

**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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TABLE OF CONTENTS

Section	Page
Summary	ii
1 Introduction	1
2 General Program.....	2
3 Network Management	7
4 Field Operations	9
4.1 Rocky Mountain National Park (ROM406).....	10
5 Laboratory Operations (Field Calibration Laboratory)	15
6 Data and Data Management	16
7 Quality Control and Quality Assurance.....	22

LIST OF APPENDICES

Appendix	Page
A. Rocky Mountain National Park (ROM406) Field Site Questionnaire	A-1
B. Rocky Mountain National Park (ROM406) Site Photos.....	B-1
C. Data and Data Management Questionnaire	C-1
D. 6-Month Calibration Audit of the Rocky Mountain National Park (ROM406).....	D-1
E. EE&MS PE Audit of the Rocky Mountain National Park (ROM406)	E-1

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 Air Resource Specialist, Inc. (ARS) for Clean Air Status and Trends Network (CASTNET) program. ARS is responsible for overseeing the operations of the CASTNET sites located at national parks and operated by National Park Service (NPS) staff and at sites sponsored by the Bureau of Land Management (BLM). A TSA was conducted to assess its compliance with established regulations governing the collection, analysis, validation, and reporting of ambient air quality data. The TSA consisted of an onsite visit to a NPS site (Rocky National Park – ROM406), a visit of the Ozone Calibration Laboratory at the ARS facility in Ft. Collins, Colorado (CO), and a review of ozone data collection and data management.

RTI prepared two 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 first questionnaire covered the onsite visit to the field site and the review of the Ozone Calibration Laboratory. The second questionnaire discussed activities related to the data review and data management for ozone data. Prior to the TSA, RTI submitted the questionnaires to the ARS staff to be interviewed and the CASTNET Program Manager, Mr. Kemp Howell, and the CASTNET Quality Assurance (QA) Manager, Mr. Marcus Stewart. The questionnaires were completed by the RTI auditors during the audit process and include responses from the ARS staff. The questionnaires are attached as Appendices A and C.

The RTI audit team consists of Mr. Jeff Nichol and Mr. Eric Poitras. Both auditors visited the ROM406 site and the ARS facility in Ft. Collins, CO. Mr. Nichol was responsible for overseeing the auditing activities as well as leading the onsite review of the field site and Ozone Calibration Laboratory. He conducted interviews with the ARS staff 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. Mr. Poitras conducted interviews with ARS staff regarding the review and handling of ozone data, the data validation and correction procedures, data processing, and internal and final reporting. He also reviewed the ozone raw data records from the ROM406 site and compared the data posted to AIRNow, the NPS website, and the US 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 ARS to these databases.

For the CASTNET program, the activities at the field sites and supporting laboratories are overseen and performed by two organizations. AMEC Environment & Infrastructure (AMEC) is responsible for the sample collection activities at the US EPA field sites, providing filter pack and ozone support to the site operators, filter pack laboratory analyses support and data review/management/reporting for all of the CASTNET sites (US EPA and NPS), data reporting for ozone from the US EPA sites to AQS and filter pack results from all CASTNET sites to the CASTNET website. ARS is responsible for overseeing and providing support to the ozone collection operations at the NPS and BLM sites and assisting site operators with logistical support in the filter packs collection that are sent to the AMEC Laboratory in Newberry, Florida (FL). The ozone collection process is quite similar at both US EPA and NPS sites, but there are some differences (see **Exhibit 1**).

The findings listed below were based on a small sample set (one field site visit, a visit to the Ozone Calibration Laboratory, and a review of the ozone data streams from the ROM406 site) overseen by ARS. Continual 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 (NPS-governed sites), laboratory, and data management reviews) performed by ARS, RTI was extremely impressed with several aspects of the program such as:

- ARS management structure that oversees the CASTNET program is precise and well organized,
- ARS support staff are knowledgeable, cooperative, and supportive,

- Supportive communication link between Ozone Calibration Laboratory and Information Management Center (IMC) with the site operators is advantageous and valuable means of communication,
- Use of consistent and current state of art instrumentation (Thermo 49i, ESC data loggers, and mass flow controllers),
- Multiple calibration and verification checks conducted within the measurement system,
- Use of electronic means to maintain and store field information and provide instructions to the site operators in the forms of the QAPP, SOPs, checklists, and field notations on the DataView software system, 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.

- There are no formal training records for the NPS field operator, but training is provided by the field specialists during the 6-month calibration based on the Semiannual Site Visitation Checklist. The type of training needs to be documented as well as the field operator signing off and dating the checklist. ARS could add a signature box at the end of the form as well as a comments box that would explain the type of training provided during the visit. These forms are already maintained on the primary server at ARS and the information regarding the training provided by the field specialist can be documented to provide field operator training support. During the next 6-month visit, the field specialist can re-assess the progress of the field operator based on the previous training.
- Reviewing process of QA documentation (QAPP, SOPs, and checklists) and posting of updated documents to the CASTNET website:
 - The current CASTNET QAPP discusses activities by ARS at the NPS sites, but there is no approval signature by ARS management.
 - Current organizational charts for NPS and ARS need updated in the CASTNET QAPP.
 - The ARS Gaseous Pollutant Monitoring Program (GPMP) QAPP is dated July 2009 and needs to be reviewed, updated, and approved by NPS and ARS (see list of issues found in Section 7 of this report). Update the checklists to current forms, especially for examples of completed forms.
 - A reviewing schedule for all QA documentation (QAPP and SOPs) needs to be developed with the final approved version being submitted to AMEC for posting to the CASTNET website.
 - Some checklists in the Field Calibration SOPs need to be updated or removed if the operation is no longer in practice.
 - The latest version of the SOP 3340 was not available on the CASTNET website (current version is Revision 4.2 from Feb 2010). There have been two revisions since 2010 (Revision 4.3 in March 2012 and Revision 4.4 in October 2013).
- It was not apparent that all field specialists completed the required checklists in the SOPs. Once the SOPs and checklist are updated, ARS should have a training session conducted by the QA Manager to explain the forms and their proper completion, review, and storage.
- ARS does not have an SOP that outlines a test plan for evaluating software updates and testing changes. There is no formal documentation tracking the changes or updates, thus no results of any recent updates. Software development is performed in-house (no commercial company).
- An occurrence of data not being invalidated or flagged in reporting databases (data for wind direction based on June 10, 2013 audit has not been invalidated or flagged in reporting databases). As of November 12, 2013, these data have not been flagged. ARS has recognized the problem and the data will be invalidated.

Exhibit 1. Ozone Collection Differences at the US EPA and NPS Field Sites

Task	AMEC/Frequency	ARS/Frequency	Comments
ZSP checks	Automated daily (1:46 am)	Automated daily (1:46 am)	
Multi-point Verification checks	Automated every Sunday	By site operator once month	
Flow checks, leak checks, and line loss tests	Flow checks are performed during the 6-month calibration. The site operator does observe and record the flow rate every Tuesday, but does not measure the flow rate. The site operator does a leak check every Tuesday. The line loss test is performed during the 6-month calibration.	Not reported.	
Replacement of inline filter	Every 2 weeks	Once a month	
Audits	Six-month Calibration checks are performed by AMEC or an AMEC subcontractor. Independent performance evaluation performed annually (Mr. Eric Hebert at EE&MS).	Six-month Calibration checks are performed by ARS field specialists. Independent performance evaluation performed annually (Mr. Eric Hebert at EE&MS).	
Maintaining standards, certificates, and documentation	Standards are certified annually as required and documented on the AMEC Microsoft SQL server (hard copies also available).	Standards are certified annually as required and documented on the ARS network server.	
Communication with site operator	(Telephone) Site operators call AMEC every Tuesday before leaving the site and entries made in the electronic Call Log. Entries made in site logbook and SSRF.	(Computer program) Site operator makes all field entries in the DataView system (date and time stamped). For ozone program, there are no entries on hard copies. If power failure, hard copy forms completed and sent by fax to IMC where electronic entries are made.	
DAS	Campbell CR3000 data logger, PC200 software, router, modems (Raven and COM 220), laptop, and phone and Internet	ESC 8816 data logger, DataView software, router, modem, laptop, and phone and Internet	
Training	Initial training seminar. Site setup or equipment change outs, some from the previous site operator and some during the 6-month calibration.	Training occurs in one of three ways: From previous site operator, during new site or relocation setup, and every 6-month calibration.	AMEC needs to review and develop a continual training program.
Training documentation	Annually a CD of the Health and Safety Plan, Site Operator Handbook, and SOP for ozone air monitoring is sent to the site operator. A Signature page of acknowledgement from the site operator is sent and maintained at AMEC. No training records maintained at the site or AMEC office (just acknowledgement forms).	Marked on the 6-month calibration checklist, but does not contain a signature acknowledgement form the site operator. No training records maintained at the site or ARS office.	Both AMEC and ARS need to develop a training program that can be documented from initiation through continual events. Since training records seem to be lacking, it is very important to obtain an acknowledgement signature form the site operator.
Maintain SOPs	Electronically-CD	Electronically-DataView software on site's laptop	Electronic method seems to be the best, but the site operator must be able to locate, understand, and demonstrate proficiency of the described operation.
Control of obsolete documents	Hard copy control needs attention and plan.	No hard copies used, all electronic.	
QA documentation review	QAPP and SOPs annually	QAPP (2009) and several SOPs (2009).	
Data submittal	CASTNET website, AIRNow website (hourly) and AQS	AIRNow website (hourly), NPS website (hourly), and AQS (also to AMEC-CASTNET)	

Section 1: Introduction

For the Clean Air Status and Trends Network (CASTNET) program, the activities at the field sites and supporting laboratories are overseen and performed by two organizations. AMEC Environment & Infrastructure (AMEC) and Air Resource Specialist, Inc. (ARS) are responsible for overseeing the US Environmental Protection Agency (EPA) and National Park Service (NPS) field sites, respectively. This technical systems audit (TSA) involves the audit of the ozone operations performed by ARS located in Ft. Collins, Colorado (CO). 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 TSAs of the ozone collection process and data and data management operated by ARS. The TSA consisted of an onsite visit to a NPS site (Rocky National Park – ROM406), a visit of the Ozone Calibration Laboratory at the ARS facility in Ft. Collins, CO, and a review of ozone data collection and data management. 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.

On October 29, 2013, Mr. Jeff Nichol, with assistance from Mr. Eric Poitras, conducted the TSA at the ROM406 field site near Preservation Drive in Rocky Mountain National Park located in Estes Park, CO. While visiting the ARS facility in Ft. Collins, CO, Mr. Nichol discussed the operations and support provided by the Ozone Calibration Laboratory with ARS staff. Mr. Poitras interviewed ARS staff from the Information Management Center (IMC) regarding the data review and data management of the ozone data. The laboratory and IMC audits were conducted on October 30. Mr. Marcus Stewart, the CASTNET QA Manager from AMEC, also attended the data review and data management audit. The key ARS staff involved during the auditing process was:

- Mr. Joe Adlhoch (ARS Project Manager),
- Mr. Christian Kirk (ARS Quality Assurance Manager),
- Mr. Mike Slate (ARS Field Operations Manager), and
- Ms. Jessica Ward (ARS Information Management Section Manager).

During the onsite visit to ROM406 site, the site operators (Ms. Dyan Harden and Ms. Michelle Gillis), were not available.

Sections 2, 3, 4, 5, 6, and 7 of this report discuss the general findings of the ARS's ozone collection process; network management; field operations at the ROM406 sites laboratory operations at the Ozone 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 ROM406 monitoring site taken during the site visit, a copy of the last 6-month audit of the ROM406 site, and a copy of the last Preliminary National Performance Audit Program (NPAP) Report for the ROM406 site.

Section 2: General Program

In 2011, the U.S. EPA upgraded all ozone monitoring equipment at the EPA CASTNET monitoring sites to comply with the requirements stated in 40 CFR Part 58. Each CASTNET site that collects hourly ozone data must meet the additional audit requirements and comply with the data reporting deadlines set forth in the CFR. ARS 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 for all NPS CASTNET sites. ARS submits the real time NPS CASTNET hourly ozone data to AIRNow and the NPS websites daily. In addition, ARS submits the CASTNET ozone data to the US EPA's Air Quality System (AQS) database.

During the visits to the field site, the Ozone 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 ARS management and support staff structure at the main laboratory in Ft. Collins, CO is well-organized and documented in the CASTNET Quality Assurance Project Plan (QAPP), Revision 8.1 dated July 2013 and posted at http://epa.gov/castnet/javaweb/docs/qapp_v8-1_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 ARS management and support staff and site operators by the use of an electronic program, DataView, that allows the site operators to communicate with ARS staff at all times.

Prior to the TSA, Mr. Stewart, the AMEC QA Manager for the CASTNET program, 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 CASTNET QAPP, supportive ARS Standard Operating Procedures (SOPs), and quarterly QA reports. The current CASTNET QAPP contains information regarding the CASTNET project organization with U.S. EPA Clean Air Markets Division (CAMD), AMEC, and the National Park Service (NPS). During the TSA at the ARS facility, the ARS QA Manager provided the RTI auditors a copy of the ARS GPMP QAPP prepared in July 2009 (need reviewed and updated; see Section 7 of this report for issues found) for review. Both QAPPs were 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. Each 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). The CASTNET QAPP and SOPs are reviewed and updated annually, but the ARS GPMP QAPP has not been updated since July 2009 and the current posting of ARS SOPs on the CASTNET website are not current and up-to-date.

Findings

FINDING 1:

(Section 7) Prior to the TSA, RTI reviewed the QAPP and ARS SOPs posted on the CASTNET website. During the TSA, ARS also presented the RTI auditors with the ARS GPMP QAPP. After a complete review of all QA documents (CASTNET QAPP, ARS GPMP QAPP, ARS SOPs, and checklists used by ARS staff and NPS site operators), RTI has the following findings:

1. The ARS GPMP QAPP is not listed on the CASTNET website. This is the primary quality management document that the ARS management and staff and NPS site operators use for their quality system.
2. Both of the QAPPs need to update the organizational charts for the NPS and ARS management and staff involved with the CASTNET program.
3. The CASTNET QAPP has information regarding ARS activities and involvement at the NPS sites, but there is no ARS management signature on the approval page.

4. The ARS GPMP QAPP is dated July 2009 and needs to be reviewed, updated, and approved by NPS and ARS (see separate list of issues and concerns in Section 7 of this report).
5. The ARS SOPs posted on the CASTNET website are not current. The supporting checklists for the ARS staff and NPS site operators need to be reviewed to determine if these checklists are still being used properly.
6. There is a lack of communication between ARS and AMEC on the process and responsibilities for posting the most recent versions of the ARS SOPs to the CASTNET website.

Discussion:

Prior to the TSA, RTI was informed that the current CASTNET QAPP and ARS SOPs were posted on CASTNET website. During the TSA, the ARS GPMP QAPP was presented to RTI that closely matches the ARS SOPs and activities. The RTI auditor did not ask either Mr. Stewart or Mr. Kirk if they have considered adding the ARS GPMP QAPP to the CASTNET site as a point of reference for personnel involved with the NPS sites.

The organizational charts for ARS and NPS management and staff needs updated in both QAPPs. Mr. Kirk provided the RTI auditor a copy of the most recent ARS-NPS organizational chart involving the CASTNET program during the TSA. A copy of the organizational chart can be found in Section 3.

The CASTNET QAPP is relatively up-to-date (Revision 8.1 dated October 2013) and discussed the ARS activities and their involvement at the NPS sites. In reviewing the approval page, there are no ARS management approval signatures, some management personnel are no longer with the program, and the signatures are dated for February 2011.

The RTI auditor discussed with Mr. Kirk that the ARS GPMP QAPP needs to be reviewed, updated, placed on a reviewing schedule, and submitted to upper management and NPS for approval. The RTI auditor reviewed the QAPP and has provided some of the issues and concerns in Section 7 of this report.

Based on a conversation with Mr. Marcus Stewart (AMEC) and Mr. Kirk, a process will be re-established for the posting of current ARS SOPs to the CASTNET website. ARS will establish an annual reviewing process for reviewing and updating SOPs to the CASTNET website. Mr. Kirk is aware of the outdated SOPs and as time allows will review SOPs and return the process to annual reviews. Mr. Kirk will also review the checklists listed in the Field Calibration SOPs to determine if these checklists are still be used and are valid. There have been some equipment upgrades that have made some of the checklists outdated. Ms. Jessica Ward provided RTI with updated revision of SOP 3340 (Revision 4.3 in March 2012 and Revision 4.4 in October 2013) that were not posted on the CASTNET website.

RECOMMENDATION:

AMEC and ARS management need to discuss if there are enough differences in each of their quality management systems to determine if it is necessary to have the ARS GPMP QAPP also posted on the CASTNET website. It could be beneficial because the information provided in the ARS GPMP QAPP closely matches the activities conducted by ARS staff at the NPS sites. Both QAPPs (CASTNET and ARS-NPS) need to be updated to include the current ARS-NPS organizational chart. The CASTNET QAPP also needs changes and corrections to the CASTNET QAPP approval page (changes in personnel and adding ARS management representative, reviewed with updated approval signatures) and change or explanation of company name change from MACTEC to AMEC. The ARS GPMP QAPP prepared in July 2009 needs to be reviewed, updated, and sent through ARS and NPS for approval. A reviewing schedule needs to be developed and followed. If it is decided the ARS GPMP QAPP will be posted to the CASTNET website, a process for doing so also needs to be developed. The ARS SOPs need to be reviewed, updated, and submitted for approval to ARS management. All checklists need to be verified with the field specialists that they are still being used. Updated examples of the checklists need to be added to the ARS GPMP QAPP and ARS SOPs. Along with the process to post the ARS GPMP QAPP to the CASTNET website, the current ARS SOPs also need to be posted. This process should be documented in both QAPPs.

FINDING 2:

(Section 4 and 7) It was not apparent that all field specialists completed the required checklists in the Field

Calibration SOPs.

Discussion:

In conversations with Mr. Kirk and Mr. Mike Slate, it was inconclusive if all field specialists were completing the required checklists or forms in the Field Operation SOPs. Several of these checklists revolve around the 6-month calibration. There are checklists:

- SOP 3000 “*Procedures for Semiannual Maintenance Visits to a National Park Service Ambient Air Monitoring Station*”
 - Semiannual Site Visit Pre-trip Preparation Checklist
 - Semiannual Site Visitation Checklist
 - Equipment Maintenance/Repair Record
 - NPSAIR Capital Equipment Inventory Checklist
- SOP 3050 “*Siting of Ambient Air Quality Monitoring Stations*”
 - Information Management Center (IMC) New Site/Site Relocation Form
- SOP 3100 “*Calibration and Routine Maintenance of Thermo Environmental Instruments Model 49c or 49i Ozone Analyzers*”
 - Pre-maintenance Ozone Calibration Form
- SOP 3160-2100 “*Calibration of ESC 8816 or 8832 Analog Input Card*”
 - ESC Voltage Analog Input Card Calibration Check Form

Some of these checklists are electronic and others are hard copies. There are also checklists in the SOPs for equipment used at the NPS site that have been updated and replaced. Thus, the checklists are outdated.

RECOMMENDATION:

These SOPs and checklists should be reviewed and updated based on a designed and approved schedule. ARS should have a training session conducted by the QA Manager to explain the forms and their proper completion, review, and storage. Old checklists should be removed from the SOPs and completed examples of the current checklists should be added to the ARS SOPs and ARS GPMP QAPP.

FINDING 3:

(Section 4) There are no formal training records for the NPS field operator, but training is provided by the field specialists during the 6-month calibration based on the Semiannual Site Visitation Checklist form.

In Section A.8 of the ARS GPMP QAPP “*Gaseous Pollutant Monitoring Program Quality Assurance Project Plan (QAPP)*” it states that NPS site operators are trained on-site by ARS field staff, but does not describe in detail the method for training, the frequency of the training, or where the training records will be maintained.

In Section 4.2.8 of the ARS SOP “*Procedures for Semiannual Maintenance Visits to a National Park Service Ambient Air Monitoring Station*” it states:

Following the completion of all scheduled calibrations and maintenance, spend as much time as required with station operators to ensure that the operators have a complete and working knowledge of their required duties. The overall quality of network operators directly translates to the quality of network data. The field specialist will:

- **Observe operator** – Observe the operator perform a complete station check and review procedures for zero checks, precision span checks, and multipoint calibrations.
- **Review log notes**- Review operator log notes, station checklists, calibration forms, other data documentation, and overall station organization.
- **Train**- Further train the station operator on any aspect of multipoint calibrations, precision checks, data reporting, data transmittal, or other operational requirement where deficiencies are observed.
- **Review changes**– Thoroughly review any changes in SOPs or operations with the station operator.
- **Verify on-site SOPs**- Verify that the current versions of all SOPs are available on-site, and update if necessary to reflect any changes in instrumentation, procedures, or protocols.
- **Verify inventory**- Verify that the operator has an adequate inventory of all required forms and consumable supplies, including desiccant, particulate filters, gloves, printer ink, and similar items.

- **Encourage/answer questions** – Encourage station operator comments and fully answer any questions the operator may have. Note any operator comments or suggestions.
- **Inform** - Update the operator on the monitoring program goals and objectives. Instill in each operator a sense of purpose to stimulate self-interest and responsibility.

The field specialist checks the blocks and documents the corrective action. The training record process is not complete until the site operator signed and dates the form acknowledging the training was received.

Discussion:

At the ROM406, site, Mr. Kirk and Mr. Slate stated the site operators are trained three different ways: 1) From previous site operator, 2) during new site or relocation setup, and 3) every 6-month calibration. Since the site operator was not present during the onsite visit, the RTI auditor could not confirm with her (Ms. Dyan Harden) the method she was trained. ARS also does not maintain or track NPS training records. The only trackable method for determining the site operator’s training would be through the Semiannual Site Visitation Checklist. The items for the field specialist to choose from are listed in the finding.

RECOMMENDATION:

The training regimen is there, but not describing the type of training performed or having the site operator sign and date the Semiannual Site Visitation Checklist form as acknowledgment of receiving the training does not complete the record. The type of training needs to be documented as well as the field operator signing off and dating the checklist. ARS could add a signature box at the end of the Semiannual Site Visitation Checklist form as well as a comments box that would explain the type of training provided during the visit. These forms are already maintained on the primary server at ARS and the information regarding the training provided by the field specialist can be documented to provide field operator training support. During the next 6-month visit, the field specialist can re-assess the progress of the field operator based on the previous training.

FINDING 4:

(Section 6) ARS does not have an SOP that outlines a test plan for evaluating software updates and testing changes. There is no formal documentation tracking the changes or updates, thus no results of any recent updates. Software development is performed in-house (no commercial company) and is verified, but not documented.

Discussion:

Ms. Ward stated that any changes to the data process are thoroughly tested by a minimum of the database programmer plus the IMC manager before the changes are released for use. Requirements related to the update were provided to the software developers by the IMC manager and discussed to ensure understanding. The software developers made the required updates in the appropriate software application modules, and tested both the modified modules and the entire application within the development environment using test monitoring sites and configurations based on real monitoring sites. Data values were compared between the test sites using the updated software and the real monitoring sites using the production software. The updated software was then published in a test environment, used on the test sites and a subset of real monitoring sites, and closely monitored by the software developers and IMC staff until all were confident the update was working correctly. The updated software was then put in place as the production software.

SOP 3340 “*Information Management Center (IMC) Concept and Configuration for the National Park Service Gaseous Pollutant Monitoring Program*” states under the responsibilities of the Database Manager to:

- Design, develop, implement, test, and maintain database, data acquisition, data communications, site documentation (DataView), trip report forms, and applications software to meet evolving program needs
- Ensure that all software licenses and updates are current
- Maintain and upgrade project and request Website hardware configurations and software.

SOP 3340 does not state where the design plan, test plan, and results are maintained.

RTI Auditors are satisfied that prior to implementation of internally developed new software packages and/or changes in programming scripts, each are fully tested by multiple qualified personnel prior to field implementation.

RECOMMENDATION:

In Section 14.0 Data Management of the *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, December 2008 (QA Handbook)* discussed the importance of validating and testing your software programs. The Database Manager (Database programmer) and IMC Manager validate that changes to the software after updates or changes do not affect the quality of the data measurements and calculations, but the design plan, test plan, and results of the test should be documented and maintained to demonstrate the software is within compliance.

While a single form to document testing parameters is likely impossible (due to the variability and likely complexity of all potential software development packages), it is recommended that any tests performed as part of the testing procedure are documented in some manner and stored for future review.

