TEST/QA PLAN AMENDMENT

TEST/QA PLAN TITLE AND DATE: Test/QA Plan for Verification of Semi-Continuous Ambient Air Monitoring Systems: Version 1 (September 26, 2008)

AMENDMENT NUMBER: 1.0

EFFECTIVE DATE: 8/31/2010

PART TO BE CHANGED/REVISED: Various (see attached)

CHANGE/REVISION: Various (see attached)

REASON FOR CHANGE: Changes reflect performance of second round of testing at new location and with various changes to personnel. Additional changes reflect general improvements to the Version 1 test/QA plan (TQAP).

ORIGINATED BY:

_____
Battelle Verification Test Coordinator

_____
DATE

APPROVED BY:

_____	_____
Battelle AMS Center Manager	Battelle AMS Center Quality Manager
_____	_____
DATE	DATE

CHANGES TO BE MADE:

The following revisions are made throughout the document:

Replace references to North Carolina State University or NCSU with MACTEC.

Replace references to Burden's Creek Monitoring Site with AIRS monitoring site.

Section A3 – The distribution list is revised to the following:

Vendors

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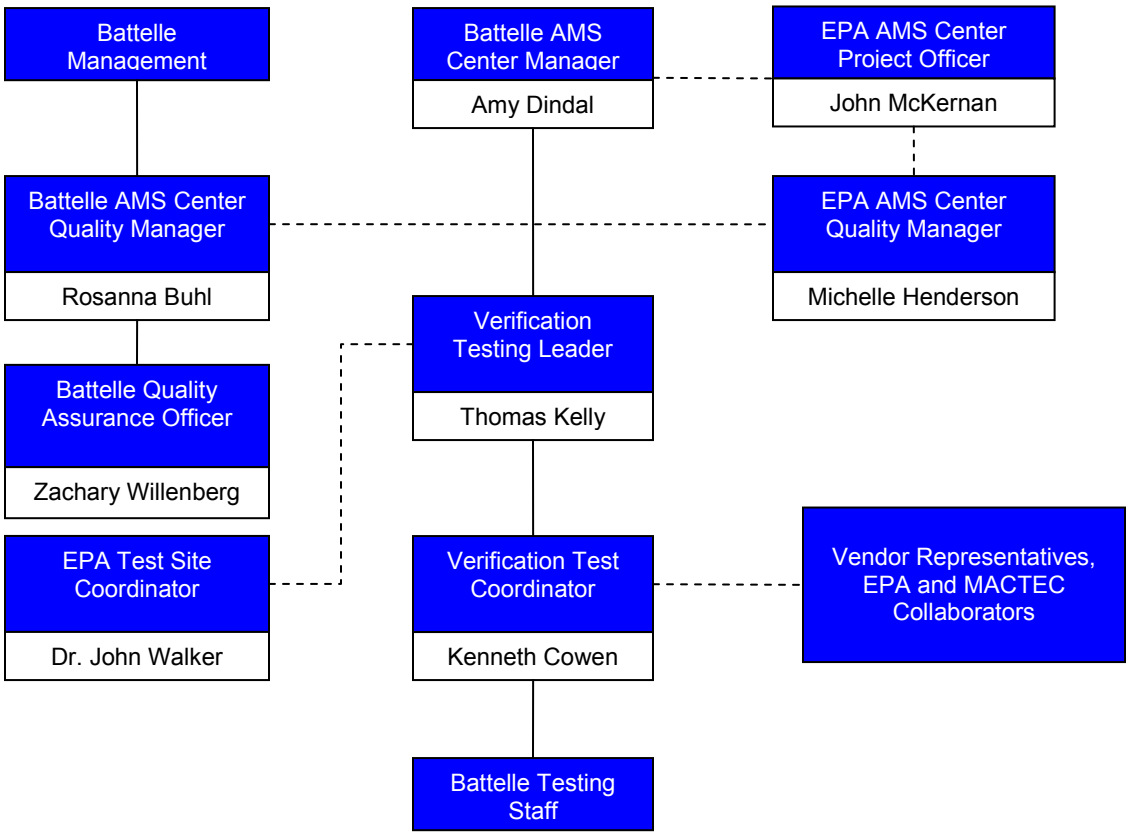
Section A4 - The second and third paragraphs in this section are revised to read:

This verification test will be coordinated and directed by Battelle in cooperation with EPA, with the support of MACTEC Engineering and Consulting (MACTEC). A 30-day period of field testing will be conducted at the AIRS monitoring site at EPA's Research Triangle Park (RTP)

campus to evaluate a commercial, semi-continuous ambient air monitoring system. EPA's Office of Air Quality Planning and Standards (OAQPS), which operates and maintains the monitoring site, will provide continuous sulfur dioxide (SO_2) measurements for the verification test. MACTEC will support this verification test under contract to EPA by preparing and shipping sampling media for reference method air sampling, as well as conducting analysis of the collected samples. Battelle technical staff will perform the collection of duplicate denuder/filter pack samples throughout the verification testing period, store the sampling media and collected samples onsite, and ship collected samples in pre-paid shipping containers provided by MACTEC.

