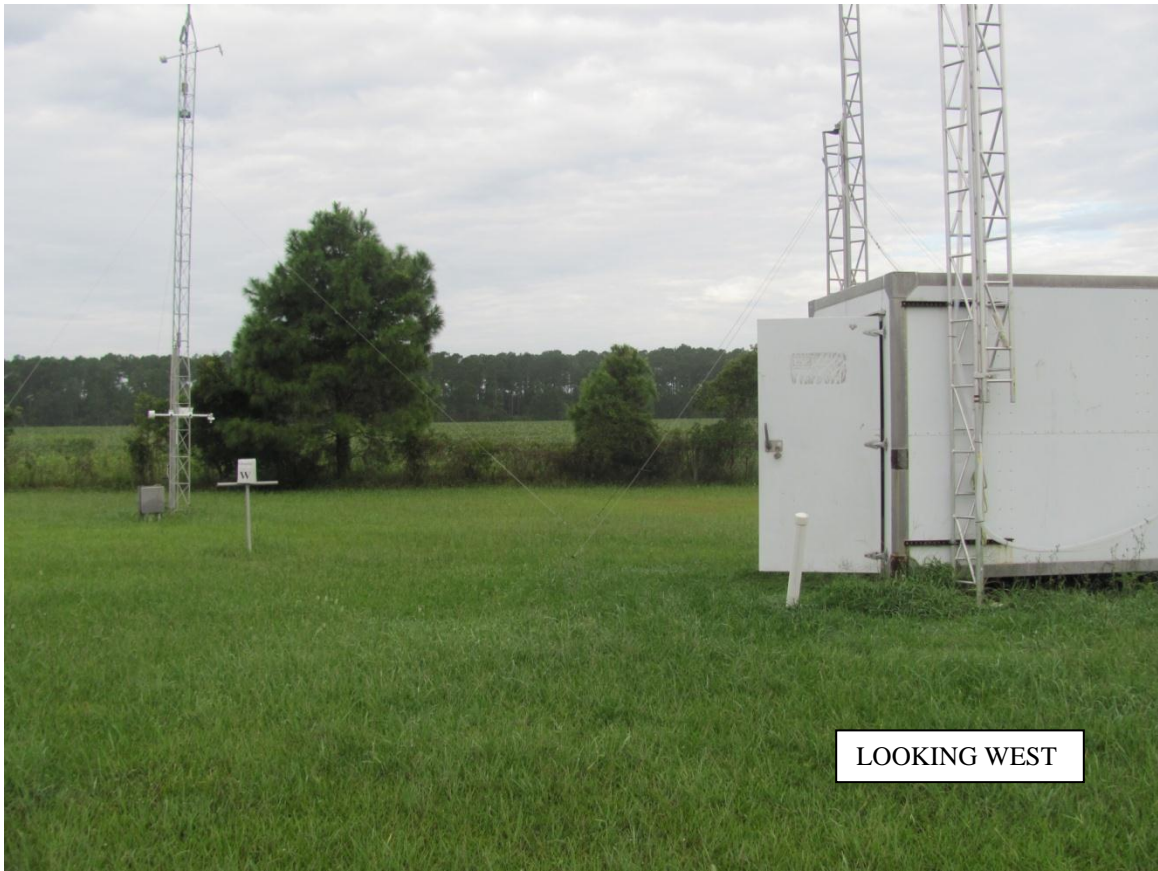


LOOKING EAST



LOOKING SOUTHEAST





APPENDIX E

Data and Data Management Questionnaire

DATA AND DATA MANAGEMENT

Auditee Identification: **AMEC Laboratory Facility**

Location of Audit: **Newberry, FL**

Audit Date: **September 13, 2012 (on-site TSA); August-October, 2012 (off-site data assessments)**

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

PERSONNEL INTERVIEWED:

NAME	POSITION	PHONE/E-MAIL
Chris Rogers	Data Operations Manager	Christopher.rogers@amec.com 904-391-3744
Marcus Stewart	QA Manager	Marcus.stewart@amec.com 352-332-3318 (ext. 6099)