FINDING 5:

(Section 6) An occurrence of data not being invalidated or flagged in reporting databases (Data for wind direction based on June 10, 2013 audit has not been invalidated or flagged in reporting databases). As of November 12, 2013, this data has not been flagged.

Discussion:

Ms. Ward stated the data will be invalidated back to the last good check. At the time of the TSA, the ARS trip report from August confirming the audit finding in June had not yet been finalized and released to IMC.

The result of the audit is first verified to determine that it was an accurate result. In this case, the audit result was confirmed by the ARS calibration check that was done a few months later. These types of results are reviewed monthly when validating data, but the results are usually available after data have been “finalized” for the month. In this case, the corrections are generally made as soon as the result has been confirmed and the appropriate course of action has been determined, and always prior to preparing the annual report and beginning the annual data certification process.

There exists adequate SOP’s and Technical Instructions for submitting data to AQS (and other supporting agencies), however the timeliness of resubmitting invalidated data should be addressed. ARS personnel informed RTI Auditors that the Trip Report from August confirming the wind direction issue had not been finalized, so no action to the data could take place.

RECOMMENDATION:

In following SOP instructions, determine the root cause of the problem and provide the necessary documentation to validate or invalidate the data for this particular event. Updating SOP’s to include information on specific invalidation steps after a found instrument failure, and time frame to complete steps should be added. If timeliness is still insufficient, additional unscheduled site audits may be needed to expedite data invalidation process.

Section 3: Network Management

AMEC and 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 AIRNOW, NPS, and AQS. AMEC oversees the EPA sites and is responsible for the data collection, management, and reporting of the ozone data from the EPA CASTNET monitoring sites to the EPA CASTNET web page, AIRNow and AQS. 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>).

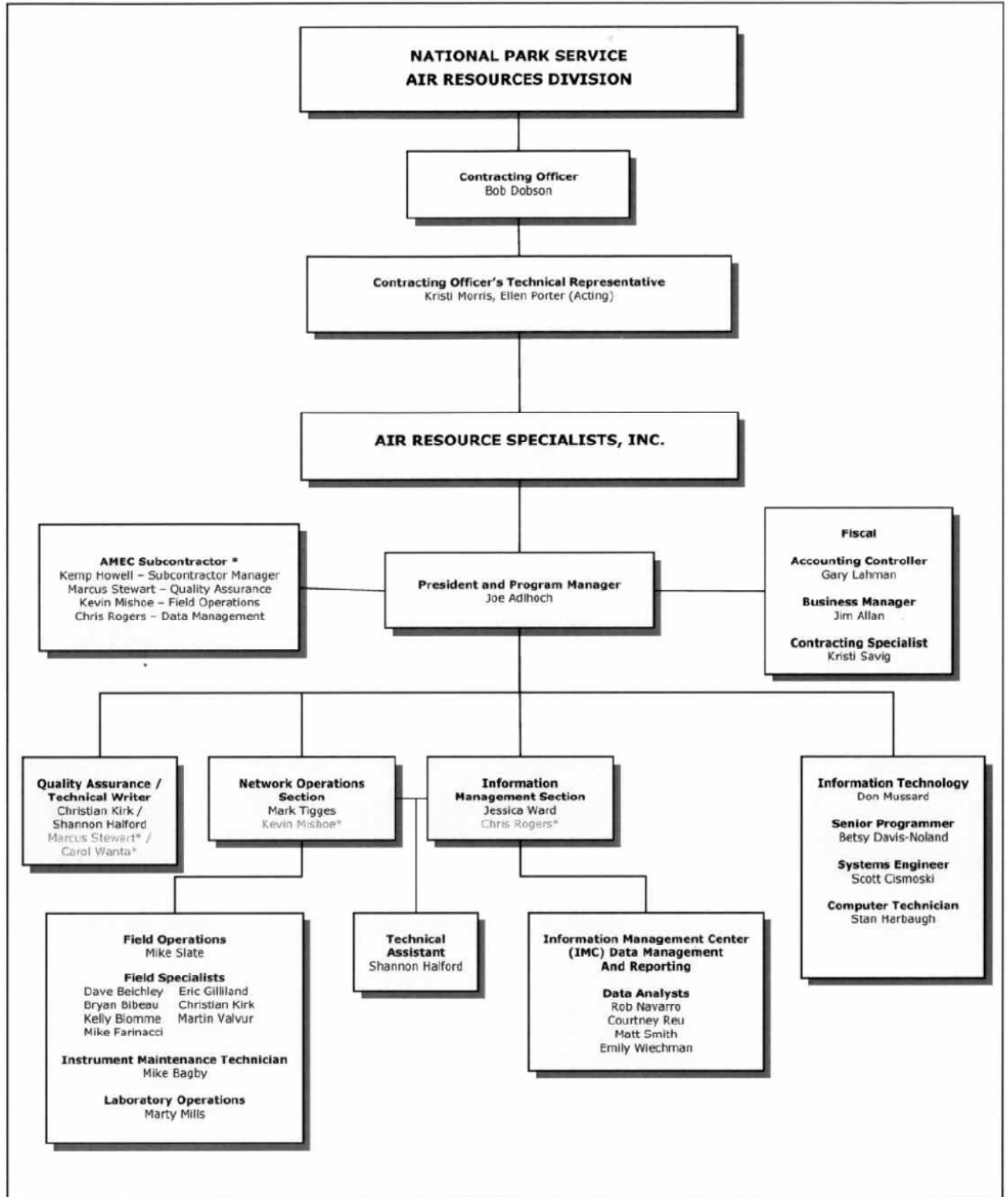
During this TSA, RTI visited Rocky Mountain National Park (ROM406) near Preservation Drive in Estes Park, CO. Based on 40 CFR Part 58, the site is within siting criteria requirements and has not requested or received any waivers. At each site, the distance from roadways, obstructions, trees were all 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 and strip chart recorders as a back-up data logging system. A collocated site, ROM206, is operated by AMEC for EPA.

Exhibit 2 displays the current organizational chart for the ARS-NPS management and staff working on the CASTNET program.

FINDINGS

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

Exhibit 2. ARS-NPS Organizational Chart for CASTNET Program



Section 4: Field Operations

ARS oversees the NPS-governed CASTNET monitoring sites. During this TSA, RTI visited the ROM406 site near Preservation Drive in Estes Park, CO. **Exhibit 3** displays 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.

Exhibit 3. ROM406 Site Information

	ROM406
Site Location Address	7000 Highway 7 (at Preservation Drive) Estes Park, CO 80517
AQS Number	080690007
Site Operator Contact Information	Dyan Harden 970-586-1252 Other Contact Information was unavailable
Backup Site Operator Contact Information	Michelle Gillis Other Contact Information was unavailable
Site Ozone Analyzer (Manufacturer, S/N, EPA decal)	Thermo 49i S/N: 1030745086 (last calibrated on August 20, 2013)
Transfer Standard Site Ozone Analyzer (Manufacturer, S/N, EPA Decal)	Thermo 49i S/N: CM08460009 (last calibrated on August 20, 2013)
GPS Coordinates	N 40.2778° W 105.5453°
Elevation	8996 ft. (2742 m)

The ARS field specialists oversee the field activities for the NPS-governed sites. The site operators (NPS ranger or other personnel) collect the field samples (filter pack) and complete the Site Status Report Forms (SSRFs) based on procedures listed in CASTNET QAPP Appendix 1 Standard Operating Procedures. The site operators use the DataView software program on the site's laptop to document all activities at the site during their normal visit on Tuesday and non-routine visits due to issues or problems at the site. The site operator does not enter any ozone information on the SSRF. All data entries are electronic (DataView). Hard copy forms are only used if the DataView log is not working. There was no evidence of the DataView system not working, but there are several forms on hand at the site for the site operator just in case. The field oversight operations of the NPS-sites for the CASTNET program is led by Mr. Mike Slate and performed by a group of field specialists (Mr. Mike Bagby, Mr. Mike Slate, Mr. Kelly Blomme, and Mr. Martin Valvur). The QA area is led by Mr. Christian Kirk. The CASTNET program for NPS sites is led by Mr. Joe Adlhoch. The data management and data review is led by the

Information Management Section (IMC) Manager, Ms. Jessica Ward. Ms. Emily Wiechmam leads the IMC and is supported by Ms. Courtney Grant (data analyst), Mr. Robert Navarro (data technician), and Mr. Matt Smith (air quality technician). As a group, the field specialists are responsible for calibration and maintenance of the ozone analyzers, maintenance of the monitoring site, training the site operators, and conducting the 6-month calibrations of the analyzers. The data management group along with the field specialists is responsible for reviewing the electronic data of the analyzers.

At the NPS sites, zero, span, and precision (ZSP) checks and monthly and multi-point calibration are performed on the ozone analyzers. The ZSP checks are automated and occur every day at 1:46 am (takes approximately 20 minutes). The site operator performs the monthly multi-point verification check by following the step-by-step procedure on the DataView software program. The site operator performs a 3-point calibration (260 to 440 ppb, 150 to 200 ppb, and 50 to 80 ppb) and zero point. All electronic data is saved on site's laptop and transmitted by the data logger to the ARS primary server. ARS staff also uses the Site Status Log, which is a web-based interface to our AQDBMS at ARS, to log operational and maintenance issue at monitoring sites. This is more comprehensive than entries in the DataView log.

The site operators visit the site every Tuesday as stated in the ARS Field SOPs. In some cases the site operator might visit more frequently if other they are responsible for other networks at that monitoring site. 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 document all activities on the DataView software system and then submits sampled filter pack and SSRF to the AMEC Laboratory in Newberry, FL.

4.1 Rocky Mountain National Park (ROM406) Field Site

On October 29, 2013, Mr. Nichol and Mr. Poitras met Mr. Christian Kirk and Mr. Mike Slate at the ARS facility in Ft. Collins, CO. Flooding in the Estes Park area occurred a few months before the audit so all four of us travelled with Mr. Kirk to the field site at Rocky Mountain National Park. The site operator (Ms. Dyan Harden) and backup operator (Ms. Michelle Gillis) were unable to meet us for the TSA. Mr. Kirk and Mr. Slate were able to answer all of the questions since both are field specialists with the CASTNET program. The ROM406 site has been collecting ozone data since July 1, 1987 and was a National Atmospheric Deposition Program (NADP) site since December 20, 1987. This is the second contract period that ARS has been providing oversight support. As we drove to the site and at the 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 with Mr. Kirk and Mr. Slate.

Operations at the site are performed by following Weekly Station Visit Checklist and Multi-point Calibration Checklist on the DataView log. The CASTNET and ARS GPMP QAPPs and current field SOPs are stored on DataView system on the site's laptop. There are no hard copies of old (obsolete) or current SOPs maintained at the site. The site operators were not available to discuss how they were trained, but Mr. Kirk state the site operators are trained by the previous site operator, during new site or relocation setup, and every 6-month calibration. The only training documentation is reported in Section 8 of the Semiannual Site Visitation Checklist (see **Exhibit 4**). Maintenance and repair work on instruments is performed at the monitoring site if possible by the field specialists. When repairs are not possible onsite, equipment is brought back to the ARS Ozone Calibration Laboratory, which serves as the centralized maintenance and repair facility.

Site Description

There are two shelters at the site and three towers. The first shelter houses the ozone analyzers, desk, and data logger system for the primary ROM406 station. The second shelter houses the collocated ROM206 station. There is a tower for each filter pack assembly and a meteorological tower. A tipping bucket, nephelometer, and camera are mounted on the ROM406 shelter. Natural terrain 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 pine trees all around the site.

Exhibit 4. Copy of the Semiannual Site Visitation Checklist

SEMIANNUAL SITE VISITATION CHECKLIST
NPS Ambient Air Quality Monitoring Program



Station: _____ Visit Conducted By: _____
 Station Operator: _____ Site Visit Dates: _____

1. SHELTER AND TOWER INTEGRITY (verify condition and proper operation)

ITEM	CORRECTIVE ACTION
<input type="checkbox"/> Shelter Exterior (roof, siding, door, etc.)	
<input type="checkbox"/> Shelter Interior (floor, walls, ceiling, door, racks)	
<input type="checkbox"/> Shelter Electrical (outlets, lights, grounding, polarity)	
<input type="checkbox"/> Shelter Heating and Air Conditioning (inspect, clean, check thermostats)	
<input type="checkbox"/> Meteorological Tower (supports, guys, hardware, grounding)	
<input type="checkbox"/> Flow Tower (supports, guys, hardware, grounding)	
<input type="checkbox"/> Other:	

2. SUPPORT SYSTEM INTEGRITY (verify condition and proper operation)

ITEM	CORRECTIVE ACTION
<input type="checkbox"/> Lightning Protection Panel (LPP)	
<input type="checkbox"/> Quality Assurance Monitor (QAM), STP Monitor	
<input type="checkbox"/> Power and Telephone Lines	
<input type="checkbox"/> Interconnect Cabling (tower and shelter)	
<input type="checkbox"/> Intake and Exhaust Manifolds (if applicable)	
<input type="checkbox"/> Other:	

3. AIR QUALITY EQUIPMENT CALIBRATIONS/MAINTENANCE

Pre Cal.	Maint. Completed	Post-Cal.	ITEM	CORRECTIVE ACTION
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	O ₃ Analyzer	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	O ₃ Transfer Standard	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Consumable Reagents Replaced (charcoal/dessicant)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Clean or Change Inlet Tubing	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other:	

4. DRY DEPOSITION SAMPLING EQUIPMENT CALIBRATION/MAINTENANCE

Pre Cal.	Maint. Completed	Post-Cal.	ITEM	CORRECTIVE ACTION
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sampling System Leak Check	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Flow Controller Calibrated (pre and post values must be documented)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Replace Balston Particulate Filter	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Rebuild Pump	

5. METEOROLOGICAL EQUIPMENT CALIBRATIONS/MAINTENANCE

Pre Cal.	Maint. Completed	Post-Cal.	ITEM	CORRECTIVE ACTION
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Wind Speed Range (4 point)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Wind Speed Starting Threshold	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Wind Direction Orientation and Linearity (8 point)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Wind Direction Torque	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Temperature Probes (3 point)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Relative Humidity Sensor (hourly averages)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Aspirators (Climatronics/Qualimetrics/RM Young/Rotronics)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Solar Radiation (hourly averages)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Precipitation	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Wetness	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other:	

-- Continued --

Exhibit 4. Copy of the Semiannual Site Visitation Checklist (Continued)

SEMIANNUAL SITE VISITATION CHECKLIST
NPS Ambient Air Quality Monitoring Program



6. DATA ACQUISITION CALIBRATIONS/ MAINTENANCE/ OPERATIONAL VERIFICATION

Pre Cal.	Maint. Completed	Post-Cal.	ITEM	CORRECTIVE ACTION
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Datalogger Time and Date	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Datalogger Keyboard (operations test, cleaned)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Datalogger Modem	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	DataView System (computer operational, software functioning, communication links functioning)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Printer (operations test, ribbon, cleaned)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Other:	

7. STATION MODIFICATIONS AND CONFIGURATION ENHANCEMENTS

Pre Cal.	Maint. Completed	Post-Cal.	ITEM	CORRECTIVE ACTION
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

8. OBSERVE/TRAIN STATION OPERATOR

	ITEM	CORRECTIVE ACTION
<input type="checkbox"/>	Observe Operator Competence	
<input type="checkbox"/>	Review Log Notes, Data Documentation	
<input type="checkbox"/>	Train, if necessary	
<input type="checkbox"/>	Review Changes in SOPs or Other Operational Changes	
<input type="checkbox"/>	Verify That On-Site SOPs are Available and Complete	
<input type="checkbox"/>	Encourage/Answer Station Operator Comments or Questions	
<input type="checkbox"/>	Inform Operator if Additional Action is Required	

9. VERIFY AND UPDATE SITE EQUIPMENT INVENTORIES AND DOCUMENTATION

	ITEM	CORRECTIVE ACTION
<input type="checkbox"/>	Inventory Completed	
<input type="checkbox"/>	Site Documentation Photographs Taken:	
	- Cardinal Directions	- All Other Exterior Instrumentation
	- Shelter Exterior Close-up	- Interior Instrumentation
	- Tower(s) with Instrumentation	- Scenic Photograph

10. SUPPLEMENTAL FLOW CHECKS (please note)

Pre Cal.	Maint. Completed	Post-Cal.	ITEM	CORRECTIVE ACTION
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

Semiannual visit checklist.doc (01/08)

-- End --

Rocky Mountain National Park (ROM 406) Measurements
(Distance measurements and compass directions are from the ozone inlet on the 10-m tall tower)

Items	Compass Degrees	Distance (m)	Height (m)
A. ROM206 station shelter (center)	45	7.5	2.44
B. Meteorological tower	120	29	10
C. Tipping bucket on ROM406 shelter	130	4	3.35
D. ROM406 station shelter (center)	75	.1	2.44
E. Camera	140	2.4	2.5
F. IMPROVE sampler	50	3	2.3
G. Nephelometer	27	1.1	4.0

See Appendix A for responses to questionnaire and Appendix B for photos of the ROM406 site.

FINDING 1:

It was not apparent that all field specialists completed the required checklists in the Field Calibration SOPs.

Discussion:

In conversations with Mr. Kirk and Mr. Mike Slate, it was inconclusive if all field specialists were completing the required checklists or forms in the Field Operation SOPs. Several of these checklists revolve around the 6-month calibration. There are checklists:

- SOP 3000 “*Procedures for Semiannual Maintenance Visits to a National Park Service Ambient Air Monitoring Station*”
 - Semiannual Site Visit Pre-trip Preparation Checklist
 - Semiannual Site Visitation Checklist
 - Equipment Maintenance/Repair Record
 - NPSAIR Capital Equipment Inventory Checklist
 -
- SOP 3050 “*Siting of Ambient Air Quality Monitoring Stations*”
 - Information Management Center (IMC) New Site/Site Relocation Form
- SOP 3100 “*Calibration and Routine Maintenance of Thermo Environmental Instruments Model 49c or 49i Ozone Analyzers*”
 - Pre-maintenance Ozone Calibration Form
- SOP 3160-2100 “*Calibration of ESC 8816 or 8832 Analog Input Card*”
 - ESC Voltage Analog Input Card Calibration Check Form

Some of these checklists are electronic and others are hard copies. There are also checklists in the SOPs for equipment used at the NPS site that have been updated and replaced. Thus, the checklists are outdated.

RECOMMENDATION:

These SOPs and checklists should be reviewed and updated based on a designed and approved schedule. ARS should have a training session conducted by the QA Manager to explain the forms and their proper completion, review, and storage. Old checklists should be removed from the SOPs and completed examples of the current checklists should be added to the ARS SOPs and ARS GPMP QAPP.

FINDING 2:

There are no formal training records for the NPS field operator, but training is provided by the field specialists during the 6-month calibration based on the Semiannual Site Visitation Checklist form.

In Section A.8 of the ARS GPMP QAPP “*Gaseous Pollutant Monitoring Program Quality Assurance Project Plan (QAPP)*” states that NPS site operators are trained on-site by ARS field staff, but does not describe in detail the method for training, the frequency of the training, or where the training records will be maintained.

In Section 4.2.8 of the ARS SOP “*Procedures for Semiannual Maintenance Visits to a National Park Service Ambient Air Monitoring Station*” states:

Following the completion of all scheduled calibrations and maintenance, spend as much time as required with station operators to ensure that the operators have a complete and working knowledge of their required duties. The overall quality of network operators directly translates to the quality of network data. The field specialist will:

- **Observe operator** – Observe the operator perform a complete station check and review procedures for zero checks, precision span checks, and multipoint calibrations.
- **Review log notes**- Review operator log notes, station checklists, calibration forms, other data documentation, and overall station organization.
- **Train**- Further train the station operator on any aspect of multipoint calibrations, precision checks, data reporting, data transmittal, or other operational requirement where deficiencies are observed.
- **Review changes**– Thoroughly review any changes in SOPs or operations with the station operator.
- **Verify on-site SOPs**- Verify that the current versions of all SOPs are available on-site, and update if necessary to reflect any changes in instrumentation, procedures, or protocols.
- **Verify inventory**- Verify that the operator has an adequate inventory of all required forms and consumable supplies, including desiccant, particulate filters, gloves, printer ink, and similar items.
- **Encourage/answer questions** – Encourage station operator comments and fully answer any questions the operator may have. Note any operator comments or suggestions.
- **Inform** - Update the operator on the monitoring program goals and objectives. Instill in each operator a sense of purpose to stimulate self-interest and responsibility.

The field specialist checks the blocks and documents the corrective action. The training record process is not complete until the site operator signed and dates the form acknowledging the training was received.

Discussion:

At the ROM406, site, Mr. Kirk and Mr. Slate stated the site operators are trained three different ways: 1) From previous site operator, 2) during new site or relocation setup, and 3) every 6-month calibration. Since the site operator was not present during the onsite visit, the RTI auditor could not confirm with her (Ms. Dyan Harden) the method she was trained. ARS also does not maintain or track NPS training records. The only trackable method for determining the site operator’s training would be through the Semiannual Site Visitation Checklist. The items for the field specialist to choose from are listed in the finding.

RECOMMENDATION:

The training regimen is there, but not describing the type of training performed or having the site operator sign and date the Semiannual Site Visitation Checklist form as acknowledgment of receiving the training does not complete the record. The type of training needs to be documented as well as the field operator signing off and dating the checklist. ARS could add a signature box at the end of the Semiannual Site Visitation Checklist form as well as a comments box that would explain the type of training provided during the visit. These forms are already maintained on the primary server at ARS and the information regarding the training provided by the field specialist can be documented to provide field operator training support. During the next 6-month visit, the field specialist can re-assess the progress of the field operator based on the previous training.

Section 5: Laboratory Operations (Ozone Calibration Laboratory)

The Ozone 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 Ozone 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 ARS 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 ARS 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 four transfer standards and annual recertifications all of which are maintained in the database of certifications on the ARS server. Besides the ozone analyzers, the Ozone Calibration Laboratory also uses and tracks 15 flow meters (BGI tetraCals, BGI deltaCals, and BIOS Definer 220 units that are certified by BGI and MESA Labs), 12 temperature sensors certified annually at Micro Precision, and 3 barometric pressure sensors (2 within certification from Micro Precision) (see **Exhibit 5**).

Exhibit 5. Standards Used by ARS on CASTNET Program

		Manufacturer S/N and EPA Decal Number	Last Certification Date
Level II Transfer Standards			
1	Thermo 49i PS	S/N: 1130450195	June 5, 2013 by US EPA in RTP, NC by Scott Moore using NIST SRP (NIST certified on April 18, 2013)
2	Thermo 49i PS	S/N: 1130450196	June 5, 2013 by US EPA in RTP, NC by Scott Moore using NIST SRP (NIST certified on April 18, 2013)
3	Thermo 49i PS	S/N: 1130450197	July 15, 2013 by US EPA in RTP, NC by Scott Moore using NIST SRP (NIST certified on April 18, 2013)
4	Thermo 49i PS	S/N: 733726105	July 15, 2013 by US EPA in RTP, NC by Scott Moore using NIST SRP (NIST certified on April 18, 2013)
Laboratory-Controlled Standards			
1	Thermo 49C	S/N: 75759-380	June 27, 2013
2	API 700EU	S/N: 59-S	June 27, 2013

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

During the TSA of the Ozone Calibration Laboratory, the RTI auditor could not find any discrepancies in the operations as stated in the CASTNET QAPP or the ARS SOPs (Appendix 3 of the QAPP).

FINDINGS

No problems or issues base on the visit to the view of the Ozone Calibration Laboratory and discussions with ARS staff.

Section 6: Data and Data Management

Introduction

The evaluation of the data management system for ozone data was conducted by Mr. Poitras that included a visit to the ROM406 site, a review of the ozone raw data records from the site and a comparison of the data posted to AIRNow, CASTNET, the NPS Air Resource Division website and EPA's Air Quality System (AQS) database. He also performed a review of the overall ozone data management system and QA/QC validation procedure from the site through ARS to final data submission. The overall quantity and quality of CASTNET's project documentation was impressive, and the ARS 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 Reviewed

The audit of the data review and data management was comprised of five parts: Data Handling/Review, Software Documentation, Data Validation and Correction, Data Processing/Reporting, and Internal Reporting as well as tracking selected data from a site (ROM406) through data review, validation, and posting. ARS has prepared and documented SOPs designed to cover each of these sections and in most cases, multiple SOPs and Technical Instructions (TIs) that discuss the different components of the audited sections. All data review and data management SOPs are available on the CASTNET website, but the posted SOPs were last reviewed in April 2011. Ms. Jessica Ward, the IMC Data Manager, provided the RTI auditors with electronic copies of the most recent updated versions dated October 2013. There appears to be a disconnect between the SOPs posted to the CASTNET website and the operational SOPs currently being used by the ARS staff (this will be discussed in Section 7 findings). Ms. Ward did inform the RTI Auditors that some revised SOPs have been updated, reviewed, and posted to the ARS staff, while others are going through the revision process.