The vendor of the semi-continuous ambient air monitoring system will install two identical units of its system prior to the verification test, and train a skilled EPA-designated operator to operate the system throughout the verification test.

Section A4 – Figure 1 is revised as shown below.



Section A4.1 - Roles and responsibilities for Dr. Kenneth Cowen are revised to add:

- Conduct a kickoff meeting before the start of the verification test.
- Maintain real-time communication with the Battelle AMS Center Manager and EPA AMS Center Project Officer and Quality Assurance Manager on any potential or actual deviations from the TQAP. Prepare written deviation for any departure from TQAP procedures, and retain the approved deviation in the verification test files.
- Provide test data, including data from the first day of testing, to the Battelle AMS Center Manager and EPA AMS Center Project Officer and Quality Manager.
- Compile data from the first day of the verification test and provide the data to the EPA Quality Manager and Project Officer for review.
- Direct the 100% validation and verification of data by technical staff prior to submission for data quality audit.

Roles and responsibilities for the Battelle Field Testing Staff are revised to read:

Battelle Field Testing Staff will oversee and document the testing of the semi-continuous ambient air monitoring system during the verification test, and will be responsible for reference sample collection and on-site sample storage. Battelle staff will be onsite at the EPA air monitoring facility during the entire verification test, including the setup and teardown of the technology, and will be in frequent communication with MACTEC staff responsible for preparation, shipment, and analysis of the reference method samples. Battelle Field Testing Staff will also maintain communication with the technology operator and the technology vendor as needed. The responsibilities of the field testing staff will be to:

- Participate in the kickoff meeting before the start of the verification test.
- Perform the verification test as described in the TQAP.
- Communicate with MACTEC testing staff on the planning, performance, and reporting of the reference analysis.
- Receive and store sampling media for use in reference method sampling.
- Conduct reference method sampling according to the prescribed sampling schedule.

- Store and ship collected reference method samples according to procedures described in this TQAP.
- Record qualitative observations about the maintenance and operation of the semi-continuous ambient air monitoring system during testing.
- Ensure that the data from the semi-continuous ambient air monitoring system are compiled, recorded, and transmitted to the Verification Test Coordinator (VTC) on at least a weekly basis.
- Perform analysis of the collected data to carry out the statistical evaluations in Section B1.1.
- Provide input on test procedures, technology operation and maintenance, and field conditions for the draft verification reports.

Roles and responsibilities for Ms. Rosanna Buhl are added as follows:

Ms. Rosanna Buhl is Battelle's Quality Manager for the AMS Center. Ms. Buhl will:

- Review the draft and final TQAP.
- Assign a quality assurance officer (QAO) for each verification test.
- Delegate to other Battelle quality staff any QAO responsibilities assigned below as needed to meet project schedules.
- Review any audit checklists prepared by the QAO for completeness and detail.
- Review draft audit reports prior to release to the VTC and/or EPA for clarity and appropriate assessment of findings.
- Review audit responses for appropriateness.
- Review and approve TQAPs, TQAP amendments, deviations, and audit reports.
- Maintain frequent communication with the QAO on QA activities, audit results, and concerns.
- Work with the QAO, VTC, and Battelle's AMS Center Manager to resolve data quality concerns and disputes.
- Recommend a stop-work order if audits indicate that data quality or safety is being compromised.

The roles and responsibilities for Mr. Willenberg are revised to the following:

Mr. Zachary Willenberg is Battelle's QAO for this test. Mr. Willenberg will:

- Attend the verification test kickoff meeting and lead the discussion of the QA elements of the kickoff meeting checklist.
- Prior to the start of verification testing, verify the presence of applicable training records, including any vendor training on test equipment.
- Conduct a technical systems audit at the reference method laboratory during the 15-day method validation period.
- Conduct a technical systems audit at the field testing site during the 30-day field period.
- Conduct audits to verify data quality.
- Prepare and distribute an audit report for each audit.
- Verify that audit responses for each audit finding and observation are appropriate and that corrective action has been implemented effectively.
- Communicate to the VTC and/or technical staff the need for immediate corrective action if an audit identifies TQAP deviations or practices that threaten data quality.
- Provide a summary of the QA/QC activities and results for the verification reports.
- Review the draft and final verification report(s) and verification statement(s).
- Maintain frequent communication with the Battelle Quality Manager on QA activities, audit results, and concerns, including potential schedule and budget problems.
- Communicate data quality concerns to the VTC and Battelle's AMS Center Manager and Quality Manager; recommend the need for a stop-work order if audits indicate that data quality or safety is being compromised.