Data Management Questions

Audit Questions	Response			Comments and References (provided by AMEC personnel unless otherwise indicated)
	Y	N	NA	
Audit Questionnaire Part I – General (adapted from Appendix H of QA Handbook)				
<i>Data Handling</i>				
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			Table 4-1 Flow of Data in the October 2011 CASTNET QAPP
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			Table 4-1 Flow of Data in the October 2011 CASTNET QAPP
3. Are procedures for data handling (e.g., data reduction, review, etc.) documented?	X			CASTNET QAPP Appendix 6 Data Operations SOPs
4. In what media (e.g., diskette, data cartridge, or telemetry) and formats do data arrive at the data processing location?			X	All electronic (telemetry – TCP/IP or dial-up modem)
5. How often are data received at the processing location from the field sites and laboratory?			X	Automatically (hourly)
6. 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			Flagged by the data logger program. Only the 1-hr average data is flagged not the 5-min average data.
7. How data are 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)?	X			Electronically from data logger through modem to AMEC server.
8. Describe the data QC checks applied to ensure that data transfer is accurate.				<p>Daily ZSP checks are excluded from the hourly average data electronically by the Campbell CR3000 system.</p> <ol style="list-style-type: none"> 1. Data transmission polling software (TCP/IP or dial-up modem) 2. LoggerNet software in Campbell system 3. Campbell performs initial validation
9. For manual data entry, is a double-key entry system used?			X	There are no manual data entries for the ozone collection system for the CASTNET program.
10. Are precision and accuracy data gathered and reported to AQS?	X			Precision (RP records) data only. Accuracy (RA records) data are collected and loaded by auditors performing PE audits.
<i>Software Documentation</i>				
11. 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)				Production database; automated processes and e-mail report (Excel spreadsheet).

Audit Questions	Response			Comments and References (provided by AMEC personnel unless otherwise indicated)
	Y	N	NA	
12. 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			Raw data (.dat file) is maintained on the GNVLOGGERNET Server. Raw data are inserted into SQL Server database on GNVCASTNET server. The raw data is stored in raw data tables and sent to production data tables on the GNVCASTNET server. A QA review is performed and data is validated. All data from the GNVCASTNET server is back-upped by AMEC IT nightly. All AMEC staff who has access to the GNVCASTNET server has selected limited privileges. Mr. Rogers has complete access. Campbell system and cellular modems are on a backup battery system at each site that is monitored by voltage output.
13. 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			Initially tested with Campbell assistance. AMEC Data Operation Manager, Field Operations Manager, and QA Officer work with IT. AMEC does have records from the testing period before CR3000's were deployed, but these were not reviewed by the RTI auditor during the laboratory visit.
Data Validation and Correction				
14. 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			Section 4.3 QAPP.
15. Does the CASTNET project document describe the process for making changes to data that have already been posted on AQS or on the CASTNET website? Provide references.		X		Section 4.6 QAPP will be updated to discuss changes to data that already has been placed on AQS.
16. Examine a few recent examples of actions that were taken when data had to be flagged: <ul style="list-style-type: none"> 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. 	<u>See Responses to Question 38</u>			

Audit Questions	Response			Comments and References (provided by AMEC personnel unless otherwise indicated)
	Y	N	NA	
<p>17. 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.</p> <p>Is it possible for unauthorized personnel being allowed to change data values in AQS? How is this avoided?</p>	X			<p>Mr. Chris Rogers (Data Operations Manager) and/or Mr. Marcus Stewart (QA Officer)</p> <p>Only Mr. Rogers places data on AQS. Ms. Anna Karmazyn performs daily data validation of the ozone data the day after the sample collection day.</p> <p>The Campbell software performs the initial data check</p>
<p>18. Are corrected data resubmitted to the issuing group for cross-checking prior to release? [i.e., who within the CASTNET program organization must be consulted before posting corrected data to AQS?]</p>	X			<p>Mr. Chris Rogers (Data Operations Manager)</p>
<p>19. Are regular data summary reports issued by the organization?</p> <p>Attach a list of reports routinely generated, including title, distribution, and period covered. Provide a citation to project documentation.</p>	X			<p>Hourly reporting to EPA (AIRNow) through the AIRNOW FTP server, daily submittal to EPA/CAMD for the CASTNET web site through the EPA FTP server, and 90-day post to AQS. Final (Level 3) data are submitted to EPA/CAMD following completion of bracketing calibration, and updates are sent to AQS as necessary.</p> <p>The ozone data on AQS is current to June 30.</p>
Data Processing				
<p>20. How often are data submitted to AQS and The CASTNET website?</p>	<u>see Comments and References</u>			<p>Monthly (90-day post)</p> <p>The ozone data on AQS is current to June 30.</p>
<p>21. Briefly describe any difficulties that your organization has encountered in coding and submitting data following the AQS guidance documents.</p>	<u>see Comments and References</u>			<p>Major learning curve initially. Support from Ms. Angie Shatas.</p>
<p>22. Are records kept for at least 3 years by the organization in an orderly, accessible form?</p> <p>Does this include raw data, calculations, QC data, and reports? If no, please comment.</p>	X			<p>Electronic raw data has no timeline (maintained forever)</p> <p>Hard copies such as the Site Status Report Form (SSRF) are maintained for 5 years. 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.</p>
<p>23. 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?</p>	X			<p>Calibrations are performed at STP, thus no correction are necessary.</p>