Part 1 Data Handling/Review and Part 2 Software Documentation of the audit questionnaire, followed the processes involved with the transferring data points from the ozone analyzer through to the Air Quality Data Base Management System (AQDMBS). The data handling process involves transferring of data through three primary devices: the ESC datalogger, the DataView software housed on a site laptop, and the AQDMBS located at the ARS office location and is covered primarily in SOP 3350 and SOP 3345. A detailed process flow diagram can be found in SOP 3350 Figure 1-1. Software used in the data transfer and review process can be found in SOPs 3340 and 3650, with detailed software information provided Table 3-2 of SOP 3340. After the on-site audit, the RTI auditors were provided electronic updates of SOP 3340 Revisions 4.3 and 4.4 listing the current software. All roll-outs of new software are tested, but no documentation is maintained relating to a design plan, test, plan troubleshooting, and acceptance plan for in-house developed software.

The RTI auditor reviewed and discussed Data Validation and Correction Procedures and Processes (Part 3 of the questionnaire) and Data Processing and Reporting (Part 4) with Ms. Ward and there was no issues observed. The RTI Auditor observed instances where flags were appropriately added to the data and the data remained flagged in the final reporting steps. There exists sufficient validation review levels and each step is well documented in SOPs 3450, 3340 and 3650. Reporting, based on polled results, is also adequate and available in a timely manner.

Internal Reporting (Part 5) steps are documented primarily in SOP 3550. Reports exist for audits (such as Technical System Audits (TSAs), 6-month site calibrations, maintenance review, etc.) and are distributed and discussed among the various personnel. The overall quantity and quality of the ARS project documentation was impressive, and the personnel who assisted with the audit were knowledgeable and helpful. The data management audit looked at several of the steps involved the operation and verifying and comparing selected data, including calculated ozone concentrations, validity flags and status codes, and date/time stamps. Data were compared at the following points in the on-site process:

- "raw" data from site datalogger, viewed and recorded by auditors while at the site

- "raw" data from site datalogger, provided by ARS operator at the site off the data collection laptop housing DataView software
- data extracted from the in-house database

In addition, data were polled from external EPA and NPS databases after uploading from the contractor's database. While each website contains multiple collection parameters and time durations, only hourly ozone data reported was tracked for this audit.

- 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 ARS SOP 3350 "Collection of Ambient Air Quality and Meteorological Monitoring Data" Revision 5.1, April 2011.
- EPA AQS system
This is the final repository of fully validated data for compliance and reporting purposes. ARS uploads data to AQS as described in SOP 3550 "Ambient Air Quality and Meteorological Monitoring Data Reporting", Revision 5.1, April 2011.

NOTE: Unlimited access to AQS requires an EPA approved account, but subsets of the data are available to the general public through EPA sites such as AQS's DataMart described in the next bullet.

- DataMart (<http://www.epa.gov/ttn/airs/aqsdatamart/>)
This public EPA website can be accessed by means of an easily obtained username and password, through which hourly ozone data (among multiple other parameters) are available. One limitation of the DataMart is lack of information regarding data flags, submitting agency, and submitted date. Information available to DataMart is readily available after submission to AQS. Files containing hourly Ozone data for the ROM406 site were downloaded from DataMart for comparison with the hourly data.
- AIRNOW (<http://www.airnow.gov>)
This site is a valuable resource which allows public access to real-time ozone and meteorological data. Unfortunately it has a severe limitation in regards to the level of access to previously reported data; any data beyond after a single day of collection is not readily available. Similar to DataMart, there exists a site which requires an easily obtained username and password and is linked directly to AIRNow. Some of the reported information contained in this report is taken from this site (<https://ofmext.epa.gov/AQDMRS/aqdmrs.html>).
- NPS Air Resource Division collects hourly data (www.nature.nps.gov/air/data/current/index.cfm)
This site includes 8-hour averages and timeline trends. Validated data is also available and updated monthly through <http://ard-request.air-resource.com/data.aspx>.

Site ID's used in all data queries are as follows:

- AQS ID: 08-069-0007
- NPS ID: ROMO
- CASTNET ID: ROM406

Data Evaluation Activities of Typical Reports:

RTI reviewed data streams from the ozone analyzers at the monitoring sites to the posting on several databases. The evaluation of the data reporting system for ozone was reviewed on-site portion during the site visit and laboratory audit and off-site during the post-audit review by Mr. Poitras. A comparison of raw data from the ozone analyzer through each of the controlling devices was compared to each other and the 1-minute collected data was averaged to hourly results that were compared to data posted to NPS, CASTNET, and AIRNow. The results of this review are summarized in **Exhibit 6** and **7**.

Exhibit 6. Real-Time Ozone Readings

Date/Time	Observed Thermo 49i Reading (PPB)	Observed ESC Datalogger Reading (PPB)	Observed DataView Reading (PPB)
October 29: 9:58:25	30.17	30.2	No one-second data recorded by auditor
October 29: 9:58:35	33.51	33.5	No one-second data recorded by auditor

Exhibit 7. Hourly Non-Validated Data

Date/Time (local time)	Observed DataView Reading (PPB)	Calculated DataView Reading (PPB)	AIRNow Value (PPB)	NPS Value (PPB)	CASTNET Value (PPB)
10-29-13/07:00 ^a	-	-	-	-	-
10-29-13/08:00	19.4	19.4 ^b	19 ^c	19	19
10-29-13/09:00	40.4	40.4	41 ^c	40	40

^aNo values reported due to scheduled instrument maintenance.

^bTwo one-minute points were flagged by datalogger and excluded from calculation.

^cAs detailed below, value are not an accurate representation of the site.

Ozone data values read directly from the Thermo 49i primary ozone analyzer by RTI auditor were observed and immediately compared with listed values on the ESC datalogger system. For each instance, there was good agreement. Variations between the two reported values involved the number of significant figures and the interval with which each was updated. The Thermo 49i updated approximately every 3 seconds and values of 30.2 PPB and 33.5 PPB were observed, while the datalogger updated every second and had values of 30.17 PPB and 33.51 PPB respectively. Comparative Ozone values between the ESC datalogger and values displayed on the site laptop running the DataView software were also made with no discrepancies or flags observed.

One-minute data was collected from the DataView software from October 29, 2013 at 00:00 a.m. to October 29, 2013 at 10:34 a.m., which coincides with some of the time RTI Auditors were at the site. From this minute data, hourly averages from 7:00 a.m. – 9:00 a.m. were manually calculated. Each of these averages agreed with hourly points collected from DataView. During the collection of the 8:00 a.m. data points, the system was taken down temporarily for maintenance. These points were observed to be flagged and were removed from the manual calculation.

A comparison was made on-site using the site laptop internet connection to data posted to AIRNow at 9:00 a.m. It was discovered the reported value was 41 PPB. Ms. Ward of ARS has subsequently contacted Sonoma Tech and learned that the value posted to the “Rocky Mountain National Park” site on AIRNow is actually a forecasted value from multiple sites in the vicinity of ROM406 and is not an actual measured concentration. The next day, the 9:00 am measured value was checked and had an accurate value of 40 PPB.

Comparison of the data from the site laptop to the NPS website for the 9:00 a.m. measurement on October 29, 2013, yielded the expected 40 PPB value at the 11:00 am time point. The time reported on the NPS website is defined as “time hour ending”. When accounting for the lack of Day Light Savings time adjustment at the site and the one hour difference between hour-ending and hour-starting, the result comparisons are as expected.

A further comparison of the October 29 values was conducted at the 7:00 a.m. time point. In this instance, there was an instrument collection down time of more than 15 minutes (scheduled down time) causing no data point to be reported. Raw data from the site had more than fifteen one-minute points excluded by a datalogger flag, this time point (7:00 a.m. AIRNow, 9:00 a.m. NPS) was excluded on both sites.

RTI also reviewed audit trails for three selected dates (May 15, 2013, August 14, 2013, and October 16, 2013) comparing supplied data from ARS against the posted, final validated data on the AQS and NPS sites. The results of this comparison are summarized in **Exhibit 8**.

Exhibit 8. Hourly Reported Data

Date/Time (local time)	ESC Datalogger (PPB)	Raw Data from IMC Database (PPB)	Validated Data from IMC Database (PPB)	AIRNow Value (PPB)	NPS Value (PPB)	CASTNET Value (PPB)	AQS Value (PPB)
May 15 / 08:00	54	54	54	54	54	54	54
May 15 / 09:00	56	55	55	55	55	56	55
August 14 / 16:00	-	56	-	56	56	56	56
August 14 / 17:00	-	58	-	57	57	57	57
October 16 / 13:00	-	46	-	-	-	45	-
October 16 / 14:00	-	47	-	-	-	47	-

After real-time data reviews were satisfactorily tracked, recent historical information was pulled and cross-verified starting with ozone data from August 14, 2013. Raw hourly data was pulled from the site laptop during the site visit and validated hourly data was queried from the various website listed earlier in report. All data points observed (between raw, NPS, CASTNET, and AQS) were either equal in value or within 1 PPB of each other (see Exhibit 8 for examples). It is suspected variations are likely attributed to rounding differences between raw data (off the site laptop) and reported data (websites), or are attributed to slight value adjustments made during the data validation process. Since reported validation codes are not available values changed by validation adjustments cannot be verified. Due to the minimal amount of change in the values, this is not considered a finding.

Data from May 15, 2013 and October 16, 2013 were also queried for comparison. In the case of the October 16, 2013 values, the validated data had not been submitted at the time of the writing of this report. It was observed that values from the site laptop did match CASTNET data with the same infrequent 1 PPB value difference discussed above.

For the May 15 date, data from the ESC datalogger, the site laptop, validated data from the IMC database, CASTNET data, AQS data, and NPS data were all available and used for comparison. In most instances all data matched up across the board for any given hour. Multiple hourly points had good comparisons between the datalogger, site laptop and CASTNET data, while exhibiting a 1 PPB difference from the IMC database, AQS, and NPS.

Based on all the data points collected there exists good cross-agreement from all reporting agencies, and the data collection to submission process detailed in ARS SOP 3550, appears to work as intended.

Data Evaluation Activities of Incorrectly Reported Data:

There were two instances of instrument malfunctions at the ROM406 site were disclosed to the RTI Auditors during the audit. The first issue was based on a PE audit performed by EE&MS on June 10, 2013 where a wind direction failure was observed and reported. Reported data has not been updated or flagged at the time of the writing of this report. An ARS calibration check was performed a few months later and the issue was confirmed. The second issue occurred for data points from April 13, 2012 to August 21, 2012 for the ambient temperature sensor measurements. The RTI Auditor observed in the IMC database program the validation codes changed from “V” (valid) to “IM” (Instrument Malfunction). Data viewed in CASTNET, NPS and AQS have been removed for this parameter for April 14, 2012 (other dates were not checked but it is assumed all data has been removed for this site & parameter). In both cases the issues were resolved, but the timeliness and the method of updating data may need further evaluation to improve efficiencies.

FINDING 1:

ARS does not have an SOP that outlines a test plan for evaluating software updates and testing changes. There is no formal documentation tracking the changes or updates, thus no results of any recent updates. Software development is performed in-house (no commercial company) and is verified, but not documented.

Discussion:

Ms. Ward stated that any changes to the data process are thoroughly tested by a minimum of the database programmer plus the IMC manager before the changes are released for use. Requirements related to the update were provided to the software developers by the IMC manager and discussed to ensure understanding. The software developers made the required updates in the appropriate software application modules, and tested both the modified modules and the entire application within the development environment using test monitoring sites and configurations based on real monitoring sites. Data values were compared between the test sites using the updated software and the real monitoring sites using the production software. The updated software was then published in a test environment, used on the test sites and a subset of real monitoring sites, and closely monitored by the software developers and IMC staff until all were confident the update was working correctly. The updated software was then put in place as the production software.

SOP 3340 “*Information Management Center (IMC) Concept and Configuration for the National Park Service Gaseous Pollutant Monitoring Program*” states under the responsibilities of the Database Manager to:

- Design, develop, implement, test, and maintain database, data acquisition, data communications, site documentation (DataView), trip report forms, and applications software to meet evolving program needs
- Ensure that all software licenses and updates are current
- Maintain and upgrade project and request Website hardware configurations and software.

SOP 3340 does not state where the design plan, test plan, and results are maintained.

RTI Auditors are satisfied that prior to implementation of internally developed new software packages and/or changes in programming scripts, each are fully tested by multiple qualified personnel prior to field implementation.

RECOMMENDATION:

In Section 14.0 Data Management of the *Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, December 2008 (QA Handbook)* discussed the importance of validating and testing your software programs. The Database Manager (Database programmer) and IMC Manager validate that changes to the software after updates or changes do not affect the quality of the data measurements and calculations, but the design plan, test plan, and results of the test should be documented and maintained to demonstrate the software is within compliance.

While a single form to document testing parameters is likely impossible (due to the variability and likely complexity of all potential software development packages), it is recommended that any tests performed as part of the testing procedure are documented in some manner and stored for future review.

FINDING 2:

An occurrence of data not being invalidated or flagged in reporting databases (Data for wind direction based on June 10, 2013 audit has not been invalidated or flagged in reporting databases). As of November 12, 2013, these data have not been flagged.

Discussion:

Ms. Ward stated the data will be invalidated back to the last good check. At the time of the TSA, the ARS trip report from August confirming the audit finding in June had not yet been finalized and released to IMC.

The result of the audit is first verified to determine that it was an accurate result. In this case, the audit result was confirmed by the ARS calibration check that was done a few months later. These types of results are reviewed monthly when validating data, but the results are usually available after data have been “finalized” for the month. In this case, the corrections are generally made as soon as the result has been confirmed and the appropriate course of action has been determined, and always prior to preparing the annual report and beginning the annual data certification process.

There exists adequate SOP's and Technical Instructions for submitting data to AQS (and other supporting agencies), however the timeliness of resubmitting invalidated data should be addressed. ARS personnel informed RTI Auditors that the Trip Report from August confirming the wind direction issue had not been finalized, so no action to the data could take place.

RECOMMENDATION:

Follow your SOP and determine the root cause of the problem and provide the necessary documentation to validate or invalidate the data for this particular event. Updating SOP's to include information on specific invalidation steps after a found instrument failure, and time frame to complete steps should be added. If timeliness is still insufficient, additional unscheduled site audits may be needed to expedite data invalidation process.

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 audits and assessments; databases and back-up copies on AMEC servers; and records of e-mail transmittals.

On the CASTNET website, the current CASTNET QAPP and supplementary SOPs are in the 8.1 Revision and dated July 2013. 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 ARS GPMP QAPP was prepared in July 2009 and also follows the EPA Guidance Document “*EPA Requirements for Quality Assurance Project Plans EPA QA/R-5*.” This document was provided by the ARS QA Manager during the TSA. It closely follows the management structure and steps outlined in the ARS SOPs. This document is not posted on the CASTNET website and needs to be reviewed, updated, and submitted for approval by ARS and NPS management. Finding 1 below outlines some key issues and concerns that need to be updated in the ARS GPMP QAPP.

The CASTNET website lists the entire current ARS SOPs in Appendix 3 of the QAPP (October 2010). These SOPs are to be reviewed annually, but the ARS SOPs on the website are outdated and need reviewed and updated. The current ARS SOPs are dated October 10, 2011, but during the TSA, staff provided revisions to the SOPs posted on the CASTNET website. Since a new QA Manager has taken over at ARS, there appears to be a disconnect between who is responsible for updating vs. posting the SOPs to the website. The CASTNET QA Manager (Mr. Stewart) and new ARS QA Manager (Mr. Kirk) will discuss the issue of posting current ARS SOPs and develop a process to be followed in the future.

Audit and Assessment Program

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

Quality assurance is a management or oversight function; it deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities, and

the use of data in decision making. Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications that are needed to acquire data of known and adequate quality. As stated in Section 5, all onsite 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 month. 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 ROM406 site, the last 6-month calibration prior to the TSA was conducted on August 20, 2013 (see **Appendix D**) and the last PE by EEMS was performed on June 10, 2013 (see **Appendix E**). **Exhibit 9** below states the acceptance criteria for each of the assessments performed at the CASTNET monitoring sites.

Exhibit 9. Acceptance Criteria for Calibration and Audit Checks

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	± 1.5 ppb for levels 1 and 2 and $\pm 10\%$ for all other levels

ARS 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. ARS 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 AIRNow, NPS, and AQS. By applying some improvements in the current practices such as developing a schedule to review all QA documentation (QAPP and SOPs); tracking training record of the site operators through the Semiannual Site Visitation Checklist form; conducting follow up training with the site operators and field specialists; using the proper checklists and forms during the 6-month audits; developing a process to post the current ARS GPMP QAPP and ARS SOPs to the CASTNET website in a timely manner; and documents design plans, test plans, and results of test when evaluating software updates and changes will help ensure that these practices continue in the future.

FINDING 1:

Prior to the TSA, RTI reviewed the QAPP and ARS SOPs posted on the CASTNET website. During the TSA, ARS also presented the RTI auditors with the ARS GPMP QAPP. After a complete review of all QA documents (CASTNET QAPP, ARS GPMP QAPP, ARS SOPs, and checklists used by ARS staff and NPS site operators), RTI has the following findings:

1. The ARS GPMP QAPP is not listed on the CASTNET website. This is the primary quality management document that the ARS management and staff and NPS site operators use for their quality system.
2. Both of the QAPPs need to update the organizational charts for the NPS and ARS management and staff involved with the CASTNET program.

3. The CASTNET QAPP has information regarding ARS activities and involvement at the NPS sites, but there is no ARS management signature on the approval page.
4. The ARS GPMP QAPP is dated July 2009 and needs to be reviewed, updated, and approved by NPS and ARS
 - General issues: In reviewing the ARS QAPP, many tables, diagram, and exhibits are displayed several pages after the discussion of the table, diagram, or exhibit. To make it easier for the reader, it might be more straightforward to add the table, diagram, or exhibit right after the text in the QAPP. For instances, the organizational chart (Figure A4-1) is mentioned on page 10, but the reader needs to turn to page 27 to see the chart. Between pages 10 and 27 is the complete Section A text with all project management responsibilities.
 - Cover page: The QAPP is outdated (July 2009) and a reviewing schedule needs developed for the future reviews)
 - A1: Are management listed still involved?
 - A: QA/G-5 has been updated
 - A3: Staff involved and last paragraph states QAPP will be reviewed annually
 - A4: Network QA Manager Organizational chart shows independence from technical work, but there is no discussion in the text. Is the QAM only responsible for overseeing QA documentation? Who is responsible for reviewing internal and external audits and assessments and overseeing corrective/preventive actions are remedied? Are these responsibilities of the QA advisor or QA Coordinator? There are several types of audits discussed, who oversees these audits, tracks them, and determines if corrective action steps were performed successfully?
 - A4: QA Coordinator has very little responsibility and should have some of the tasks listed for the QA Manager
 - A6.1: Confirm number in paragraph starting, “As of July 1, 2009... “ are still correct.
 - A6.2: Independent Field Performance Audits-Discuss where the results of these audits are maintained and how used towards the QA program.
 - A6.2: CASTNET Program Auditor-Discuss where the results of these audits are maintained and how used towards the QA program.
 - A6.2: EPA NPAP audits-Discuss where the results of these audits are maintained and how used towards the QA program.
 - A6.2: TSAs-Are these TSAs really being performed and at this frequency? Be careful of listing all of these audits. If they are listed in the QAPP with a time line, they need to be completed and results need to be maintained for reviews.
 - A6.2: Data Management Assessments-Document how tracking is performed.
 - A6.2: Statement-These documents are reviewed and revised (if necessary) annually.
 - A8: More information on where training records for ARS and NPS staff are maintained
 - A9: Do you have hard copies of any data or forms?
 - Section B-watch mentioning SOPs by number, just in case they may change or be removed.
 - References: check for more current documents
5. The ARS SOPs posted on the CASTNET website are not current. The supporting checklists for the ARS staff and NPS site operators need to be reviewed to determine if these checklists are still being used properly.
6. There is a lack of communication between ARS and AMEC on the process and responsibilities for posting the most recent versions of the ARS SOPS to the CASTNET website.

Discussion:

Prior to the TSA, RTI was informed that the current CASTNET QAPP and ARS SOPs were posted on CASTNET website. During the TSA, the ARS GPMP QAPP was presented to RTI that closely matches the ARS SOPs and activities. The RTI auditor did not ask either Mr. Stewart or Mr. Kirk if they have considered adding the ARS GPMP QAPP to the CASTNET site as a point of reference for personnel involved with the NPS sites.

The organizational charts for ARS and NPS management and staff needs updating in both QAPPs. Mr. Kirk provided the RTI auditor a copy of the most recent ARS-NPS organizational chart involving the CASTNET

program during the TSA. A copy of the organizational chart can be found in Section 3.

The CASTNET QAPP is up-to-date (Revision 8.1 dated July 2013) and discussed the ARS activities and their involvement at the NPS sites. In reviewing the approval page, there are no ARS management approval signatures, some management personnel are no longer with the program, and the signatures are dated for February 2011.

The RTI auditor discussed with Mr. Kirk that the ARS GPMP QAPP needs to be reviewed, updated, placed on a reviewing schedule, and submitted to upper management and NPS for approval. The RTI auditor reviewed the QAPP and has provided some of the issues and concerns in Section 7 of this report.

Based on a conversation with Mr. Marcus Stewart (AMEC) and Mr. Kirk, a process will be re-established for the posting of current ARS SOPs to the CASTNET website. ARS will establish an annual reviewing process for reviewing and updating SOPs. Mr. Kirk is aware of the outdated SOPs and as time allows will review SOPs and return the process to annual reviews. Mr. Kirk will also review the checklists listed in the Field Calibration SOPs to determine if these checklists are still be used and are valid. There have been some equipment upgrades that have made some of the checklists outdated. Ms. Jessica Ward provided RTI with updated revision of SOP 3340 (Revision 4.3 in March 2012 and Revision 4.4 in October 2013) that were not posted on the CASTNET website. ARS SOPs to the CASTNET website was undetermined.

RECOMMENDATION:

AMEC and ARS management need to discuss if there are enough differences in each of their quality management systems to determine if it is necessary to have the ARS GPMP QAPP also posted on the CASTNET website. It could be beneficial because the information provided in the ARS GPMP QAPP closely matches the activities conducted by ARS staff at the NPS sites. Both QAPPs (CASTNET and ARS-NPS) need to be updated to include the current ARS-NPS organizational chart. The CASTNET QAPP also needs changes and corrections to the CASTNET QAPP approval page (changes in personnel and adding ARS management representative, reviewed with updated approval signatures) and change or explanation of company name change from MACTEC to AMEC. The ARS GPMP QAPP prepared in July 2009 needs reviewed, updated, and sent through ARS and NPS for approval. A reviewing schedule needs to be developed and followed. If it is decided to post the ARS GPMP QAPP to the CASTNET website, a process will need to be developed. The ARS SOPs need reviewed, updated, and submitted for approval to ARS management. All checklists need to be verified with the field specialists that they are still being used. Updated examples of the checklists need to be added to the ARS GPMP QAPP and ARS SOPs. Along with the process to post the ARS-NPS QAPP to the CASTNET website, the current ARS SOPs also need to be posted. This process should be documented in both QAPPs.

APPENDIX A

Rocky Mountain National Park (ROM 406) 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

<u>Part</u>	<u>Title</u>	<u>Page No.</u>
1	General Information	2
2	Basic QA/QC	3
3	Network Management.....	13
4	Specific Sampling Criteria (Ozone Sampling).....	15
5	Sampler Siting	25
6	Data Management	28

This audit form was prepared by RTI International (RTI) to evaluate the technical systems for ozone measurements at the CASTNET air monitoring sites operated by Air Research Specialists, Inc. (ARS). This form will be used to evaluate the QA/QC documentation, network management, basic site operations (ozone specific), sample siting requirements, and data management at the Rocky Mountain National Park (NP) (ROM406) in Colorado and the ARS CASTNET Ozone Calibration Laboratory. 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 site (ozone activities), CASTNET Calibration Laboratory (ozone), and data management system for ozone reporting to EPA AQS. Those appendices are:

- Appendix 1 CASTNET Field SOPs,
- Appendix 3 ARS SOPs, and
- Gaseous Pollutant Monitoring Program Quality Assurance Project Plan (QAPP).