Audit Questions	Response			Comments and References (provided by AMEC personnel unless otherwise indicated)
	Y	N	NA	
24. Are audits (internal or external) on data reduction procedures performed? If yes, at what frequency?	X			Internal audits are performed when new systems are developed and put into place or when existing systems undergo updates. External audits have been performed in the past (approx. once a contract period), but until RTI started they were not at any set frequency.
25. Are data precision and accuracy checked each time they are calculated, recorded, or transcribed to ensure that incorrect values are not submitted to EPA?			X	No manual entry of data is performed. All data reduction is performed electronically by the data logger or by verified automated processes. Only validation of data performed.
Internal Reporting				
26. Are internal reports prepared and submitted as a result of the audits required under 40 CFR 58, Appendix A? List Report Titles and Frequency.	X			Most EPA external audits are performed and reported to EPA on a quarterly basis by another contractor (EEMS). Spot reports and quarterly/annual summaries are provided to AMEC. States and Regions have also performed external audits, but, to date, AMEC has not been involved with reporting these results or submitting RA records to AQS.
27. 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	X			40 CFR Part 58 by internal review. Quarterly QC reports prepared by AMEC and submitted to EPA include site-specific results based on ozone QC checks.
28. Do either the audit or precision check reports include a discussion of corrective actions initiated based on audit or precision check results?	X			Quarterly QC reports state issues in a table for sites where QC checks do not meet criteria or are otherwise noteworthy.
29. 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)			<u>see Comments and References</u>	Mr. Rogers (Data Operations Manager) Mr. Stewart (QA Officer)
Audit Questionnaire Part II – Detailed questions and data requests				
30. 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, BP, RH, shelter temperature, flow rate, etc., if available. Include a zero-span check if available. Auditor will compare the data obtained at the site vs. the data reported in The CASTNET website and AQS. Identify any discrepancies and follow-up with AMEC staff.			<u>see Comments and References</u>	Mr. Michael Smith previously provided the 5-min and 1-hour ozone average data from April through the field audit day (July 21 CND 125 and July 28 BFT142) to RTI. Since the Mr. Rogers has submitted ozone data up to June 30, RTI will select days prior to June 30 to review the raw data against posted data on AQS and AIRNow.

Audit Questions	Response			Comments and References (provided by AMEC personnel unless otherwise indicated)
	Y	N	NA	
<p>31. While on site, for the TSA, the auditor will record (if possible) several hours of raw ozone data directly from the front panel or instrument outputs and compares it versus raw data obtained from AMEC.</p> <ul style="list-style-type: none"> 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. 				<p>Downloaded "raw" data were compared vs. data in the database. No significant discrepancies were observed. Data were compared vs. EPA data sets (AQS and CAMD websites). No significant discrepancies were found, but see summary report for some observations.</p>
<p>32. Obtain 5-minute data directly from the instrument or from AMEC.</p> <p>Do recalculated hourly averages agree with the reported hourly data? (The auditor will calculate data completeness for hourly data that contains one or more invalidated 5-minute values, and verify any completeness flags that should have been applied.)</p>	X			<p>Mr. Michael Smith previously provided the 5-min and 1-hour ozone average data from April through the field audit day (July 21 CND125 and July 28 BFT142) to RTI.</p>
<p>33. While on site, the auditor performing the TSA should note the time of any interruption in monitoring data that occur during the TSA. If any were observed:</p> <ul style="list-style-type: none"> Check that the raw data records reflect the data gap at the correct time. Do the correct flags appear in the hourly data records? 			X	<p>No interruptions in the ozone collection of data during the field visits.</p>
<p>34. Have any recent PE audits resulted in data revisions or reflagging? List site IDs, dates and times. RTI will compare corresponding data records on the CASTNET website and in AQS and will determine if the appropriate changes or flags were applied.</p>		X		
<p>35. Auditor will observe the data validation process with the iCASTNET software and will follow the steps in the SOP.</p> <p>Were any deviations from the data processing and validation SOPs observed? Note any significant deviations that should be reflected in a revised SOP.</p>		X		
<p>36. Auditor will ask the data management staff to identify a few examples where they had to add data flags or change/invalidate data, as a result of higher level data validation. Record the reasons for the changes, site IDs, dates and times of the data affected. (Example data need not come from the two sites that were audited for the field TSA.) Answer the following questions:</p> <ul style="list-style-type: none"> 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? 				<p>All higher-level validation actions are recorded in transaction log data table in the database. Final (Level 3) data are submitted to EPA/CAMD by Mr. Chris Rogers using an Oracle database link. Automated processes at CAMD replace data on the CASTNET web site.</p> <p>To date, updates to the AQS database have only been required for two sites. As indicated in Question 15 comment, this process will be documented in the next QAPP revision.</p>

Audit Questions	Response			Comments and References (provided by AMEC personnel unless otherwise indicated)
	Y	N	NA	
<p>37. Based on the three data sources (AMEC raw data; AQS; CASTNET web site) determine the following:</p> <ul style="list-style-type: none"> 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-minute data sources agree? Do hourly averages posted on AQS and the CASTNET website agrees as to both concentration and time? 	X			<p>(Completed by J. Flanagan based on data review.)</p> <ul style="list-style-type: none"> Flags and validity codes generally agreed, but reflected the stage of validation of each dataset. See findings. Hourly concentration averages computed from the 5-minute data agreed for the CND and BFT datasets provided by AMEC. A one-hour offset was noted due to how the Campbell data logger assigns sampling time, which is offset by one hour from the convention followed by AQS. AMEC was aware of this offset, and times were corrected appropriately.
<p>38. Review AMEC's validation records for CND125, 8/15/12. (One 5-minute average was a clear outlier.) How the outlier was identified and marked invalid by the standard validation process?</p> <ul style="list-style-type: none"> Was the outlier correctly identified? Was the correct data flag applied? 	X			<p>See e-mail package sent by Mr. Rogers on September 13.</p> <ol style="list-style-type: none"> Observation Report completed by Ms. Helen Reed during data review on August 16 and entered into the Problem Tracking System database. Production System Data Report to EPA for that day (sent August 16) included a "P" assigned (ozone value > 150) for the hourly average. Data will be invalidated for that hour.
<p>39. Was anyone contacted (site operator, auditor, and network service person) to ask about the outlier? Discuss the general process of investigating unexplained outliers in the data.</p>	X			Mr. Rogers and Mr. Stewart.
<p>40. For the 8/15 event, did enough valid observations remain to compute a valid hourly average? (RTI will re-compute the hourly average and compare it to the hourly averages posted in AQS and on the CASTNET website)</p>		X		<p>AMEC: The data was invalidated for that hour. AMEC only uses the 5-minute data for investigation and does not re-compute the hourly average. The hourly data for this outlier was invalidated.</p> <p>RTI: The auditor recomputed the 24 hourly averages for CND125, 8/15/12, and found that the values in AQS agreed with respect to the expected concentration values and null value flags. Three values around the time of the previously noted outlier (18:00 – 20:00) had been invalidated and flagged in AQS, and the AS null value code had been set.</p>
<p><i>In the following question RTI will download previous CASTNET data from AQS and the CASTNET web site and compare hourly data over several months and sites.</i></p>				

Audit Questions	Response			Comments and References (provided by AMEC personnel unless otherwise indicated)
	Y	N	NA	
41. Do the hourly data received directly from AMEC agree with the corresponding data downloaded from the EPA data sources (AQS and the CASTNET website operated by EPA/CAMD)?	X			Numerical values agree, except where invalid concentration values were rendered null in accordance with AQS formatting policies.
42. Do time stamps agree?	X			Timestamps from the Campbell data logger had to be adjusted by one hour before reporting to the EPA databases.