Part 1. General Information

Monitoring Site Information

NAME/LOCATION OF MONITORING SITE: (Ozone): Rocky Mountain National Park

MONITORING SITE ADDRESS: 7000 Highway 7, Estes Park 80517 at Preservation Drive

MONITORING SITE AQS NUMBER: 080690007 CASTNET SITE NUMBER: ROM406

MONITORING AGENCY AFFILIATION: CASTNET

NAME OF ANALYSIS/SUPPORT LABORATORY: Air Research Specialist (ARS), Inc. in Ft. Collins, CO

AUDIT TEAM MEMBERS/AFFILIATIONS: Jeff Nichol and Eric Poitras (RTI auditors) and Marcus Stewart (AMEC)

AUDIT DATE: October 29 and 30, 2013

PERSONNEL INTERVIEWED:

NAME	POSITION	PHONE/E-MAIL
Site		
Dyan Harden	Site Operator	dyan_harden@nps.gov 970-586-1252
Michelle Gillis	Backup Site Operator	michelle_gillis@nps.gov
ARS Ozone Calibration Laboratory and Data Handling		
Joe Adlhoch	ARS (CASTNET) Project Manager	jadlhoch@air-resource.com 970-484-7941
Christian Kirk	ARS (CASTNET) QA Manager	ckirk@air-resource.com 970-484-7941
Mike Slate	ARS Field Operations Manager	m slate@air-resource.com 970-484-7941
Mike Bagby, Mike Slate, Kelly Blomme, and Mark Valvur	ARS Field Specialists	mbagby@air-resource.com m slate@air-resource.com kblomme@air-resource.com mvalvur@air-resource.com 970-484-7941
Jessica Ward	ARS Information Management Section Manager	jward@air-resource.com 970-484-7941
Emily Wiechmam	ARS IMC Team Leader	ewiechman@air-resource.com 970-484-7941
Courtney Grant	ARS IMC Data Analyst	cgrant@air-resource.com 970-484-7941
Rob Navarro	ARS Data Technician	rnavarro@air-resource.com 970-484-7941
Matt Smith	ARS IMC Air Quality Technician	m smith@air-resource.com 970-484-7941

OPERATIONAL AREAS THAT WERE OBSERVED: Site operator had completed work before our visit.

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 8.1 dated July 2013 ARS also has another QAPP developed for the NPS programs titled "Gaseous Pollutant Monitoring Program Quality Assurance Project Plan (QAPP)", Revision 2 dated July 2009.
2. What is the level of detail Category (i.e., 1, 2, 3, etc.) consistent with EPA guidelines) of the QAPP?				Both are 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			CASTNET QAPP AMEC management (H. Kemp Howell-Project Manager, William Imbur- Project Quality Assurance Supervisor, and Marcus Stewart-Quality Assurance Manager) ARS QAPP ARS management (David Dietrich-Program Manager and Gloria Mercer-QA Coordinator)
7. Has the Regional EPA Clean Air Markets Division (CAMD) Project Officer and QA Officer reviewed the QAPP?	X			CASTNET QAPP Lance McCluney (EPA Project Officer) Larry Kertcher (EPA QA Officer) John Ray and David Maxwell (NPS)
8. Has the CAMD Project Officer and QA Officer approved and signed the QAPP?	X			CASTNET QAPP 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) ARS QAPP No EPA staff signature (Dennis Crumpler)
9. Has the National Park Service (NPS) Contracting Officer's Technical representative approved and signed the QAPP? (Listed on the distribution list)	X			John Ray for both QAPPs David Maxwell on ARS QAPP

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
10. Has the ARS Project Officer and QA Manager approved and signed the QAPP? (Listed on the distribution list; not QA Manager)		X		CASTNET QAPP (Both are listed in the distribution list) ARS QAPP (Both signed)
11. Is the purpose of the QAPP clearly stated?	X			
12. Is the project organization clearly identified with their roles and responsibilities?	X			
13. Is the organizational chart in the QAPP up-to-date?		X		The organizational charts in both QAPPs need to be updated. Mr. Kirk provided the RTI auditor with the current NPS/ARS organizational chart for the CASTNET program and the personnel listed are slightly different.
14. 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			Both QAPPs are stored on DataView system on the site's laptop.
15. Is a signed copy of the approved QAPP onsite and available to the field operator(s)?	X			Electronic version on DataView system.
16. Has the approved QAPP been reviewed (or will be reviewed) on a periodic basis? Ask to see.	X			The ARS QAPP was last revised in 2009 and needs reviewed.
17. Is this review of the QAPP documented (or will it be documented)?	X			
18. Are there amendments or deviations from the approved QAPP?		X		No amendments or deviations.
19. Have they been EPA approved?			X	
20. Are they available for review?			X	
21. Has the QAPP been reviewed or will be reviewed on a periodic basis and re-approved? What is the review/approval schedule?	X			
22. Are reviews/approvals documented? Review.	X			
23. Does the QAPP cover the complete field/laboratory operation for the CASTNET program?	X			
24. 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 monthly multi-verification check, 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. The data from the DataView log is transmitted to the ARS Office. The field specialist and data analyst can view the data in the Site Status log.
25. Are Data Quality Objectives (DQOs) and Data Quality Indicators (DQIs) identified in the QAPP? How are realized?	X			
26. What steps are performed if DQOs are not achieved and maintained?				Audit the issue, determine the problem, and develop a solution.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
27. 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			
28. Are written and approved standard operating procedures (SOPs) in place for the various samplers and analyzers?	X			SOPs need to be reviewed and updated. Some information in the SOPs is obsolete and needs reviewed.
29. 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			
30. Does the SOPs reflect, present and address specifications and operations that are in accordance with those applicable to the CASTNET program?	X			
31. Are the SOPs signed by management and QA staff?	X			
32. Are the SOPs available for review by auditor?	X			
33. Are the SOPs controlled documents?	X			
34. Are signed copies of the SOPs available to the field operator?	X			Electronically stored on the DataView log.
35. Does site operator have current up-to-date SOPs <u>onsite</u> ? Electronic or hard copies.	X			Current SOPs are on the laptop (DataView log), but some SOPs have not been reviewed and revised for over 2 years.
36. Are there deviations from the SOPs?		X		
37. If yes to Question 36, have these deviations been documented and approved?			X	
38. Are documented deviations available for review?			X	
39. Has training been conducted for these SOPs?	X			Training occurs in one of three ways: From previous site operator, during new site or relocation setup, and every 6-month calibration.
40. Is this training documented?				Training is documented on the 6-month (Semiannual Site Visitation Checklist form).
41. Are the SOPs current and up-to-date and met the specifications presented in the CASTNET program?		X		Several SOPs are over 2 years old since last review.
42. Is there a process in place to remove obsolete SOPs? Describe the process and where is it documented.		X		SOPs are updated and changes are listed in Revision History table. Since there are no hard copies of SOPs prepared (all documents are maintained electronically), no obsolete instructions are in SOPs.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
43. Have the SOPs been reviewed on a periodic basis?		X		Prior to 2011, the answer is yes. Recent change over to new QA Officer has caused a delay in reviewing process. The QA Manager is aware of this issue and as time allows will review SOPs and return the process to annual reviews.
44. What are the frequency and the approach?				Was annually until 2011, process has slipped slightly.
45. Is this review documented? (Review).	X			
46. Is there an ARS CASTNET project work organizational chart available? (obtain a copy)	X			In the ARS QAPP.
<p>Additional Comments:</p> <p>1,16. The ARS QAPP is outdated (2009) and needs reviewed and revised. Prior to the revision, ARS should discuss with NPS and EPA if a revision schedule for all quality documents can be agreed upon. This revision schedule will be part of the QAPP and will reduce overall cost and time during document revision and review. The schedule will use annual NPS- and EPA-approved amendments that will be added to the QAPP until a complete revision is performed. ARS QA staff will annually review the QAPP and submit an e-mail to NPS and EPA listing changes from the previous version. Upon their approval, an amendment will be added to the QAPP. After an agreed date such as 3 to 5 years, the QAPP will be revised and all amendments will be included. This new QAPP will be sent to NPS and EPA for approval. If any changes affect the quality of data, the QAPP will be revised immediately and sent for NPS and EPA approval. A list of these data quality changes must be discussed and approved between NPS and ARS management and listed with the revision schedule in the QAPP. All SOPs listed in the QAPP need to be verified that they are still operational.</p> <p>6, 7. All Personnel in the ARS QAPP should be reviewed and updated.</p> <p>8. The revised QAPP should have NPS signature and approval.</p> <p>13. The organizational charts in both QAPPs need to be updated to current personnel working on the NPS/ARS sites.</p> <p>28, 35. SOPs need to be reviewed and updated. Some information in the SOPs is obsolete and needs reviewed. Current SOPs are on the laptop (DataView log), but some SOPs have not been reviewed and revised for over 2 years. Many of the SOPs have instructional forms for performing the work. The QA Manager should confirm that these forms are be used properly and provide training as needed.</p> <p>43. Prior to 2011, the answer is yes. Recent change over to new QA Officer has caused a delay in reviewing process. The QA Manager is aware of this issue and as time allows will review SOPs and return the process to annual reviews.</p> <p>Observation: In reviewing the ARS QAPP, many tables, diagram, and exhibits are displayed several pages after the discussion of the table, diagram, or exhibit. To make it easier for the reader, it might be more straightforward to add the table, diagram, or exhibit right after the text in the QAPP. For instances, the organizational chart (Figure A4-1) is mentioned on page 10, but the reader needs to turn to page 27 to see the chart. Between pages 10 and 27 is the complete Section A text with all project management responsibilities.</p>				
B. Organization and Responsibilities				
1. Key staff that oversee CASTNET operations:				
a. CASTNET Project Manager				Name: Kemp Howell
b. CASTNET Quality Assurance (QA) Manager				Name: Marcus Stewart

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
c. NPS Contracting Officer's Technical Representative				Name:
d. ARS (CASTNET) Project Manager				Name: Joe Adlhoch
e. ARS (CASTNET) QA Manager				Name: Christian Kirk
f. CASTNET QA Auditor(s) 6-month calibration				Name: Kelly Blomme or other field specialists
g. ARS Field Operations Manager				Name: Mark Tigges and Mike Slate
h. ARS Field Specialist				Name: Mike Bagby, Mike Slate, Kelly Blomme, and Mark Valvur
i. ARS Information Management Section Manager				Name: Jessica Ward
j. ARS IMC Team Leader				Name: Emily Wiechmam
k. ARS IMC Data Analyst				Name: Courtney Grant
l. ARS Data Technician				Name: Rob Navarro
m. ARS IMC Air Quality Technician				Name: Matt Smith
2. Name of management responsible for (indicate which apply):				
a. Development of monitoring site,				Name: Field specialists
b. Coordinates field operations,				Name: Mike Slate
c. Logistical support of field operations,				Name: Field specialists
d. Training monitoring site operators, and				Name: Field specialists
e. Review of routine sampler data and quality control data.				Name: Data Management group and Field specialists
3. Name of ARS staff or subcontractor responsible for (indicate which apply):				
a. Operation of samplers/monitors/equipment,				Name: NPS
b. Calibration of samplers/monitors/equipment,				Name: ARS Field specialists
c. Maintenance of samplers/monitors/equipment,				Name: ARS Field specialists
d. Maintenance of monitoring site,				Name: ARS Field specialists
e. Operation of ozone monitor,				Name: ARS Field specialists
f. Calibration of ozone monitors, and				Name: ARS Field specialists
g. Maintenance of ozone monitor.				Name: ARS
5. Is there someone who reviews the following completed forms:				
a. Field forms or electronic entries? Who?	X			Name: Administrative assistant and Field specialists
b. Chain of Custody (COC) forms? Who?		X		No COC forms used
c. Review of electronic data from monitors? Who?	X			Name: Data Management group and Field specialists

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
d. Review of field logbooks (site, monitor). Who?	X			Name: Data Management group and Field specialists (site uses electronic entries (DataView).
6. Has the review of completed field and COC forms been done?	X			The site operator does not enter any ozone information on the Site Status Report Form (SSRF). All data entries are electronic (DataView).
7. Is anyone responsible for QA audits of the site? If so, who?	X			QA: Field specialists
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: 6-moth calibration August 20, 2013; biannual audit was June 10, 2013.
11. Were there any findings during the audits in Question 10?	X			Wind direction was off; sensor was replaced, checked, and put back into operation.
12. Are audits documented? How?	X			Data reported "as found" and "as left" in trip report and posted to NPS website.
13. Are the audit results available for review by staff and auditors? Ask to view audits from this program.	X			
14. Does the site operator conduct performance checks of the ozone monitor? Frequency?	X			
15. What types of QC checks are conducted?				Performs daily ZSP checks (automatically) at 0146 and monthly multi-point calibration checks.
16. Are the results of these checks available for review by staff and auditors? Ask to view check results from this program.	X			On DataView log.
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 month. This is not a calibration, just a supplemental check.
18. If yes to Question 17, who conducts the internal audit?				Site operator and field specialists
19. What is the frequency and where are the results posted?				6-months
20. Is there a designated schedule for calibrations of the ozone monitor? Frequency?	X			Every 6 months.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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 the database and later posted on the NPS website.
22. Are the staff that work at the site agency employees? How many?	X			Site operators are part of the NPS for Rocky Mountain NP.
23. Do any contractors work at the site? How many? Name?		X		
24. What steps are taken to ensure contract staff meets training and experience criteria?				Training occurs at three possibilities: From previous site operator, during new site or relocation setup, and every 6-month calibration. Training is re-enforced during each 6-month calibration visit.
25. Is this documentation maintained? Where?	X			The 6-month calibration checks are stored in the database and later posted on the NPS website.
26. Is there a written procedure for the QA audit, QC checks, calibration, or internal audits for the CASTNET program?				
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 month a multi-point verification check.
c. Calibrations?	X			Every 6 months by a field specialist.
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?				Data management group and Christian Kirk
28. How is the audit data reviewed and what are the decisions (criteria) based on?				ARS follows the limits listed in QA Handbook Vol II with regards to evaluating the ZPS checks (10% for data acceptance). The acceptance criteria for the ozone analyzer is: All points within $\pm 2\%$ of full scale of the best fit straight line $\pm 5\%$ of actual for any value, $r^2 > 0.9950$, $0.9500 < \text{slope} < 1.050$ $-3.0 \text{ ppb} < \text{intercept} < 3.0 \text{ ppb}$
29. Is this process documented? Where?	X			The 6-month calibration checks are stored in the database and later posted on the NPS website.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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 DataView then database, and finally posted on NPS website.
31. Where are these steps documented? Review examples of corrective action, if possible.	X			In the checklist forms of the Semiannual Site Visitation Checklist.
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			Training occurs at three possibilities: From previous site operator, during new site or relocation setup, and every 6-month calibration. Training is re-enforced during each 6-month calibration visit.
2. Is it fully implemented?	X			
3. Is this training documented in a training record?		X		Training is part of the Semiannual Site Visitation Checklist that is finally posted on the NPS website.
4. Is the training record available for review?			X	
5. Is there a process of training, testing, and qualification for job responsibilities?	X			
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			
8. Are personnel adequately trained regarding appropriate safety procedures?	X			
9. Are personnel adequately trained regarding cylinder handling?			X	
10. Does the site use field data sheet (FDS) and Chain-of-Custody (COC) forms other than the Site Status Report Form (SSRF) provided by the AMEC laboratory for the filter packs?		X		
11. Are these forms being completed properly?			X	
12. Does sample ID's match the COC?			X	
Additional Questions or Comments:				
3. During the 6-month visit, there is a section (Section 8) on the Semiannual Site Visitation Checklist for entering training information and observations. Since there are no formal training records for the NPS field operators maintained by ARS, this form could be used for tracking training except: (1) the field specialist and NPS site operator do not sign off and date the form and (2) the form does not state the type of training provided. ARS could add a signature box at the end of the form as well as a comments box that would explain the type of training provided during the visit. These forms are maintained on the primary server at ARS and the information regarding the training provided by the field specialist can be documented to that field operator. During the next 6-month visit, the field specialist can re-assess the progress of the field operator based on the previous training.				

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
D. Monitoring Site Housekeeping				
1. How long has this site been used for the CASTNET program?				Established: December 20, 1994 Ozone collection start: July 1, 1987
2. Are all site logbooks and/or forms filled in promptly, clearly, and completely?	X			Hard copy forms only used if the DataView log is not working. There was no evidence of the DataView system not working, but there are several forms on hand at the site for the site operator just in case.
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	Entries made in the DataView log system. ARS staff also use the Site Status Log, which is a web-based interface to our AQDBMS at ARS, to log operational and maintenance issue at monitoring sites. This is more comprehensive than entries in the DataView log.
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?				The program consists of the QAPP and several attached appendices for SOPs used in the program. An electronic data system (DataView) is used for field entries on a weekly, monthly, and 6-month basis.
2. Are the following necessary documents for this project in the controlled document program:				
a. EPA-approved QAPP for the CASTNET Program work?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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, the NPS Contracting Officer’s Technical Representative, AMEC Project Officer and QA Manager, and ARD Project Manager and QA Manager	X			Also the ARS QAPP
b. SOPs – by the ARS Project Manager and Program QA Manager	X			
4. Is distribution of the project documents controlled to prevent unauthorized copies from being made/distributed? If so, how?	X			All versions are electronically controlled; no hard copies.
5. Are outdated controlled documents collected and disposed of at the sites?			X	
6. Are procedures in place if out-of-date documents are found? If so, briefly describe.			X	
7. Are the following being filled out promptly, legibly, and clearly:				
a. Logbooks?			X	
b. Forms?	X			
8. Are the logbooks and forms maintained at the site? Where and how?	X			SSRF forms for 2 years
9. If yes to Question 8, are the logbooks/forms available for review?	X			
10. Are all entries being made in indelible ink (preferably a dark color)?	X			
11. 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			
12. Has a review of the logbooks/forms been performed? By whom?	X			Checklist forms are maintained on the DataView log on the site’s laptop.
13. Are archived logbooks/forms stored at the site? How?			X	
14. Does the site operator make electronic entries of field activities? (SOP 3178)	X			
15. If site operator is using is recording field operations electronically, how does he/she record activities if electronic recording is not available such as power outage and no telephone service? (SOP 3178)	X			
16. Are hard copy records maintained for short term? Long term? (SOP 3178)	X			Site operator attached the hard copy record to an e-mail and sends to the data management group. The information is uploaded to the DataView log.
Additional Questions or Comments:				

Part 3: Network Management

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
A. Key Individuals				
1. List all key individuals, job titles, e-mail extensions, and telephone numbers associated with this site.				
(Site operator)				Dyan Harden
(Backup operator)				Michelle Gillis
2. Other than CASTNET, what other networks is the site associated?				EPA CASTNET site operated by AMEC.
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) (Might need to obtain this information from Marcus-AMEC)				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		ROM206 is located at the Rocky Mountain National Park.	
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			
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			
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		

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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 ARS Ozone Calibration Laboratory.				
a. Thermo 49i ozone analyzer (Site)				S/N: 1030745086 ARS sticker of last calibration: August 20, 2013
b. Thermo 49i ozone analyzer (Transfer)				S/N: CM08460009 ARS sticker of last calibration: August 20, 2013
c. Zero air System pump				Werther Model PC7014 pump S/N: 531392
2. Check for certification, validation, and calibration labels for samplers, monitors, and equipment.				
Flow pump				Thomas Model 107CAB18 (EPA S/N A07928) ARS sticker: September 3, 2013
Temperature sensor for shed				YSI Model 44000 Series sensor that was last calibrated on August 20, 2013.
Datalogger				ESC Model 8816 S/N: 2025
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 PS ozone analyzer (last calibrated June 5, 2013) by US EPA in RTP, NC by Scott Moore using NIST SRP (NIST certified on April 18, 2013).				S/N: 1130450195
b. Thermo 49i PS ozone analyzer (last calibrated June 5, 2013) by US EPA in RTP, NC by Scott Moore using NIST SRP (NIST certified on April 18, 2013).				S/N: 1130450196
c. Thermo 49i PS ozone analyzer (last calibrated July 15, 2013) by US EPA in RTP, NC by Scott Moore using NIST SRP (NIST certified on April 18, 2013).				S/N: 1130450197
d. Thermo 49i PS ozone analyzer (last calibrated July 15, 2013) by US EPA in RTP, NC by Scott Moore using NIST SRP (NIST certified on April 18, 2013).				S/N: 733726105
Additional Questions or Comments:				

Part 4: Specific Sampling Criteria (Ozone Sampling)

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

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
A. Site Installation				
1. Is there a required training program for the ARS staff that perform site installation?	X			The training program is actually senior field specialist training junior specialist
2. Is there any certification records for instrumentation used to install a CASTNET site? (Examples of this instrumentation would be compasses, inclinometers, measuring tapes, voltmeters, etc.)	X			
3. Does ARS use subcontractors for site installation? Does an ARS staff member oversee all of the installation process?	X			Overseen by ARS staff
4. Is there a checklist the Field Installation Team updates during installation?	X			New Site/Site Relocation Form in SOP 3050
5. If yes to Question 4, where is it maintained and can the ROM 406 form be reviewed? If not, could ARS provide a completed form from another site?				Records are maintained on the Air Quality Data Base Management System (AQDBMS) server.
6. Does ARS need to obtain EPA approval for CASTNET site location? Discuss steps in determining site.	X			NPS and EPA approvals
7. Does ARS perform an acceptance test or burn-in of all instrumentation prior to install at the site?	X			
8. Are record maintained of this acceptance testing and where are these records maintained?	X			With trip pack maintained on primary server
9. Are records maintained for the initial onsite equipment calibration for ROM406? If not, could ARS provide records from another site?			X	This site was established before ARS took on oversight responsibility of the site. Since ARS has been responsible for the NPS sites for the CASTNET program, there have been no new CASTNET sites added.
10. If yes to Question 9, where is it maintained and can it be reviewed?				If there were any new additions, the information would be on the AQDBMS server.
11. If calibration standards are used, can ARS provide records of certification? Records maintained where.	X			Records are maintained on the primary server.
12. Does the CASTNET sites need to be inspected by local municipalities for Building Codes and Restrictions during the installation process?	X			
13. If yes to Question 12, where are these records maintained?				Records are maintained on the primary server.
14. Who provides the training to the site operator?				ARS field specialists
15. Is there a checklist or confirmation documentation that the site operator has completed the training?	X			In Section 8 of the Semiannual Site Visitation Checklist
16. If yes to Question 15, is this documentation maintained and where?	X			the AQDBMS server

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
17. Is the data acquisition system (DAS) validated during the initial installation? By whom? Records?	X			The field specialist will validate the DAS is working properly and the results will be part of the Semiannual Site Visitation Checklist (Section 6). These records are maintained on the AQDBMS server.
18. Are records (Capital Equipment Inventory Checklist) maintained for the inventory of instrumentation installed at the site such as manufacturer, model number, ARS Property Number, EPA decal, etc.?	X			
19. If yes to Question 18, who is responsible for maintaining the inventory records and where are they maintained?				Administrative assistant and records are maintained on the AQDBMS server.
20. Does an ARS 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	ARS has not had to install a new sampling site. If so, the documentation would be maintained on the AQDBMS server.
Additional Questions or Comments:				
B. Site Operations Procedure				
1. Is the ozone sampling performed within the guidelines of an EPA- and ARS-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.	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? Is a copy of the SOP readily available?	X			
7. Where does the site operator document all procedures performed during each site visit?				DataView log Weekly Station Visit Checklist Multi-point Calibration Checklist
8. If the site operator has a problem, who does he/she communicate with and how? (SOP 3178)				Information Management Center (IMC) and/or ARS field specialist
9. Where does the site operator obtain local weather conditions? Alternate source?				From the temperature sensor on the 10-m tower.
10. What device does the site operator use to confirm shelter temperature? Are values recorded with 20 to 30 °C?	X			YSI Model 44000 Series sensor last calibrated on August 20, 2013. Shelter temperature probe has traceable calibration. Hourly data are collected, polled, and stored.
11. Is this device certified? Frequency?	X			Every 6-month during site visit (August 20, 2013).

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
12. Does the site operator complete and document activities in checklists? (Observe.)	X			
13. Are the checklists maintained and where?	X			DataView log
14. Is the Data View System Station Log available to track entries? (Review entries.)	X			
15. 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 ARS.
16. If the operations in Question 15 were not successful, what does the site operator do?				IMC contacts the field specialist to discuss and determine the problem; troubleshoot as needed.
17. Does the site operator perform a flow rate and leak check of the ozone monitor?	X			The site operator only performs a weekly leak check; no flow checks are performed during weekly visit, monthly multi-point verification, or 6-month calibration.
18. What device (standard) does the site operator use to measure the flow rate?				The site operator does not measure flow rates at the site.
19. Is this standard certified? Review documentation.			X	
20. Where are these values (flow rate and leak checks) documented? Review previous entries if possible.				Leak checks are documented weekly on the DataView log.
21. Is there any documentation on the FDS/COC forms for ozone sampling?	X			The site operator does not enter any information regarding ozone collection on the SSRF.
22. How are telephone conversations documented between the site operator and ARS?				The main communication mode used by the site operator is the DataView log. There is a form to use if the DataView log is not working properly. This form is hand-written and sent by e-mail to IMC. At IMC, the information is placed into the primary server by data analyst.
23. Review and discuss the DAS with the site operator. a. Data from ozone monitor to datalogger (ESC 8816 or 8832). b. Datalogger to network router. c. Network router to computer for review onsite. d. Modem to ARS by Internet.				Site operator was not present during the site visit. Explanation of communications was explained by Christian.
24. Do you use uninterruptable power supplies or backup power sources at the site?		X		
25. What instruments or devices are protected (electrically)?				none
26. How are the ambient ozone sampling and zero, span, and precision check (ZSP) controlled?				electronically
27. What device is used for the ZSP checks?				Manufacturer: Thermo Model: 49i Serial Number: CM08460009
28. What is the frequency of the ZSP checks?				Daily at 1:46 am
29. Are the ZSP checks documented? Where and how.	X			DataView log

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
30. Are steps in place if ZSP checks fail? Review.	X			
31. How long does it take to conduct a ZSP? Time of Day.				Approximately 20 min starting shortly before 0200.
32. Can the results of the ZSP be reviewed at the site? Review, if possible.	X			
33. What is the height of the inlet for the ambient ozone sampling?				10 m
34. What is the supply line made of?				Teflon tubing
35. Does it connect to a manifold or designated supply line to the monitor?				Designated supply line to the analyzer.
36. Does the air stream flow through any filters before entering the ozone monitor?	X			A Teflon filter (outside) at the top of the tower.
37. What is the reporting measurement unit for the ozone measurement?				PPB
38. 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 (Werther Model PC7014 pump S/N: 531392).
39. 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.
40. During the ZSP checks, does the air flow from the transfer ozone monitor to the inlet and then to the ambient ozone monitor?	X			
41. What concentrations are evaluated during a ZSP checks?				Zero air, 400 PPB ozone (span), and 90 PPB (precision check).
42. Are MQOs being met at the site for ZSP checks?	X			Zero ($\leq \pm 10$ PPB) and precision and span ($\leq \pm 7\%$ between supplied and observed concentrations). ZSP checks are charted.
43. What is the frequency of multi-calibrations of the ozone monitors?				A monthly multi-point verification check is performed by the site operator and every 6 months a calibration check by a field specialist.
44. How many calibration points are checked?				Site operator performs a 3-point calibration (260 to 440 ppb, 150 to 200 ppb, and 50 to 80 ppb) and zero point. The field specialist performs a 5-point calibration (470 ppb, 370 ppb, 270 ppb, 170 ppb, and 70 ppb) and a zero point.
45. How are the multi-point calibration (Pre-Maintenance Ozone Calibration Form) reported and where is the data maintained? (Review data.)				Data View log for the 3-point cal check by the site operator and the 6-month calibration is maintained on the primary server.
46. Who are the results reported to?				IMC and then QA review by the QA Manager. Eventually, posted to NPS site.
47. Who repairs the monitors if outside acceptance during the calibration?				Field specialists
48. Where is the Operation Support Center located?				This is part of the IMC at the ARS offices in Ft. Collins, CO.

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
49. What is the frequency of checking and replacing the ozone particulate filter? SOP 3178				Monthly based on discussion with Mike Slate, but SOP 3178 states every week they are inspected and replaced every two weeks.
50. Who does the site operator contact if there is a problem with the DAS?				Data analyst in IMC
51. Discuss Data View software and document site operator's knowledge of the software and entries that he/she would make.				Site operator was not present during the visit. Christian explained the DataView log process and PDF help instructions.
52. Does the site operator follow the SOP for data entries in to the DAS?	X			Only could confirm by reviewing past site operator entries in the DataView log.
53. Who is responsible for performing preventive maintenance?				The site operator checks every Tuesday and relays issues to IMC.
54. Is special training provided for site operator for performing preventive maintenance on the monitors/samplers/equipment? Briefly comment on background or courses.	X			Training occurs at three possibilities: From previous site operator, during new site or relocation setup, and every 6-month calibration.
55. Is this training routinely reinforced?	X			During the 6-month visit by the field specialist.
56. What is the site's preventive maintenance schedule for the ozone measuring system?				6-month or if issues develop
57. If maintenance, troubleshooting, or replacement of a sampler is required, who does the site operator contact and at what phone number?				IMC to discuss the problem that is later followed up by a field specialist.
58. Who provides support to the site operator when a sampler replacement is preformed? How are these directions provided?				Field specialist (mainly Mike Bagby)
60. 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		
61. 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			Sufficient spare parts are available at the ARS lab.
62. 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		
63. 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			No ozone data, but wind direction vane was inoperative at a time (eventually replaced).
64. Explain any situations where instrument down time was due to lack of preventive maintenance of unavailability of parts.				
Additional Questions or Comments:				

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 June 10, 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 June 10, 2013. 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 ARS 6-month calibration been performed at this site? When and who performed the last calibration.	X			Field specialist Kelly Blomme on August 20, 2013.
6. Are the results of the calibration documented? If so, where and review if possible.	X			Hard copy report was provided by Mike Slate. Electronic report in queue of primary server for QA Manager to review.
7. What is the frequency of the ARS site calibration?				6 months
8. Review Data View System Station Log to track entries made during calibration.				Review completed at site.
9. Is the transfer ozone monitor allowed time to stable? If yes, what amount of time is allowed?	X			
10. What device is used to provide air for the zero air check for the calibration?				Werther air 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		Site does not conduct a line loss test.
13. What does a high line loss indicate (greater than 5%)?				Not checked.
14. How is this issue resolved and documented?				Not checked.
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?				Bi-weekly leak checks are performed on the ozone collection system.
18. Does the calibrator use NIST-traceable standards when conducting the calibration?	X			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
19. Where is the documentation (certificates) maintained? Are they available for review during the audit?	X			On the primary server.
20. Is there a Pre-trip Preparation checklist? If so, who completed it, where is maintained, and can it be reviewed? Review ROM 406 last 6-month check.	X			The field specialist and stored on the primary server. There was discussion with Christian and Mike that all field specialists might not be using this form.
21. If yes to Question 20, who completed it, where is maintained, and can it be reviewed? Review ROM 406 last 6-month check.				The field specialist and stored on the primary server. Did not view checklists (Pre-trip Preparation or Semiannual Site Visitation), but was able to view trip report. Field staff have not been utilizing the pre-trip form or the site visitation form lately. We plan to update the forms during the SOP review process. Christian will be sending the updated site visit form detailing all the calibration results.
22. Is there a checklist (Semiannual Site Visitation Checklist) for the 6-month site visit?	X			
23. If yes to Question 22, who completed it, where is maintained, and can it be reviewed? Review ROM 406 last 6-month check.	X			
24. If an analyzer does not perform within acceptance criteria, what does the calibrator do?				Troubleshoot the problem and repair or replace the analyzer.
25. Who determines when an analyzer can be repaired in the field or needs to be shipped back to the ARS Ozone Calibration Laboratory?				Field specialist
26. 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?				Documentation maintained on the primary server and the Equipment Maintenance/Repair Record- blue card.
27. If an analyzer fails the 6-calibration, is previous data collected from that site reviewed? By whom?	X			BY QA Manager
28. Is there a form for documenting instrument's maintenance or repair for the 6-month site visit?	X			Equipment Maintenance/Repair Record- blue card
29. If yes to Question 29, who completed it, where is maintained, and can it be reviewed? Review ROM 406 instrumentation blue cards.	X			August 2013 blue card reviewed
30. What steps are taken to confirm valid ozone data was collected?				ZSP checks are reviewed by data analyst and field specialist
31. Who is responsible for calibration the DAS?				Field specialists

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
32. Is there a calibration check form to document the DAS calibration? If so, where is it maintained and review latest DAS calibration for ROM 406 site.	X			<p>In SOP 3160, the field specialist is make annotation marks on the script chart to represent the voltage checks. These values are later confirmed against results logged on storage media.</p> <p>There was discussion with Mike Slate and Christian Kirk if this process was still being performed or if outdated and needs removed from the SOP. The RTI auditor could not find any information on the Semiannual Site Visitation Checklist or recent trip report for RM406 to show that the field specialist performed a voltage check on the DAS.</p> <p>Cristian stated these voltage checks are no longer being performed formally as ARS have not seen issues related to this since the network transitioned to the 8816/8832 series dataloggers. The field specialist is supposed to verify and document that the analyzer display and DAS are in agreement. ARS will revise forms to make it easier to document this in the future.</p> <p>The voltage checks are not documented, but the analog signal is verified during the 6 month visits.</p>
33. Who is responsible for providing maintenance to the DAS?				The field specialist is to track any maintenance performed on the DAS
34. Who determines if the DAS is operating properly after a calibration check?				The field specialist confirms all systems are operating prior to leaving the site.
35. Who is responsible for calibration the analog input card on the ESC datalogger?				SOP 3160-2100 states that there is a form "ESC voltage Analog Input Card Calibration Check" for calibrating the dataloggers. Since the network transitioned to the 8816/8832 series dataloggers, the field specialist does not calibrated the card.
36. Is there a calibration check form to document the ESC datalogger calibration? If so, where is it maintained and review latest ESC datalogger calibration for ROM 406 site.	X			ESC voltage Analog Input Card Calibration Check listed in SOP 3160-2100 is no longer being used since switching to the 8816/8832 dataloggers.
37. Who is responsible for providing maintenance to the ESC datalogger?				field specialist

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
38. What type of training has been conducted during the 6-month site visits?				On any aspect of multipoint calibrations, precision checks, data reporting, data transmittal, or other operational requirement where deficiencies are observed.
39. Where is this training documented?				Maintained on the Semiannual Site Visitation Checklist form and discussed in the trip report. Both are maintained on the primary server at ARS and posted on the NPS website.
Additional Questions or Comments:				
21. Field staff have not been utilizing the pre-trip form or the site visitation form lately. We plan to update the forms during the SOP review process.				
D. Field Operations Procedure (performed by the ARS Ozone Calibration Laboratory)				
1. What is the minimum frequency of certifying the ozone transfer standards?				1 year.
2. Is this documented (Ozone Transfer Standard Certification Worksheet) and are the documents available for reviewing? Review the documentation for the transfer standard used at ROM 406.	X			
3. What is the frequency of calibration of the ozone transfer standards?				
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 ARS with Level II analyzer.
6. How many sample concentrations are performed during the transfer standards certification? What values are normally run? (SOP 3300)				6 (0, 470 370, 270, 170, and 70 ppb)
7. How many sample runs are performed during the transfer standards certification?				Six
8. Where is this data maintained? Is it reviewable?	X			Ozone Transfer Standard Certification form to primary server.
9. Describe the process of certifying the transfer standard?				Explained by Mr. Slate.
10. Is there a single-point accuracy criterion? List.	X			± 5%
11. Describe the calculations for the slope, intercept, and correlation coefficient?				$S_m \leq 3.7\%$; $S_b \leq 1.5$; and slope change by < 0.05 from the previous calibration check.
12. Who performs the certifications of the transfer ozone analyzers?				Field specialists or lab technicians
13. Who gives final approval the transfer standard is acceptable?				Cristian Kirk, QA Manager
14. What are the acceptance limits?				
	RSD of six slopes $\leq 3.7\%$ Std. Dev. of 6 intercepts 1.5	Transfer Standard Doc EPA 600/4-79-056 Secti 6.6		
	New slope = ± 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>Approx. 15 flow meters (BGI tetraCals, BGI deltaCals, BIOS 220 units certified by BGI and Mesa Labs) 12 temperature sensors (certified annually at Micro Precision) 3 barometric pressure sensors (2 within certification at Micro Precision) Certificates are maintained on the ARS primary server</p>				<p>Lab controls (2 ozone) Thermo 49C (S/N 75759-380) was last certified on June 27, 2013. API 700EU (S/N 59-S) was last certified on June 27, 2013. Standards used in the Calibration Laboratory Temperature (Eutechnics Model 4400 S/N 305596) was last calibration January 3, 2013. Barometric pressure (Vaisala AIR-HB-1A S/N 3F2502) was last calibrated on October 9, 2013. Flow (BIOS Definer 220 High Flow (S/N 122997) was last calibrated on January 3, 2013.</p>
16. Is the certification of the transfer standards performed manually or automatic?				Manually
17. Is there a maintenance and calibration schedule for the ozone analyzers? If yes, where is it maintained and review?	X			Primary 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 Corrective Action: replace sensor 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 Corrective Action: calibrate Standard certificate information:</p>
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?				<p>Limit: 250 mm Hg Usually 200 mm Hg Above 230 mm Hg questioned Corrective action: replace tubing and check transducers</p>
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	
22. Is the flow rate checked on the ozone analyzers? If yes, what device is used? Is it certified? Last certification.			X	
23. How are transfer standards tracked when shipped to sites? Where is this documented?				Fed-Ex

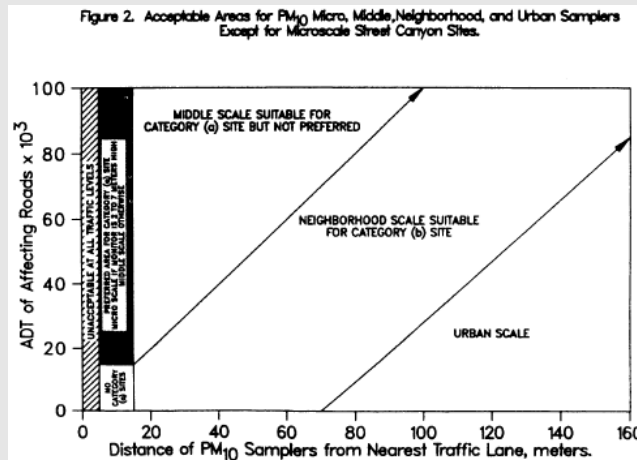
AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
24. When are calibrations required? (5 reasons in SOP 3100)				1. Upon acceptance testing of a new instrument 2. Upon installation of the instrument at a field station 3. Whenever control limits are exceeded 4. Prior to any corrective action, service, or maintenance to any portion of the instrument that affects its operational principle 5. At a maximum interval of three months
25. Who performs the calibrations of the site analyzers and transfer standards?				Field specialists
26. How is data tabulated?				Ozone Transfer Standard Certification form on primary server.
27. Is the data available for review? Review calibration for the primary ozone analyzer at ROM 406.	X			
Additional Questions or Comments:				

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			

AUDIT QUESTIONS	RESPONSE			COMMENTS
	Y	N	NA	
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 20 m from the drip line of the tree or trees.	X			
i. Spacing from roadways. If the area is primarily affected by mobile sources and the maximum concentration area(s) judged to be a traffic corridor or street canyon, the monitor should be located near roadways with the highest traffic volume. See Figure 2 below or 40 CFR 58 App. E.	X			
9. What are the GPS coordinates (latitude and longitude) for the field site:				N 40.2778° W 105.5453°
10. What is the elevation of the site (feet)?				8996 ft.
11. Nearest meteorological site?				Site has a temperature sensor on the 10 meter tower.
Additional Questions or Comments:				

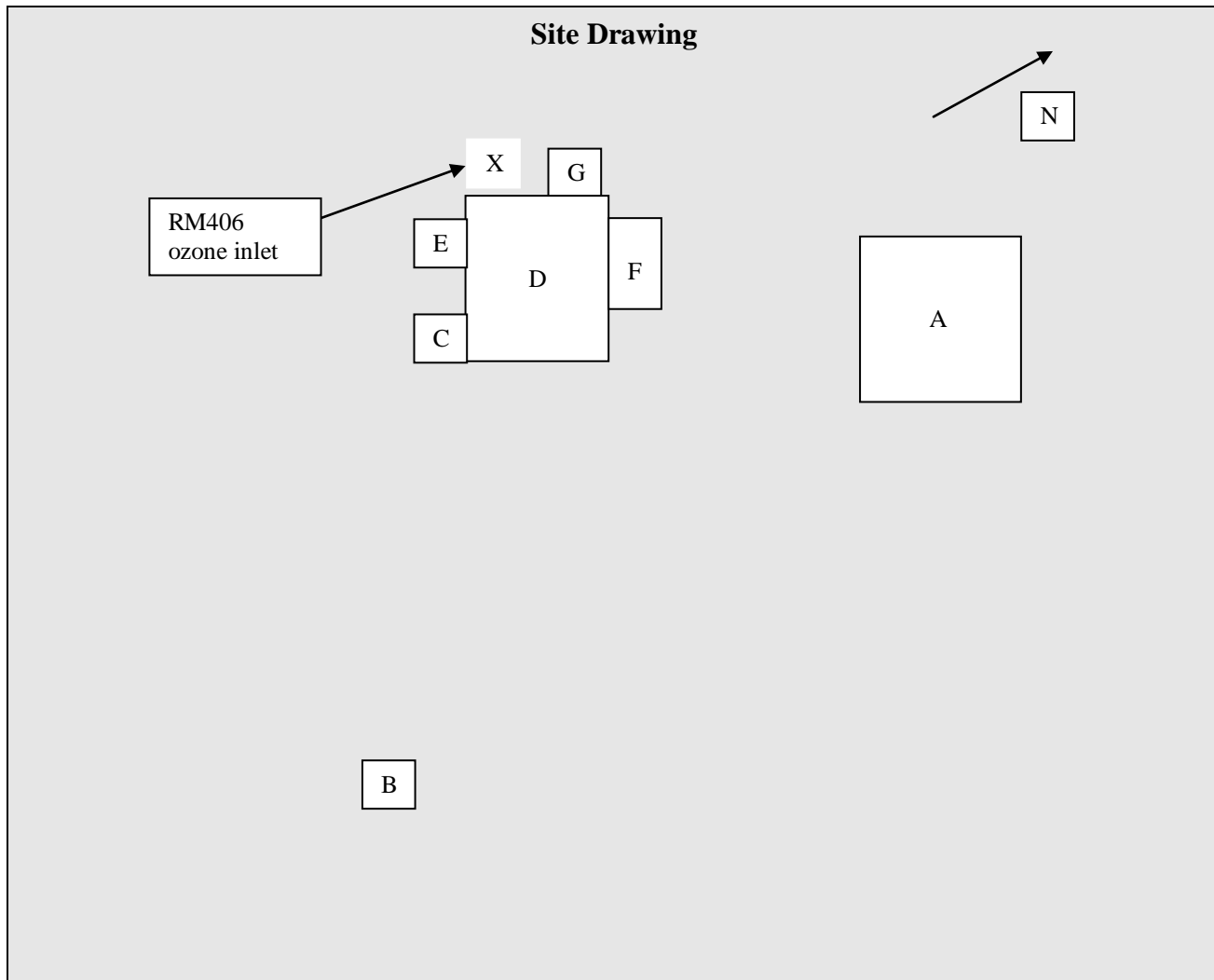
For Ozone Sampling	
Roadway Average daily traffic, vehicles/day	Minimum separation distance, m
<10,000	10
15,000	20
20,000	30
40,000	50
70,000	100
>110,000	250



B. Site Sketch

Rocky Mountain National Park (ROM 406) Measurements
 (Distance measurements and compass directions are from the ozone inlet on the 10-m tall tower)

Items	Compass Degrees	Distance (m)	Height (m)
A. RM206 station shelter (center)	45	7.5	2.44
B. Meteorological tower	120	29	10
C. Tipping bucket on RM406 shelter	130	4	3.35
D. RM406 station shelter (center)	75	.1	2.44
E. Camera	140	2.4	2.5
F. IMPROVE sampler	50	3	2.3
G. Aethalometer	27	1.1	4.0



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 AQS.

NOTE: Data (1 minute) was downloaded from the Datalogger and saved to a flash drive.

- 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.

NOTE: Data was downloaded from the Datalogger and saved to a flash drive.

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

NOTE: No disruption in the data collection.

- 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 data are checked.

NOTE: The site operator was not present during the visit. ARS staff stated that there has been no problem at this site. All activity entries are electronic into a DataView log program.

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 AQS.

NOTE: The CASTNET site has not posted QA audit reports since 2011. Cristian Kirk provided RTI the results of the last NPAP audit by EEMS conducted on June 10, 2013 of the ROM406 site.

- Observe the data validation process using the IMS 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.

NOTE: Request raw data for October 16, 2013 (within a month), August 14, 2013 (prior quarter), and May 15, 2013 (within 6 months). Place data on flash drive to check against data placed on AQS. Data from October 16 and August 13 were downloaded at the site and saved to a flash drive. The May 15 data is not maintained at the site and Jessica Ward will be requested to send May 15 data to RTI to check against values posted to AQS.

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

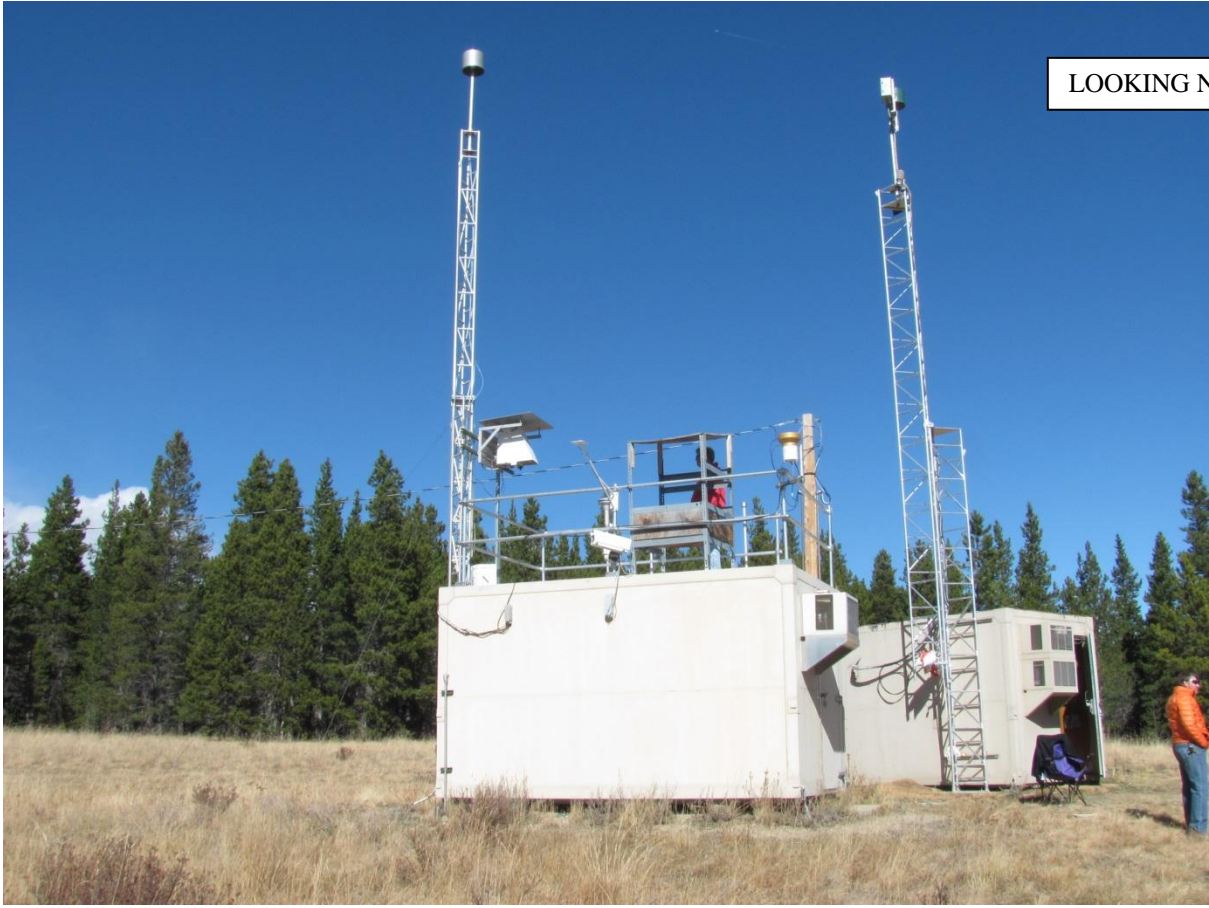
NOTE: This will be completed at the ARS Laboratory in Ft. Collins, CO when RTI visits the laboratory for ARS Ozone Calibration Laboratory and data management review.