APPENDIX F

Installation/Implementation Checklist for EPA Regulatory Ozone Monitoring

**Installation/Implementation Checklist
for
EPA Regulatory Ozone Monitoring**

Site ID: _____ **Installer:** _____ **Date:** _____

Completed (Check Box)	Follow these procedures in the order given below	Comments
	Ensure the sample port is capped on Level 2 transfer and then power on transfer for internal leak check. Fix leak if present.	
	Turn off Level 2 transfer.	
	Toggle <i>Calibrator Onsite</i> to "True" and Down the ozone channel. Record date and logger time in the site log book.	
	Audit the existing site analyzer using current SOP procedures.	
	Power off Level 2 transfer.	
	For initial conversion of site to regulatory configuration (Installation SOP):	
	Remove existing analyzer, zero air relay box, and zero air pump. (6.1)	
	Record existing flow and temperature calibration factors. (6.2)	
	Using software provided on the USB flash drive from the calibration kit, update the CR3000 data logger operating system, configuration, and program. (6.2)	
	Reenter flow and temperature calibration factors into the logger through PC200W on the site laptop. (6.4 & 6.5)	
	Install new switch for communication. (6.6)	
	Install new site analyzer. (6.7)	
	Install Level 3 site transfer. (6.8)	
	Install new air compressor and attach new canister rack to compressor. (6.9)	
	Replace desiccant and charcoal/purafil mix in existing canisters and add quick disconnects to the inlet and outlet ports. (6.9)	
	Place canisters in new canister rack along with an additional desiccant canister supplied in the install kit. (6.9)	
	Set air compressor regulator to 20 psi. (6.9)	
	Using the established procedures, including clean gloves, end caps and re-sealable zipper storage bag, down the flow system and uninstall the filter pack until the new ozone sampling train installation is complete. (6.10)	

Completed (Check Box)	Follow these procedures in the order given below	Comments
	Remove current ozone sampling probe from flow tower's pothead. (6.10)	
	Install new ozone sampling probe, from the install kit, in the flow tower's pothead. (6.11)	
	Using software provided on the USB flash drive from the calibration kit, update PC200W network configuration file and backup. (6.12)	
	Enter Level 3 six audit average slope and intercept, from ozone documentation in the site calibration folder, into logger through PC200W on the site laptop. (6.13)	
	Connect the zero air compressor solenoid wiring to the data logger. (6.14)	
	Turn analyzers on in normal operation (Level 3 and site analyzers on, Level 3 in sample mode with pump off). (6.15)	
	Check Level 3 analyzer for any sample flow. The flow rate should be below 0.01 liters per minute for A and B cells. (6.16)	
	Leak check ozone system by capping sample probe inlet. (6.17)	
	Relocate shelter temp probe to rack (or next to analyzer if no rack). (6.18)	
	Post Installation Calibration (Audit SOP):	
	Install Level 2 transfer. (6.1)	
	Set air compressor regulator to 30 psi. (6.2)	
	Set the Level 3 transfer's level 1 target concentration to 450 ppb on the Automated Ozone page. (6.3)	
	Audit the Level 3 and site analyzers. (6.9)	
	Connect the Level 2 transfer's sample line to the tee fitting quick disconnect port on the Level 3 analyzer. (6.9)	
	Verify the air compressor regulator gauge remains set to 30 psi. (6.10)	
	Perform line loss test. (6.12)	
	Record audit findings and line loss test on iForms. (6.11 and 6.12)	
	End automated audit. (6.13)	
	Turn off and Level 2 transfer.	

Completed (Check Box)	Follow these procedures in the order given below	Comments
	Follow the Ozone AQS Audit Flow Chart on the supplied USB flash drive to determine the next course of action. (6.16)	
	Remove the Level 2 transfer. (6.17)	
	Set the Level 3 Transfer's level 1 target concentration to 400 ppb on the Automated Ozone page. (6.18)	
	Set air compressor regulator to 20 psi. (6.19)	
	Enter Level 3 updated six audit average slope and intercept, from the iForms, into logger through PC200W on the site laptop. (6.21)	
	Run Zero/Span/Precision (6.22)	
	Check all parameters for correct values and contact MACTEC for confirmation of site communication.	
	Leave one set of copies of the most recent verifications onsite and return another set with the calibration folder.	
	Call MACTEC: Mike Smith 1-888-224-5663 ex: 6620 Kevin Mishoe 1-888-224-5663 ex: 2602	