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

NOTE: ZSP checks were confirmed on September 3, 2013 electronic data.

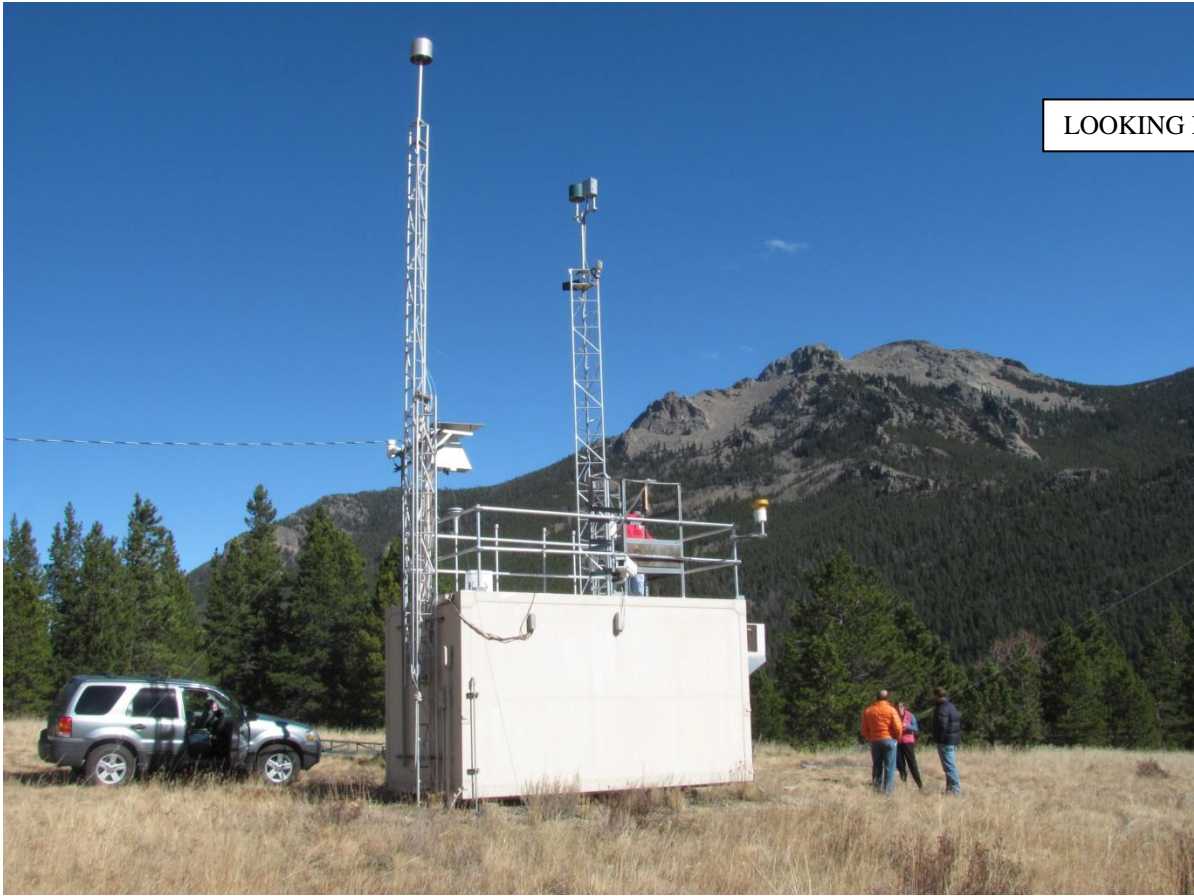
APPENDIX B

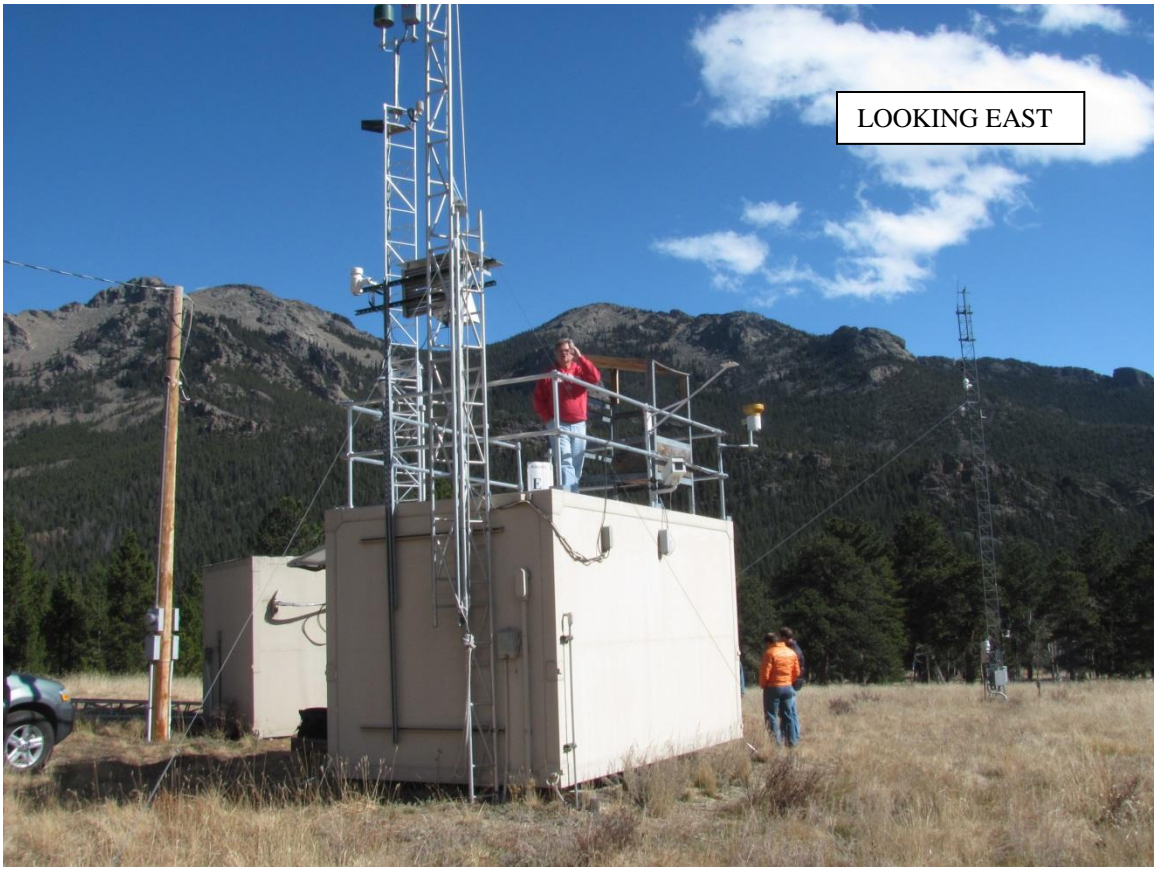
Rocky Mountain National Park (ROM 406) Site Photos



LOOKING NORTH

LOOKING NE

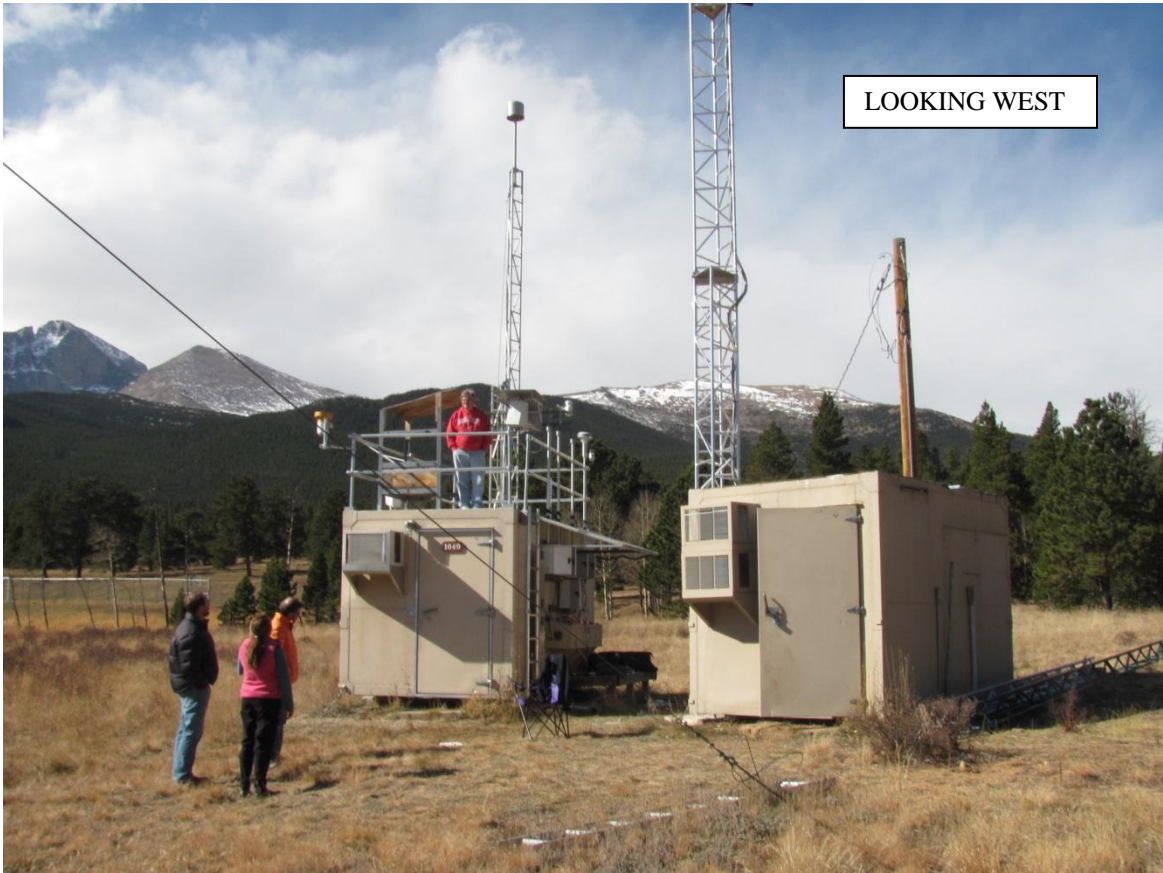
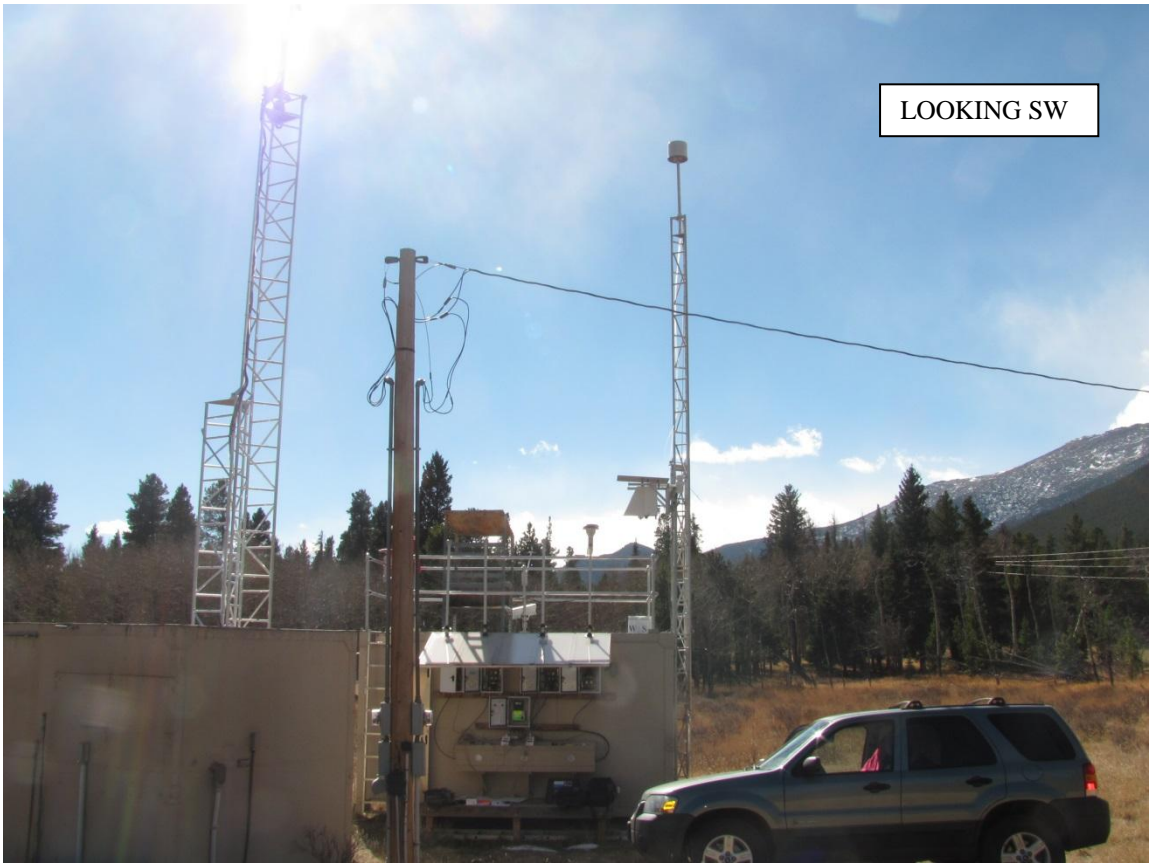




LOOKING EAST



LOOKING SOUTH





APPENDIX C

Data and Data Management Questionnaire

DATA AND DATA MANAGEMENT

Auditee Identification: **Air Research Specialist (ARS), Inc. facility**

Location of Audit: **Ft. Collins, CO**

Audit Date: **October 30, 2013**

Auditor's name and affiliation: **Eric Poitras and Jeff Nichol (RTI) and Marcus Stewart (AMEC)**

PERSONNEL INTERVIEWED:

NAME	POSITION	PHONE/E-MAIL
Jessica Ward	Air Quality Data Manager	970-484-7941 jward@air-resource.com
Christian Kirk	QA Coordinator/Field Specialist	970-484-7941 ckirk@air-resource.com

Data Management Questions

Audit Questions	Response			Comments and References (provided by ARS personnel unless otherwise indicated)
	Y	N	NA	
Audit Questionnaire Part I – General (adapted from Appendix H of QA Handbook) Data Handling/Review (SOP 3350 and SOP 3345)				
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			SOP 3350 Figure 1-1; Technical Instruction (TI) 3350-4000 Table 4-1
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			SOP 3350 Figure 1-1
3. What hardware components are used in each step of the procedure from acquisition to submission? Is there a data flow diagram that represents the components of the data management system?				Datalogger -> modem -> AQDMBS DataView Software -> modem -> AQDMBS IMC Database -> Reporting SOP 3340 Figure 3-1
4. Are procedures for data handling (e.g., data reduction, review, etc.) documented?	X			Multiple SOP's cover this.
5. Does the field operator have the ability to change or alter any of the data? Have there been any situations where this was done? What do the "C, P, U, and D" validation source codes mean? (These codes are referenced in Level 1 validation of replacing raw values; TI3450-5010, 4.4.4)		X		Collected data is read-only to field operator and any possible change is password protected. C = Network Strip Charts P = Daily Summary Printouts D = DataView U = Unusual Circumstance Codes are used by reviewer to explain data adjustments (several other codes are also used).
6. Are field operator comments included in any reports? How are these comments captured and utilized?	X			DataView captures comments at site, comments are reviewed and if necessary, codes are added to data through Information Management Center (IMC) database tool
7. In what media (e.g., diskette, data cartridge, or telemetry) and formats does data arrive at the data processing location?				Electronic transfer in ASCII format.
8. How often are data received at the processing location from the field sites and laboratory?				Data are collected and uploaded to the database hourly. Data is posted every hour to targeted websites. Calibration data are downloaded nightly.
9. Is the routine data retrieval process conducted automatically?	X			
10. Who is responsible for the conducting the data retrieval? Who is their back-up?				Data retrieval is done automatically, if manual data retrieval is performed, IMC staff are responsible. There are multiple members of the IMC team.
11. 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	No edits or changes are made to the data prior to commencement of agency review. Flagged data from site is not included in real-time posting to sites.
12. How is data actually entered to the computer system (e.g., computerized transcription (copy from disk or data transfer device), manual entry, digitization of strip charts, or other)?				Data automatically transferred to central database (Air Quality Data Base Management System (AQDBMS)). SOP's exist to instruct on how to transfer information if data does not transfer correctly.

Audit Questions	Response			Comments and References (provided by ARS personnel unless otherwise indicated)
	Y	N	NA	
13. How many data review steps are performed when reviewing ozone data? What are the data review steps? Who is responsible for each step?				There are 4 total 1. Daily review (Stackplots reviewed by field specialist and IMC staff) 2. Preliminary – review data plots, site status log, logger flags, station logs, nightly calibration results, audit results when available, calibration results when available, apply validation codes. 3. Review everything listed under preliminary and verify that validation codes were applied correctly. 4. Final review – Management reviews almost the whole process, data review occurs with the client.
14. Who (ARS staff) is responsible for determining when the data review steps are within DQO goals and can be sent on to data validation processes?				Level 0 validation done every day by a combination of data analyst and field specialist. Process is started almost immediately after data collection.
15. What information/data is contained in: a. ESC datalogger b. Data View computer How often is each queried? Can systems be controlled remotely?				a. real-time measurements b. everything from datalogger, SOP's, checklists, operator comments, etc. ESC datalogger queried hourly. DataView queried twice/week or more often as needed. Both can be accessed and controlled remotely.
16. Describe the data QC checks applied to ensure that data transfer is accurate.				Multiple reports are reviewed daily, weekly and monthly. This is done with both printed and electronic reports.
17. Are any components of the data other than the ASCII files reviewed regularly (i.e. strip charts, ZSP, calibrations)?	X			Site status logs are also reviewed as well as station logs, audit reports, trip reports, and nightly calibration results.
18. For manual data entry, is a double-key entry system used?			X	No manual entry of data is needed.
19. Are precision and accuracy data gathered and reported to AQS?	X			
20. Are there any typical post-processing calculations done to any of the data (STP corrections, modifications for humidity levels, etc.)?		X		
21. How frequently are collected <u>and</u> calculated data stored? Where and how are they stored?				There is a constant back-up of data on daily, weekly and monthly schedules. Data is backed-up to multiple locations on multiple media types.
Software Documentation (SOP 3340 and SOP 3650)				
22. Please list the documentation for the most important custom software currently in use for data processing. Include the original author, current revision number and date. Include the required operating system and application (e.g., Microsoft Windows, Microsoft Access)				SOP 3340 Table 3-2 lists all software used. The latest version of the SOP available on the CASTNET website is Revision 4.2 from Feb 2010. Jessica Ward provided the RTI auditor with electronic copies of Revision 4.3 (March 2012) and Revisions 4.4 (October 2013) after the audit. There also was a revision (March 2012) to the AQDBMS User's Guide that's used internally.

Audit Questions	Response			Comments and References (provided by ARS personnel unless otherwise indicated)
	Y	N	NA	
23. How often are software updates/changes made and by whom? What determines the need for the changes? How thoroughly are internal programs tested, and by whom?				Changes implemented as needed. An example of one recent change was the script addition of auto validation codes. All programs are commercially tested, or if produced in-house, are tested by the originator and generally the IMC Manager.
24. 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			Automated retrieval is standard; however options exist for remote manual queries and on site queries. Details are provided in multiple SOP's and TI's.
25. 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		Any changes to the data process are thoroughly tested by a minimum of the database programmer plus the IMC manager before the changes are released for use. Requirements related to the update were provided to the software developers by the IMC manager and discussed to ensure understanding. The software developers made the required updates in the appropriate software application modules, and tested both the modified modules and the entire application within the development environment using test monitoring sites and configurations based on real monitoring sites. Data values were compared between the test sites using the updated software and the real monitoring sites using the production software. The updated software was then published in a test environment, used on the test sites and a subset of real monitoring sites, and closely monitored by the software developers and IMC staff until all were confident the update was working correctly. The updated software was then put in place as the production software.
26. What software packages (if any) are used to automatically review the data?				Multiple products are used, all of which were developed and maintained in house.
27. Does any software package have the capability of automatically changing the data? Or automatically assign validation flags?		X		Raw values are never changed. Only the validated value is changed if an adjustment is needed. Logger flags are stored in a separate field and are never changed. They are used by the database to determine the appropriate validation code (which is applied in a separate field).
28. Is there a unique log-in into programs where data can be changed? Who has access to make the changes?	X			Changing data requires log-in. This was demonstrated in the DataView log. The primary data source is the AQDBMS. Only IMC staff have access to this database. Raw values are never changed.
29. Who has the technical expertise to make changes to the Oracle database? AQDBMS database?				IT personnel exist with the capability to make necessary changes. This is done after direction from management.

Audit Questions	Response			Comments and References (provided by ARS personnel unless otherwise indicated)
	Y	N	NA	
30. Is data automatically sorted into defined tables after transmission? Is this process QC checked to ensure data is incorporated into the correct location?	X			Hourly data is checked daily after it is transferred to IMC database.
Data Validation and Correction (SOP 3450, SOP 3340, and SOP 3650)				
31. Are changes to site information/coding/file structures/units documented in AQDBMS? Are there any records available for review?			X	No changes were reported.
32. Are data validation criteria established and documented? Who is responsible for each step of the data validation? Is there one person assigned to each of the three levels of validation, or is one person responsible for multiple levels? 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			Multiple SOP's cover steps. Typically one person is responsible for each validation level, with management being responsible for final steps before reporting. All IMC staff are cross-trained on the various levels of review. QAPP and SOP's cover range limits and actions (flags or invalidation) for reported data. Data are invalidated when acceptance criteria are not met (SOP 3450-5010) as discussed in Section 4.3.
33. If an ozone data point is collected at intervals of 5 minutes (or 1 minute) and averaged for the hour, what is the minimum number of individual points to obtain a suitable hour average for reporting?				Ozone data is collected and averaged every minute. To report valid hourly data, it must be collected for 45 minutes in the reported hour.
34. Do any of the project documents describe the process for making changes to data that have already been posted on AQS or on the ARS website? Provide references.	X			Changes are sent to websites reporting data. For AQS, a spreadsheet with justifications is used to re-submit data. TI 3450-5020 covers this information.
35. 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 AIRNow website database to verify that the data records were appropriately flagged. 				On 10/29, data was viewed at the ROM406 site with a "C" flag for 1-minute time points from ~01:30-02:15. In Table 4-1 of TI 3450-5000, the "C" flag is listed as a calibration flag which is consistent with the timing of the ZSP check done on the instrument. On 10/29, data was viewed with a "D" flag for 1-minute time points from ~07:30-08:30. In Table 4-1 of TI 3450-5000, the "D" flag is listed as a channel disabled flag which was a result of scheduled weekly maintenance by field operator. Data for 1-hour time points with C flag were observed on NPS website. Data for 1-hour time points with D flag were not reported on NPS website. These results are consistent with expectations due to the 45 minute minimum requirement for reporting.

Audit Questions	Response			Comments and References (provided by ARS personnel unless otherwise indicated)
	Y	N	NA	
36. When correcting, changing, deleting or invalidating data values in AQS, please address the authority under which the changes must be made. List the name and position of the individual(s) with signature authority for approving such changes. Is it possible for unauthorized personnel being allowed to change data values in AQS? How is this avoided?		X		Changes are typically made by the IMC manager (Jessica Ward), who is the same person responsible for the initial submission of data after validation steps are complete. Unauthorized personnel are unable to make changes. AQS requires log-in with password for any data submission.
37. Are corrected data resubmitted to the issuing group for cross-checking prior to release? [i.e., who within the program organization must be consulted before posting corrected data to AQS?]		X		Data is not checked after resubmission; however, AQS reports indicating changes have occurred and are submitted upon completion of the change submission. Each time updates are made in AQS a report is generated that shows how many records were updated. This report is compared to the number of update transactions in the update file to verify that all updates occurred.
38. Are regular data summary reports issued by the organization? Attach a list of reports routinely generated, including title, distribution, and period covered. Provide a citation to project documentation.	X			Daily, weekly, monthly and yearly reports exist. Each contains various data and information. Copies of reports are included in TI 3550-5000.
39. Are there any instances where a non-documented database or program would be used in the validation process?		X		
40. Is any original/raw data over-written if it is altered?		X		Data is overwritten on datalogger device only after it has been copied and stored elsewhere.
41. If a change to a data point needs to be made prior to submission to AQS (and other reporting databases), are any records of the original point maintained?	X			
42. How would AQDBMS differentiate between two values at with the same site and spec parameters?				The issue would be observed during a data review step and appropriately corrected. No instance of this occurring has been observed though.
43. What does "blank-filling" missing data entail? Are these values updated after Level 0 validation?	X			Blank-filling is a place holder device. All values are updated during preliminary validation.
44. What is the process for changing datalogger data flags to validation codes? What level of validation is this done?				Datalogger flags are stored in a separate field and are never changed to validation codes. Validation codes are a separate field within each data record. Logger flags help determine which validation code should be applied.
45. What is the process for changing anomaly codes to validation codes? What level of validation is this done?				Anomaly codes are screening flags based on DQO's. Anomaly codes are assigned before Level 0 validation. They are stored in a separate field and are never changed to validation codes. They may be used to help determine which validation code should be applied.
46. Is there a list of validation codes?	X			TI 3450-5010 Table 4-3

Audit Questions	Response			Comments and References (provided by ARS personnel unless otherwise indicated)
	Y	N	NA	
47. Are there copies of the monthly validation checklist available for review? Are the monthly validation checklists maintained electronically anywhere?	X			Monthly validation checklists are electronic. A Data Validation Data Window was observed by the RTI auditor. There's also a hardcopy printout on file by site for every month.
48. How are "expected" values/limits defined? Where do anomaly screening ranges (T13450-5000) come from?				The QAPP defines the expected limits which are based on EPA guidelines. Anomaly screenings do not affect reported data, but may initiate further investigations.
49. Are data points with control values (arithmetic calculations; T13450-5010) reported to AQS with a flag?		X		Records are tracked and reviewed in IMC database before submission.
50. Are there any additional data post-processing steps (after Level 3 validation) before reporting?		X		
Data Processing/Reporting				
51. How often are data submitted to AQS and the ARS website?				AIRNow and NPS websites are updated hourly. The CASTNET website is updated daily and AQS data is submitted monthly.
52. Are partial monthly reports ever submitted to AQS?		X		
53. Briefly describe any difficulties that your organization has encountered in coding and submitting data following the AQS guidance documents.				Over the years of submitting data, some minor issues have occurred - all of which were resolved. It was noted new AQS requirements which no longer allow multiple audit results from the same level in a single record were problematic at first.
54. Are records kept for at least 3 years by the organization in an orderly, accessible form? Does this include raw data, calculations, QC data, reviewed data, and reports? If no, please comment.	X			The entire AQDBMS is archived to three locations monthly. Records in the AQDBMS date back to a site's inception. Paper records are archived annually and the past two years are held in the IMC. The previous 5 years are available in storage lockers.
55. 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?		X		
56. Are audits (internal or external) on data reduction procedures performed? If yes, at what frequency?	X			Any time there is a systematic change an internal audit is conducted to verify procedure is functioning as intended.
57. 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			Precision and accuracy are validated in the same manner as data. Precision checked daily, accuracy checked monthly (after monthly instrument calibrations).
58. Does the AQS report come directly from AQDBMS?	X			
Internal Reporting (SOP 3550)				
59. 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			Based on 40 CFR 58 Appendix A, the data are housed and maintained in the same database as it is collected. QA requirements are listed in SOPs and QAPP. A copy of the last most recent TSA audit was provided to the RTI auditor.

Audit Questions	Response			Comments and References (provided by ARS personnel unless otherwise indicated)
	Y	N	NA	
60. 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)				Annual precision reports are created and reviewed annually. Monthly reports are also generated and are reviewed monthly. No reports based on audits are created independently of standard report for review, but the audit results are entered and stored in the AQDBMS.
61. Do either the audit or precision check reports include a discussion of corrective actions initiated based on audit.		X		Corrective actions are initiated, but no specific report (that was provided) illustrates these actions. Corrective actions based on these are documented in the database and the calibration tracking spreadsheet.
62. 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)				The IMC Manager is responsible for preparation and initial review of annual summaries. Summaries are delivered to program management and are discussed during conference calls with NPS and EPA representatives.

Audit Questionnaire Part II – Detailed questions and data requests (Based on SOPs 3340, 3350, 3450, 3550, and 3650).

Request to see raw data from the ROM406 site for October 16, 2013 (within a month), August 14, 2013 (prior quarter), and May 15, 2013 (within 6 months).

Audit Questions	Response			Comments and References (provided by ARS personnel unless otherwise indicated)
	Y	N	NA	
63. 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 ARS staff.				At the ROM406 site, minute data points for 10/29/13 was downloaded from site laptop. Hourly data for 10/16/13 and 8/14/13 was also downloaded from site laptop. The ZSP check data for 8/14, 10/16, and 10/29 included in downloads (with corresponding datalogger flags) was also reviewed.
64. 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 ARS. <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. 				Data from TECO 49i ozone analyzer was compared to datalogger screen data in real time. The only discrepancy observed was the collection timing difference. The TECO 49i analyzer updated approximately every 3 seconds while datalogger updated every second (30.17 vs. 30.2 and 33.51 vs. 33.5). The datalogger was then compared to the DataView program on the laptop with no discrepancies. No flags were reported during observation.

<p>65. Obtain 1-minute data directly from the instrument or from ARS.</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>Hourly averages are reproducible from 1-minute average for data with 60 collection points and in cases where points are excluded due to calibration.</p> <p>10/29 8am = 19.4 datalogger 10/29 8am = 19.4 calculated</p> <p>10/29 9am = 40.4 datalogger 10/29 9am = 40.4 calculated</p> <p>ARS investigated why the reported values on AIRNow did not match the reported values on DataView. Jessica Ward contacted Sonoma Tech and found that the value that was reviewed in AIRNow is a forecasted value (not an actual measured concentration) that is based on values reported from several different stations. Rocky is one of them, so for some reason it's labeled as Rocky Mountain National Park in AIRNow. Recorded concentrations should be compared to values in AIRNow Tech. Actual recorded concentrations are not available in AIRNow.</p>
<p>66. 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 interruption caused by audit activities.</p>
<p>67. 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>A PE audit conducted on 6/10/13 was reported by EEMS to have a wind direction failure. To this date, the data has not been updated at this time.</p> <p>Jessica Ward stated the data will be invalidated back to the last good check. At the time of the TSA, the ARS trip report from August confirming the audit finding in June had not yet been finalized and released to IMC.</p> <p>The result of the audit is first verified to determine that it was an accurate result. In this case the audit result was confirmed by the ARS calibration check that was done a few months later. These types of results are reviewed monthly when validating data, but the results are usually available after data have been "finalized" for the month. In this case the corrections are generally made as soon as the result has been confirmed and the appropriate course of action has been determined, and always prior to preparing the annual report and beginning the annual data certification process.</p> <p>As of November 12, this data has not been flagged in AQS or the CASTNET website.</p>

<p>68. Auditor will observe the data validation process with the datalogger and DataView 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>No deviations from data validation process were observed.</p>
<p>69. 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 ARS 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>Two instances of data changes were shown.</p> <p>First at the PEFO site, a reported parameter validation code was changed from V (valid data) to VA (valid value adjusted from raw value by analyst).</p> <p>At the ROMO site a TMP parameter issue was observed to have a validation code change from V (valid data) to IM (Instrument Malfunction) from 4/13/12 to 8/21/12.</p> <p>Data reported in CASTNET has been removed for this parameter. Data from AQS for 4/14/12 will be reviewed and included in the report.</p> <p>ARS sends updated information to websites after validation/review.</p>	
<p>70. Based on the three data sources (ARSC 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 1-minute data sources agree? • Do hourly averages posted on AQS and the CASTNET website agrees as to both concentration and time? 			<p>Information will be provided in report.</p>
<p>71. Review ARS's validation records for a past issue. How are outliers identified and marked invalid by the validation process?</p> <ul style="list-style-type: none"> - Was the outlier correctly identified? - Was the correct data flag applied? 	X		<p>All data points are coded with a "V" if points are valid.</p> <p>If a point needs to be invalidated, the V code is changed as appropriate and data is re-submitted with new code.</p>
<p>72. Was anyone contacted (site operator, auditor, and network service person) to ask about the outlier? Discuss the general process of investigating unexplained outliers in the data.</p>	X		<p>All involved parties are included in discussions. After issue is observed, data is re-coded (if necessary) and repairs to the instrumentation are discussed and implemented (if necessary).</p>
<p>73. For the observed issue, did enough valid observations remain to compute a valid hourly average? (RTI will re-compute the hourly average and compare it to the hourly averages posted in AQS and on the CASTNET website)</p>		X	<p>No specific instance where data points need to be reconstructed were observed by RTI auditor. General practice guidelines are listed above.</p>

In the following questions RTI will download previous data from AQS and the ARS web site and compare hourly data over several months and sites.

Audit Questions	Response			Comments and References (provided by ARS personnel unless otherwise indicated)
	Y	Y	Y	
74. Do the hourly data received directly from ARS agree with the corresponding data downloaded from the EPA data sources (AQS and the CASTNET website operated by EPA/CAMD)?	X			Information will be provided in report.
75. Do time stamps agree?	X			Information will be provided in report.

Additional Comments:

22. The latest version of the SOP available on the CASTNET website is Revision 4.2 from Feb 2010. Jessica Ward provided the RTI auditor with electronic copies of Revision 4.3 (March 2012) and Revision 4.4 (October 2013) after the audit. RTI recommends that a process be put into place so updated SOPs are sent to the appropriate person to update the CASTNET website.

25. ARS does not have an SOP that outlines a test plan for evaluating software updates and testing changes. There is no formal documentation tracking the changes or updates, thus no results of any recent updates. Software development is performed in-house (no commercial company). RTI recommends that ARS develop a process to valid software upgrades, updates, or changes to include at a minimum a test plan with reported results of data prior to and after the upgrade, update, or change to the data management system. In general, the systems are reviewed, but this should be documented along with the frequency and the results.

67. RTI reviewed AQS and CASTNET website regarding the wind direction failure reported by EE&MS during a PE audit conducted on June 10, 2013. As of November 12, 2013, this data has not been flagged. RTI recommends that the ARS Data Management Manager review this matter to determine that this is a one-time issue not a continual problem.

- RTI auditor was informed of an issue observed during data gathering phase of the process, where digits reported by instrument are received in reverse order; this issue is only observed on older instrumentation. RTI auditor was informed further investigation is being conducted by the ARS staff on the matter and that data validation steps catch any discrepancies. There should be no impact to reported data.
- Though it is outside ARS control, websites reporting real-time data should have a disclaimer expressing the validation status of the data. An example of a disclaimer can be found at the Colorado Department of Health and Environment website at: http://www.colorado.gov/airquality/air_quality.aspx.

APPENDIX D

6-Month Calibration Audit of the Rocky Mountain National Park (ROM406) Site

Twice-Annual Station Maintenance and Calibration Report
ROCKY MOUNTAIN NATIONAL PARK
August 20, 2013

National Park Service Gaseous Pollutant Monitoring Program
Prepared by Air Resource Specialists, Inc. under Contract P11PC00109

CALIBRATION SUMMARY

Air Quality Site: Long's Peak

Primary Site Operator: Dyan Harden

Field Specialist: Kelly Blomme

Backup Site Operator: Michelle Gibbons

All site visit and calibration forms are attached, detailing the pre- and post-maintenance calibrations.

Pre-Maintenance Calibration Summary:

The wind sensor did not pass the "as found" checks.

Maintenance Activity Summary:

O₃ analyzer and station reference (Thermo 49C / Thermo 49I) – An initial multipoint was run on the system as it was upon arrival. The analyzer, the calibrator, and the duplicate all passed the initial multipoint. The calibrator was removed and the duplicate machine was installed as the on-site calibrator. The extra Teflon tubing was removed. A second multipoint was done after the removal of the ozone sampler and all the replumbing of the Teflon tubing was done. Both the analyzer and the calibrator passed.

Wind Speed/Wind Direction (RMYoung 05305) -- Pre-maintenance checks showed that the sensor failed the alignment and the linearity checks. This sensor did pass the wind speed checks. A new sensor was installed and it passed the linearity and alignment checks. This sensor also passed the wind speed checks.

Ambient Temperature/Delta Temperature (RMYoung 41341VC) -- A pre-maintenance check of the system using water baths at three different temperatures showed the system to be within specifications. The aspirator fans were working.

Solar Radiation (Licor Pyranometer) –The sensor was found level and clean. During collocated checks against a solar standard, the sensor was found to be within specifications.

Precipitation (Climatronics 100508) – The precipitation gauge was found clean and level. A controlled precipitation check was performed on the system and the results show the system to be within specifications.

Relative Humidity (Rotronics MP601A) – Premaintenance checks against a collocated standard were within specifications. The sensor was replaced and collocated checks were performed again and the new sensor was within specifications.



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CASTNET – Pre-maintenance checks of the system against a flow standard showed the system to be within specifications and no adjustments were made. The diaphragm was replaced in the pump.

Post-Maintenance Calibration Summary:

All systems were within specifications.

ADDITIONAL NOTES AND OBSERVATIONS

Station Operator

I met with Alix Jensen and Trish Stockton at the site. They helped me with the winds.

Monitoring Shelter

The shelter, an ECTO 8 ft. by 10 ft., is in good condition. All support equipment is in good condition.



SITE INFORMATION

ABBR.	ROMO-LP	CLIENT	NPS	FIELD SPECIALIST	Kelly Blomme	DATE	8/20/2013
SITE NAME		Long's Peak				DATE OF LAST VISIT	2/12/2013
NETWORK TYPE		NPS					

		Deg	Min	Sec		Decimal
LATITUDE	North	40	16	40	--CALCULATE-->	40.2778
LONGITUDE	West	105	32	43		105.5453

Decimal		Deg	Min	Sec
	--CALCULATE-->			

	Meters		Feet
ELEVATION		--CALCULATE-->	

Feet		Meters
8999	--CALCULATE-->	2743

SITE STANDARDS	Please verify site standards used by the site operator			
PM Flow Reference				

NOTES:



**STATION TEMPERATURE SENSOR
VERIFICATION & CALIBRATION**

ABBR.	ROMO-LP	CLIENT	NPS	FIELD SPECIALIST	Kelly Blomme	DATE	8/20/2013
SITE NAME		Long's Peak			DATE OF LAST VISIT		2/12/2013
Network type		NPS					

	MANUFACTURER	MODEL	SERIAL NUMBER	EXPIRATION DATE
Temperature Reference	Eutechnics	4400	304018	1/3/2014

CALIBRATION ACCEPTANCE CRITERIA (<=)	
Temperature Difference (°C)	2.0

AS FOUND	Temperature		
Reference (°C)	DAS (°C)	Difference	
22.89	21.57	-1.3	PASS

AS LEFT	Temperature		
Reference (°C)	DAS (°C)	Difference	
23.36	23.03	-0.3	PASS

NOTES: I adjusted the scaling on the datalogger to bring them closer together.



RELATIVE HUMIDITY SENSOR VERIFICATION & CALIBRATION

ABBR.	ROMO-LP	CLIENT	NPS	FIELD SPECIALIST	Kelly Blomme	DATE	8/20/2013
SITE NAME		Long's Peak				DATE OF LAST VISIT	2/12/2013
Network type		NPS					

	MANUFACTURER	MODEL	SERIAL NUMBER	EXPIRATION DATE
RH SENSOR REFERENCE	Rotronics	101a	56095	5/20/2014

AS FOUND

Manufacturer	rotronics
Model	mp601a
Serial Number	56091

AS LEFT

Manufacturer	rotronics
Model	mp601a
Serial Number	67855

LAB CALIBRATION ACCEPT. CRITERIA (<=)		FIELD CALIBRATION ACCEPT. CRITERIA (<=)	
Relative Humidity Difference (%)	N/A	Relative Humidity Difference (%)	5.0

AS FOUND	Relative Humidity	
Reference (%)	DAS (%)	Difference
24.9	24.2	-0.7
21.7	22.0	0.3
25.6	25.2	-0.4
25.1	24.7	-0.4
26.2	25.5	-0.7
	Average	-0.4

AS LEFT	Relative Humidity	
Reference (%)	DAS (%)	Difference
29.8	29.0	-0.8
31.9	31.1	-0.8
32.5	31.4	-1.1
32.1	30.7	-1.4
29.4	28.8	-0.6
	Average	-0.9

Aspirator fan functional? Yes No N/A

NOTES:



WIND SPEED SENSOR VERIFICATION & CALIBRATION

ABBR.	ROMO-LP	CLIENT	NPS	FIELD SPECIALIST	Kelly Blomme	DATE	8/20/2013
SITE NAME		Long's Peak			DATE OF LAST VISIT		2/12/2013
Network type		NPS					

	MANUFACTURER	MODEL	SERIAL NUMBER	EXPIRATION DATE
Wind Speed Reference	RMYoung	18802	03358	1/4/2013
Wind Speed Torque Gauge	RMYoung			

AS FOUND	
Manufacturer and Model	RM Young - 05305 / 08254 PSD
Sensor Serial #	47014/nps90893
Cups Serial #	

AS LEFT	
Manufacturer and Model	RM Young - 05305 / 08254 PSD
Sensor Serial #	60813
Cups Serial #	

CALIBRATION ACCEPTANCE CRITERIA (<=)	
Wind Speed Difference (m/s)	0.2 if wind speed < 5 m/s
Wind Speed Difference (m/s)	5.0% if wind speed > 5 m/s

AS FOUND		Wind Speed		
Motor Speed (rpm)	Target Speed (m/s)	DAS (m/s)	Difference	
0	0.000	0.000	N/A	N/A
600	3.072	3.174	0.10	PASS
1200	6.144	6.144	0.00	PASS
4000	20.480	20.480	0.00	PASS
7000	35.840	35.840	0.00	PASS
9000	46.080	46.080	0.00	PASS
MAX ABS Difference			0.10	

Starting Threshold	TORQUE
Torque <= 0.3 g-cm	0.3
	NO ACTION REQUIRED

Heater sleeve functional? Yes No N/A

AS LEFT		Wind Speed		
Motor Speed (rpm)	Target Speed (m/s)	DAS (m/s)	Difference	
0	0.000	0.000	N/A	N/A
600	3.072	3.072	0.00	PASS
1200	6.144	6.144	0.00	PASS
4000	20.480	20.480	0.00	PASS
7000	35.840	35.840	0.00	PASS
9000	46.080	46.080	0.00	PASS
MAX ABS Difference			0.00	

Starting Threshold	TORQUE
Torque <= 0.3 g-cm	0.3
	NO ACTION REQUIRED

NOTES:

ABBR.	ROMO-LP	CLIENT	NPS	FIELD SPECIALIST	Kelly Blomme	DATE	8/20/2013
SITE NAME		Long's Peak		DATE OF LAST VISIT		2/12/2013	
Network type		NPS					

	MANUFACTURER	MODEL	SERIAL NUMBER	EXPIRATION DATE
Direction Alignment Reference	Brunton		5060408265	na
Direction Linearity Reference	RMYoung			na
Direction Torque Gauge	RMYoung			

AS FOUND	
Manufacturer & Model	RM Young - 05305
Sensor Serial #	47014/nps90893
Vane Serial #	

AS LEFT	
Manufacturer & Model	RM Young - 05305
Sensor Serial #	60813
Vane Serial #	

Local Magnetic Declination (degrees)	8 59
Method	magnetic-declination.com

Mag. Dec. from NOAA (deg/min/sec)	8	58	43	8.98
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<http://www.ngdc.noaa.gov/geomag-web/#declination>

CALIBRATION ACCEPTANCE CRITERIA (<=)	
Cross-arm Alignment Error (degrees)	N/A
Total Align. Diff (degrees)	5
Sensor Linearity (degrees)	3

Landmarks	Degrees
To Long's Notch	245
From Long's Notch	65
To Estes Cone	315
From Estes Cone	135

AS FOUND	
Reference Alignment Error (degrees)	0.0

AS LEFT	
Reference Alignment Error (degrees)	0.0

SENSOR ALIGNMENT			
Reference	Degrees	DAS	Difference
From the North	0		
From the South	180		
From the East	90		
From the West	270		
Total Alignment	MAX ABS Diff		

SENSOR ALIGNMENT			
Reference	Degrees	DAS	Difference
From the North	0		
From the South	180		
From the East	90		
From the West	270		
Total Alignment	MAX ABS Diff		

OR

OR

SENSOR ALIGNMENT			
Landmark	Degrees	DAS	Difference
To Long's Notch	245	235.5	-9.5
From Long's Notch	65	78.5	13.5
To Estes Cone	315	297.8	-17.2
From Estes Cone	135	139.8	4.8
Total Alignment	MAX ABS Diff	17.2	FAIL

SENSOR ALIGNMENT			
Vane Alignment	Degrees	DAS	Difference
To Long's Notch	245	240.4	-4.6
From Long's Notch	65	61.7	-3.3
To Estes Cone	315	311.4	-3.6
From Estes Cone	135	131.1	-3.9
Total Alignment	MAX ABS Diff	4.6	PASS

SENSOR LINEARITY		
Point	DAS	Difference
1	182.7	N/A
2	220.1	-8
3	260.0	-5
4	300.3	-5
5	26.2	41
6	63.5	-8
7	102.7	-6
8	142.0	-6
1	182.3	-5
MAX Difference		41

ACTION REQUIRED

SENSOR LINEARITY		
Point	DAS	Difference
1	176.3	N/A
2	220.4	-1
3	266.6	1
4	311.2	0
5	359.0	3
6	42.5	-2
7	87.0	0
8	132.0	0
1	175.5	-2
MAX Difference		3

NO ACTION REQUIRED

Starting Threshold	TORQUE
Torque <= 9.0 g-cm	5
NO ACTION REQUIRED	

Starting Threshold	TORQUE
Torque <= 9.0 g-cm	5
NO ACTION REQUIRED	

Heater sleeve functional?	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> N/A
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NOTES:



SOLAR RADIATION SENSOR VERIFICATION & CALIBRATION

ABBR.	ROMO-LP	CLIENT	NPS	FIELD SPECIALIST	Kelly Blomme	DATE	8/20/2013
SITE NAME		Long's Peak		DATE OF LAST VISIT		2/12/2013	
Network type		NPS					

	MANUFACTURER	MODEL	SERIAL NUMBER	EXPIRATION DATE	MULTIPLIER
Solar Radiation Reference	licor	pyranometer	py79872	5/24/2014	

AS FOUND

Manufacturer	licor
Model	pyranometer
Serial Number	py19983
Translator	rmyoung 70140
Fullscale (W/m ²)	1000

AS LEFT

Manufacturer	licor
Model	pyranometer
Serial Number	py19983
Translator	rmyoung 70140
Fullscale (W/m ²)	1000

CALIBRATION ACCEPTANCE CRITERIA (<=)	
Difference from CTS (%)	5%

AS FOUND	Solar Radiation			
	Hour	CTS (W/m ²)	DAS (W/m ²)	Difference
	1100	212.3	208	-1.8%
	1200	416.8	412	-1.3%
	1300	246.1	243	-1.1%
	1400	123.7	123	-0.6%
	1500	179.2	178	-0.8%
	800 8/21/13	472.5	469	-0.7%
	900 8/21/13	324.6	321	-1.1%
MEAN ABS % DIFF			1.1%	PASS

	DAS (W/m ²)
DARK RESPONSE	0

Sensor found clean? Yes No

Sensor found level? Yes No

AS LEFT	Solar Radiation			
	Hour	CTS (W/m ²)	DAS (W/m ²)	Difference
	1300			
	1400			
	1500			
	1600			
MEAN ABS % DIFF				

	DAS (W/m ²)
DARK RESPONSE	

NOTES:



PRECIPITATION SENSOR VERIFICATION & CALIBRATION

ABBR.	ROMO-LP	CLIENT	NPS	FIELD SPECIALIST	Kelly Blomme	DATE	8/20/2013
SITE NAME		Long's Peak			DATE OF LAST VISIT		2/12/2013
Network type		NPS					

	MANUFACTURER	MODEL	SERIAL NUMBER	EXPIRATION DATE
Precipitation Reference	cylinder and funnel	na	na	na

AS FOUND

Manufacturer	climatronics
Model	100508
Serial Number	usepa01620/nps02532

AS LEFT

Manufacturer	climatronics
Model	100508
Serial Number	usepa01620/nps02532

CALIBRATION ACCEPTANCE CRITERIA (<=)	
Difference from Input Volume (%)	5%

Reference Chart			Input Volume (mL)		480	
Manufacturer	Model	Diameter (in.)	mm/tip	mL/tip	DAS target	
	Climatronics	100097-1-G0-H0	8	0.254	8.24	14.80
x	Climatronics	100508	9.66	0.100	4.73	10.15
	Met One	370	8	0.254	8.24	14.80
	Met One	385	12	0.254	18.53	6.58
	RM Young	52202	6.2825	0.100	2.00	24.00

Conversions			
Value	Units	Value	Units
1.000	inch	25.400	mm
25.40	mm	1.000	inch

AS FOUND		Precipitation	
Reference (mL)	Target (mm)	DAS (mm)	Difference
480	10.15	10.20	0.0%
PASS			

Heater functional? Yes No N/A

Sensor found level? Yes No

Sensor found clean? Yes No

AS LEFT		Precipitation	
Reference (mL)	Target (mm)	DAS (mm)	Difference
480			

NOTES:

ABBR.	ROMO-LP	CLIENT	NPS	FIELD SPECIALIST	Kelly Blomme	DATE	8/20/2013
SITE NAME		Long's Peak			DATE OF LAST VISIT		2/12/2013
Network type		NPS					

Temperature Reference	MANUFACTURER	MODEL	SERIAL NUMBER	EXPIRATION DATE
	Eutechnics	4400	304018	1/3/2014

AS FOUND

10m Temperature Sensor	
Manufacturer	RM Young
Model	41341vc
Serial Number	17079

2m Temperature Sensor	
Manufacturer	RM Young
Model	41341vc
Serial Number	17078

List sensors according to height on tower, from highest to lowest.

AS LEFT

10m Temperature Sensor	
Manufacturer	RM Young
Model	41341vc
Serial Number	17079

2m Temperature Sensor	
Manufacturer	RM Young
Model	41341vc
Serial Number	17078

CALIBRATION ACCEPTANCE CRITERIA (<=)	
Ambient Temperature Difference (°C)	0.5
Vertical Temperature Difference (°C)	0.2

AS FOUND	10m Temperature			2m Temperature		
	Bath Temp (°C)	DAS	Difference	DAS	Difference	
	29.10	29.13	0.03 PASS	29.08	-0.02	PASS
	44.80	44.73	-0.07 PASS	44.69	-0.11	PASS
	0.08	0.24	0.16 PASS	0.25	0.17	PASS
MAX ABS Difference		0.16	PASS	0.17	PASS	

Δ Temp 10m- 2m	
	0.05 PASS
	0.04 PASS
	-0.01 PASS
MAX ABS Difference	0.05 PASS

Aspirator fan functional 10m?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
Aspirator fan functional 2m?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A
	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> N/A

AS LEFT	10m Temperature			2m Temperature		
	Bath Temp (°C)	DAS	Difference	DAS	Difference	
MAX ABS Difference						

Δ Temp 10m- 2m	
MAX ABS Difference	

NOTES:

ABBR.	ROMO-LP	CLIENT	NPS	FIELD SPECIALIST	Kelly Blomme	DATE	8/20/2013
SITE NAME		Long's Peak		DATE OF LAST VISIT		2/12/2013	
Network type		NPS					

MFC High Flow Reference	MANUFACTURER	MODEL	SERIAL NUMBER	EXPIRATION DATE
	Bios	Definer220	120798	1/11/2014

AS FOUND

MFC	
Manufacturer	Tylan
Model	FC280SAV-45
Serial Number	aw9403024

Pump	
Manufacturer	Thomas
Model	107cab18
Serial Number	usepa07928

Flow Target	3.00
-------------	------

AS LEFT

MFC	
Manufacturer	Tylan
Model	FC280SAV-45
Serial Number	aw9403024

Pump	
Manufacturer	Thomas
Model	107cab18
Serial Number	usepa07928

ENTER FLOWS IN SLPM

AS FOUND		MFC VDC Linear Regression		ESC Logger Scaling	
Date		Setpoint	3.050	High Input (V)	5.000
Setpoint	3.050	Slope	1.025	Low Input (V)	0.000
Slope	1.025	Intercept	-0.035	High Output (LPM)	5.460
Intercept	-0.035			Low Output (LPM)	0.040

Operational Checks	
Vacuum	17.5
DAS Flow	3.1
MFC Flow	3.1
Flow Standard	3.0

AS FOUND	Target	Flow Standard	Rotometer	MFC Display	MFC Volts DC	DAS Display	Difference		
							Value	%	
Pump Off	0.00 SLPM		0.00	-0.06	-0.027	0.016			
Leak Test	0.00 SLPM		0.00	-0.05	-0.020	0.020			
1	2.00 SLPM	1.995	2.35	2.00	1.804	1.998	0.003	0.2%	
2 (low)	2.50 SLPM	2.462	2.95	2.50	2.242	2.470	0.008	0.3%	PASS
3 (target)	3.00 SLPM	2.944	3.60	3.00	2.689	2.954	0.010	0.3%	PASS
4 (high)	3.50 SLPM	3.431	4.25	3.50	3.145	3.448	0.017	0.5%	PASS
5	4.00 SLPM	3.906	4.85	4.00	3.592	3.932	0.026	0.7%	
MAX	> 4.00 SLPM	4.578	5.00	4.70	4.221	4.614	0.036	0.8%	

Leak Test Results		
Flow (SLPM)	0.01	PASS

*Note: A leak is present if the difference between the zero and leak test value is greater than 0.10 lpm

Recalibration	Not Required
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*Note: A calibration is required if the difference between the transfer standard and the DAS value is greater than +/- 2.0% at the target setting or greater than +/- 2.5% at either the low or high point

NEW CALIBRATION FACTORS		MFC VDC Linear Regression		ESC Logger Scaling	
Setpoint		Setpoint		High Input (V)	5.000
Slope		Slope		Low Input (V)	0.000
Intercept		Intercept		High Output (LPM)	
Correlation		Correlation		Low Output (LPM)	

AS LEFT	Target	Flow Standard	Rotometer	MFC Display	MFC Volts DC	DAS Display	Difference		
							Value	%	
Pump Off	0.00 SLPM								
Leak Test	0.00 SLPM								
1	2.00 SLPM								
2 (low)	2.50 SLPM								
3 (target)	3.00 SLPM								
4 (high)	3.50 SLPM								
5	4.00 SLPM								
MAX	> 4.00 SLPM								

Leak Test Results		
Flow (SLPM)		

*Note: A leak is present if the difference between the zero and leak test value is greater than 0.10 lpm

Operational Checks	
Vacuum	18.5
DAS Flow	3.0
MFC Flow	3.1
Flow Standard	3.0

NOTES: Diaphragm was replaced on the pump.



CALIBRATION AND VERIFICATION STANDARDS

ABBR.	ROMO-LP	CLIENT	NPS	FIELD SPECIALIST	Kelly Blomme	DATE	8/20/2013
SITE NAME		Long's Peak			DATE OF LAST VISIT		2/12/2013
Network type		NPS					

	MANUFACTURER	MODEL	SERIAL #	Calibration Expiration Date		
Ozone Transfer Standard	Thermo	49I-PS	0733726105	7/15/2014		
MFC High Flow Reference	Bios	Definer220	120798	1/11/2014		
MFC Low Flow Reference	na					
Temperature Reference	Eutechnics	4400	304018	1/3/2014		
AT/RH Sensor Reference	Rotronics	101a	56095	5/20/2014		
Barometric Pressure Reference	Vaisala	air-hb-1a	3f2502	9/13/2013		
Wind Speed Reference	RMYoung	18802	03358	1/4/2013		
Wind Speed Torque Gauge	RMYoung					
Wind Direction Alignment Reference	Brunton		5060408265	na		
Wind Direction Linearity Reference	RMYoung			na		
Wind Direction Torque Gauge	RMYoung					
Solar Radiation Reference						
Multiplier	0.00	W/m ² / mV	licor	pyranometer	py79872	5/24/2014
UV Radiation Reference						
Multiplier	217.00	W/m ² / mV	na			
Precipitation Reference						
Volume	480	mL	cylinder and funnel	na	na	na
PM Flow Reference						
PM Temperature Reference						
PM Barometric Pressure Reference						
TEOM MTC Verification Reference						
Voltage Measurement Reference	fluke	179	95520648	12/28/2013		
Voltage Source						
PM Flow Reference 2						
PM Temperature Reference 2						
PM Barometric Pressure Reference 2						



**OZONE ANALYZER VERIFICATION & CALIBRATION
(AS FOUND)**

ABBR.	ROMO-LP	CLIENT	NPS	FIELD SPECIALIST	Kelly Blomme	DATE	8/20/2013
SITE NAME	Long's Peak		DATE OF LAST VISIT	2/12/2013			
Network type	NPS						

AS FOUND

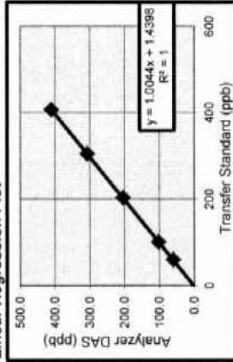
TRANSFER STANDARD		AMBIENT ANALYZER		STATION REFERENCE	
Manufacturer	Thermo	Manufacturer	Thermo	Manufacturer	Thermo
Model	49I-PS	Model	49I	Model	49I
Serial Number	0733726105	Serial Number	1030745086	Serial Number	1130450194
Coefficient	1	Coefficient	1.008	Coefficient	.960
Background	0	Background	0	Background	-.3
Cell A Intensity (Hz)	88688	Cell A Intensity (Hz)	64242	Cell A Intensity (Hz)	117804
Cell B Intensity (Hz)	81441	Cell B Intensity (Hz)	71405	Cell B Intensity (Hz)	140098
Flow A (lpm)	0.578	Flow A (lpm)	.582	Flow A (lpm)	.570
Flow B (lpm)	0.581	Flow B (lpm)	.589	Flow B (lpm)	.549
Pressure (mmHg)	558.2	Pressure (mmHg)	547.6	Pressure (mmHg)	550.5
Bench Temp (°C)	34.4	Bench Temp (°C)	35.6	Bench Temp (°C)	50.1
Bench Lamp Temp (°C)	52.7	Bench Lamp Temp (°C)	53.9	Bench Lamp Temp (°C)	54
Ozone Lamp Temp (°C)	65.7	Ozone Lamp Temp (°C)	67.4	Ozone Lamp Temp (°C)	
Ozone Source	X	Ozone Source		Ozone Source	

CALIBRATION ACCEPTANCE CRITERIA (<=)	
Mean Absolute Difference (%)	5%
Maximum Absolute Difference (%)	5%
Linearity % of Fullscale	1%
Slope (% difference from 1.000)	5%
Intercept (ppb)	3.0
Correlation	0.9950

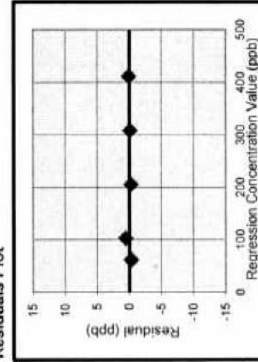
Transfer Standard Correction Factors	SLOPE	INT.
	0.9774	1.6125

Full Scale (ppb) 500

Linear Regression Plot



Residuals Plot



POINT TARGET	O3 LAMP % or mV	TRANSFER STANDARD			AMBIENT ANALYZER			STATION REFERENCE					
		Display	Corrected	DAS	Diff	%Diff	Linearity %	DAS	Diff	%Diff	Linearity %		
ZERO	0	0.2	-1.4	0.2	1.6	N/A	-0.1%	PASS	0.7	2.1	N/A	-0.1%	PASS
1	400	400	407.6	411.0	3.4	0.8%	0.0%	PASS	415.0	7.4	1.8%	0.0%	PASS
2	300	300	305.3	308.0	2.7	0.9%	0.0%	PASS	311.0	5.7	1.9%	0.1%	PASS
3	200	200	203.0	205.0	2.0	1.0%	0.1%	PASS	208.0	5.0	2.5%	-0.1%	PASS
4	100	100	100.7	103.0	2.3	2.3%	-0.1%	PASS	104.0	3.3	3.3%	0.0%	PASS
5	70	60	59.7	61.0	1.3	2.1%	0.1%	PASS	62.0	2.3	3.8%	0.1%	PASS
ZERO	0	-0.1	-1.8	-0.9	0.8	N/A	0.1%	PASS	-0.2	1.6	N/A	0.0%	PASS
		Mean ABS % Diff		1.4%		PASS		Mean ABS % Diff		2.7%		PASS	
		Max ABS % Difference		2.3%		PASS		Max ABS % Difference		3.8%		PASS	
		Slope		1.005		PASS		Slope		1.014		PASS	
		Y-Intercept		1.25		PASS		Y-Intercept		1.83		PASS	
		Correlation		1.0000		PASS		Correlation		1.0000		PASS	

NOTES:



OZONE ANALYZER VERIFICATION & CALIBRATION (AS FOUND)

ABBR.	ROMO-LP	CLIENT	NPS	FIELD SPECIALIST	Kelly Blomme	DATE	8/20/2013
SITE NAME	Long's Peak		DATE OF LAST VISIT		2/12/2013		
Network type	NPS						

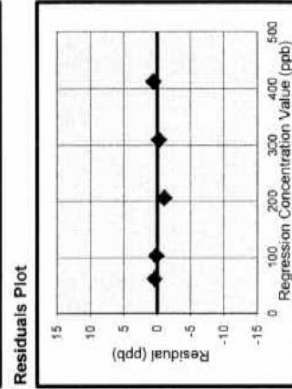
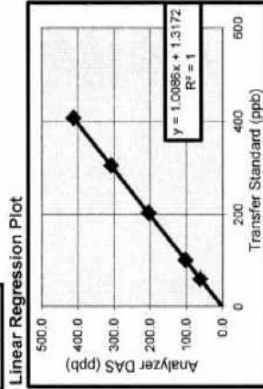
AS FOUND

TRANSFER STANDARD		AMBIENT ANALYZER		STATION REFERENCE	
Manufacturer	Thermo	Manufacturer	Thermo	Manufacturer	Thermo
Model	491-PS	Model	491	Model	491
Serial Number	0733726105	Serial Number	1030745086	Serial Number	8460009
Coefficient	1	Coefficient	1.008	Coefficient	1.01
Background	0	Background	0	Background	-5
Cell A Intensity (Hz)	89803	Cell A Intensity (Hz)	64023	Cell A Intensity (Hz)	68995
Cell B Intensity (Hz)	82388	Cell B Intensity (Hz)	71299	Cell B Intensity (Hz)	60200
Flow A (lpm)	0.58	Flow A (lpm)	.596	Flow A (lpm)	.631
Flow B (lpm)	0.582	Flow B (lpm)	.593	Flow B (lpm)	.616
Pressure (mmHg)	558.2	Pressure (mmHg)	546.9	Pressure (mmHg)	550.8
Bench Temp (°C)	31.8	Bench Temp (°C)	35.2	Bench Temp (°C)	39
Bench Lamp Temp (°C)	52.2	Bench Lamp Temp (°C)	53.8	Bench Lamp Temp (°C)	54
Ozone Lamp Temp (°C)	64.4	Ozone Lamp Temp (°C)	67.4	Ozone Lamp Temp (°C)	
Ozone Source	X	Ozone Source		Ozone Source	

CALIBRATION ACCEPTANCE CRITERIA (<=)	
Mean Absolute Difference (%)	5%
Maximum Absolute Difference (%)	5%
Linearity % of Fullscale	1%
Slope (% difference from 1,000)	5%
Intercept (ppb)	-3.0
Correlation	0.9950

Transfer Standard Correction Factors	SLOPE	INT
	0.9774	-1.6125

Full Scale (ppb) 500



POINT TARGET	O3 LAMP % or mV	TRANSFER STANDARD		AMBIENT ANALYZER			STATION REFERENCE									
		Display	Corrected	DAS	Diff	%Diff	Linearity %	DAS	Diff	%Diff	Linearity %					
ZERO	0	0	-11.6	-0.5	1.1	N/A	0.0%	PASS	-0.6	1.0	N/A	0.2%	PASS			
1	400	400	407.6	413.0	5.4	1.3%	-0.1%	PASS	411.0	3.4	0.8%	-0.1%	PASS			
2	300	300	305.3	309.0	3.7	1.2%	0.0%	PASS	307.0	1.7	0.6%	0.2%	PASS			
3	200	200	203.0	205.0	2.0	1.0%	0.2%	PASS	205.0	2.0	1.0%	0.1%	PASS			
4	100	100	100.7	103.0	2.3	2.3%	0.0%	PASS	103.0	2.3	2.3%	0.0%	PASS			
5	70	60	59.7	62.0	2.3	3.8%	-0.1%	PASS	62.0	2.3	3.8%	0.0%	PASS			
ZERO	0	-0.5	-2.2	-0.6	1.5	N/A	0.0%	PASS	0.6	2.8	N/A	-0.2%	PASS			
		Mean ABS % Diff		1.9%		PASS	Mean ABS % Diff		1.7%		PASS	Mean ABS % Diff		3.8%		PASS
		Max ABS % Difference		3.8%		PASS	Max ABS % Difference		3.8%		PASS	Max ABS % Difference		3.8%		PASS
		Slope		1.009		PASS	Slope		1.002		PASS	Slope		1.002		PASS
		Y-Intercept		1.32		PASS	Y-Intercept		1.91		PASS	Y-Intercept		1.91		PASS
		Correlation		1.0000		PASS	Correlation		1.0000		PASS	Correlation		1.0000		PASS

NOTES:



OZONE ANALYZER VERIFICATION & CALIBRATION (AS LEFT)

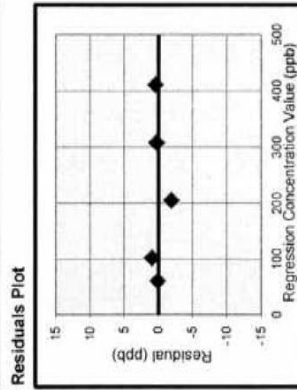
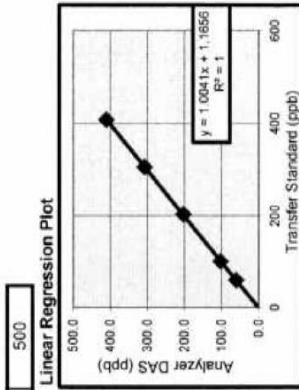
ABBR.	ROMO-LP	CLIENT	NPS	FIELD SPECIALIST	Kelly Blomme	DATE	8/20/2013
SITE NAME	Long's Peak		DATE OF LAST VISIT		2/12/2013		
Network type	NPS						

AS LEFT

TRANSFER STANDARD		AMBIENT ANALYZER			STATION REFERENCE		
Manufacturer	Thermo	Manufacturer	Thermo	Manufacturer	Thermo	Manufacturer	Thermo
Model	491-PS	Model	491	Model	491	Model	491
Serial Number	0733726105	Serial Number	1030745086	Serial Number	8460009	Serial Number	8460009
Coefficient	1	Coefficient	1.008	Coefficient	1.01	Coefficient	1.01
Background	0	Background	0	Background	-5	Background	-5
Cell A Intensity (Hz)	87744	Cell A Intensity (Hz)	78738	Cell A Intensity (Hz)	86762	Cell A Intensity (Hz)	86762
Cell B Intensity (Hz)	82388	Cell B Intensity (Hz)	87592	Cell B Intensity (Hz)	76289	Cell B Intensity (Hz)	76289
Flow A (lpm)	0.58	Flow A (lpm)	.590	Flow A (lpm)	.639	Flow A (lpm)	.639
Flow B (lpm)	0.562	Flow B (lpm)	.591	Flow B (lpm)	.619	Flow B (lpm)	.619
Pressure (mmHg)	558.2	Pressure (mmHg)	547.3	Pressure (mmHg)	550.5	Pressure (mmHg)	550.5
Bench Temp (°C)	31.8	Bench Temp (°C)	36.7	Bench Temp (°C)	36.7	Bench Temp (°C)	36.7
Bench Lamp Temp (°C)	52.2	Bench Lamp Temp (°C)	53.9	Bench Lamp Temp (°C)	54.1	Bench Lamp Temp (°C)	54.1
Ozone Lamp Temp (°C)	64.4	Ozone Lamp Temp (°C)	67.5	Ozone Lamp Temp (°C)		Ozone Lamp Temp (°C)	
Ozone Source	X	Ozone Source		Ozone Source		Ozone Source	

CALIBRATION ACCEPTANCE CRITERIA (<=)	
Mean Absolute Difference (%)	5%
Maximum Absolute Difference (%)	5%
Linearity % of Fullscale	1%
Slope (% difference from 1.000)	5%
Intercept (ppb)	3.0
Correlation	0.9950

SLOPE	INT
Transfer Standard Correction Factors	0.9774
Full Scale (ppb)	500



POINT TARGET	O3 LAMP		TRANSFER STANDARD		AMBIENT ANALYZER			STATION REFERENCE			
	% or mV	Display	Corrected	DAS	Diff	%Diff	Linearity %	DAS	Diff	%Diff	Linearity %
ZERO	0	0.3	-1.3	-0.3	1.0	N/A	0.0%	1.1	2.4	N/A	-0.1%
1	400	400	407.6	411.0	3.4	0.8%	-0.1%	411.0	3.4	0.8%	-0.1%
2	300	300	305.3	308.0	2.7	0.9%	-0.1%	309.0	3.7	1.2%	-0.2%
3	200	200	203.0	203.0	0.0	0.0%	0.4%	203.0	0.0	0.0%	0.5%
4	100	100	100.7	103.0	2.3	2.3%	-0.2%	103.0	2.3	2.3%	0.0%
5	70	60	59.7	61.0	1.3	2.1%	0.0%	62.0	2.3	3.8%	-0.1%
ZERO	0	0.2	-1.4	-0.7	0.7	N/A	0.0%	0.3	1.7	N/A	0.0%
		Mean ABS % Diff		1.2%		PASS	Mean ABS % Diff		1.6%		PASS
		Max ABS % Difference		2.3%		PASS	Max ABS % Difference		3.8%		PASS
		Slope		1.005		PASS	Slope		1.003		PASS
		Y-Intercept		0.86		PASS	Y-Intercept		1.82		PASS
		Correlation		1.0000		PASS	Correlation		1.0000		PASS

NOTES: adjusted the lamp settings on both machines. The duplicate machine was left in place as the calibrator. The certification on this machine is still active. The old calibrator was removed. Charcoal was changed and purafil was added.

APPENDIX E

EE&MS PE Audit of the Rocky Mountain National Park (ROM406) Site

**PRELIMINARY NPAP THROUGH-THE-PROBE AUDIT REPORT
AUDIT AGENCY**

OZONE REPORT

Site Name: ROM406
 Auditor: Eric Hebert (EEMS)
 Station Manager: Dyan Harden (operator)

Airs ID: 080690007
 Audit Date: 06/10/13

MOBILE PE LAB INSTRUMENTS

Instrument:	Ozone	CO
Manufacturer:	Thermo	TEI
Model:	49CPS	48C
Serial Number:	517112175	48C-62750-336
Calibration Date:	01/02/13	1/0/1900
Slope	0.9972	calibrated
Intercept (ppm)	0.00018428	day of audit

STATION INSTRUMENT INFORMATION

Instrument:	Ozone	
Manufacturer/Model #:	Thermo	49i A3NAA
Property Number:	1030745086	
Calibration Date:	06/04/13	
Slope/Intercept (ppb):	0.9810	0.3200
Indicated Flow:	0.57 / 0.58 lpm	
In-Line Filter Change:	05/28/13	
Manifold Type:	1/4" Teflon	

PRELIMINARY OZONE AUDIT RESULTS

NPEP O3 Concentration (ppm)	Site Response (ppm)	Percent Difference
0.11022	0.10970	-0.5
0.08021	0.08014	-0.1
0.04976	0.05002	0.5
0.03130	0.03112	-0.6
0.00013	0.00050	

	<u>Pass/Fail</u>	<u>Warning</u>
Ozone Audit Level 6	Pass	
Ozone Audit Level 5	Pass	
Ozone Audit Level 4	Pass	
Ozone Audit Level 3	Pass	
Ozone Audit Level 2	N/A	

<u>Audit Limits</u>	
Pass	Less than or equal to ±10%
Fail	Greater than ±10%
Warning	Greater than ±7%

Auditor	Eric Hebert
	Print
	<i>Eric Hebert</i>
	Signature

EPA person notified in case of audit failure _____

Comments:

The ozone inlet filter is replaced and the sample line conditioned every other week. There is no information on site regarding the last monitor calibration or the verification of the level 3 standard by ARS. The slope and intercept reported are the results of the site operator calibration once per month.