Section A4.3 is revised to the following:

EPA's responsibilities are based on the requirements stated in the "Environmental Technology Verification Program Quality Management Plan"[2] (ETV QMP). The roles of specific EPA staff are as follows:

Ms. Michelle Henderson is EPA's AMS Center Quality Manager. Ms. Henderson will:

- Participate in the kickoff meeting held prior to the start of the verification test.
- Review the draft TQAP, TQAP amendments, deviations, and audit reports.
- Review the first day of data from the verification test and provide immediate comments if concerns are identified.
- Perform at her option an external technical systems audit and/or audit of data quality during the verification test.
- Notify the EPA AMS Center Manager of the need for a stop-work order if the external audit indicates that data quality or safety is being compromised.
- Prepare and distribute an assessment report summarizing results of the external audit.
- Review the draft verification report(s) and statement(s).

Dr. John McKernan is EPA's Project Officer for the AMS Center. Dr. McKernan will:

- Review the draft TQAP.
- Approve the final TQAP.
- At his discretion, participate in the kickoff meeting held prior to the verification test.
- Review and approve amendments and deviations to the approved final TQAP.
- Appoint a delegate to review and approve deviations to the approved final TQAP in his absence, so that testing progress will not be delayed. Review the first day of data from the verification test and provide immediate comments if concerns are identified.
- Review the draft verification report(s) and statement(s).
- Oversee the EPA review process for the verification report(s) and statement(s).
- Coordinate the submission of verification report(s) and statement(s) for final EPA approval.

Dr. John Walker is EPA's test site coordinator. Dr. Walker will:

- Participate in the kickoff meeting held prior to the start of the verification test.
- Review and provide comments on the draft TQAP.
- Ensure that the Battelle testing staff, the vendors, and the MACTEC staff have appropriate access to the test site.
- Ensure that there is suitable space and electrical power to perform the necessary testing activities at the test site.
- Coordinate for access to continuous SO_2 reference measurements made by EPA's Office of Air Quality Planning and Standards for the duration of the verification testing period.
- Provide a skilled technical site operator to operate the technologies being verified.

Section A4.4 is revised to indicate that MACTEC rather than NCSU will be conducting the reference method analysis. The text in this section is revised to read:
MACTEC is responsible for preparing and analyzing the denuder/filter pack reference method samples used for comparison with the monitoring systems being tested. MACTEC will also be responsible for shipment of the reference method sampling media to the field.

Mr. Mark Hodges is the MACTEC Technical Lead for this verification test. In this role, Mr. Hodges is responsible for ensuring that the filter pack reference preparation, shipment, and analysis activities meet the scheduled milestones agreed upon by MACTEC and EPA. Mr. Hodges will:

- Coordinate with Battelle's QAO for the performance of an audit of MACTEC's reference sampling and laboratory analysis procedures prior to the verification test.
- At his discretion, participate in the kickoff meeting held prior to the verification test.
- Review the draft TQAP.
- Be the primary MACTEC contact for Battelle's VTC.
- Ensure that designated MACTEC staff is available for the verification test.
- Coordinate distribution of the TQAP to MACTEC staff.
- Coordinate the filter pack preparation, shipment, and analysis activities.

- Review and approve all data and records related to reference method sampling and analysis activities.

Section A4.5 is added:
A4.5. Verification Test Stakeholders

This TQAP and the verification report(s) and verification statement(s) based on testing described in this document will be reviewed by experts in the fields of ambient monitoring and/or analytical instrumentation. The following experts provided input to the TQAP and have agreed to provide a peer review of the verification report(s) and verification statement(s) resulting from testing:

- Gary Lear, EPA Clean Air Markets Division (CAMD);
- Nealson Watkins, EPA OAQPS;
- Rudy Eden, South Coast Air Quality Management District;
- Joann Rice, EPA OAQPS; and
- Cliff Glowacki, Covenant Associates.

The responsibilities of verification test stakeholders include:

- Participate in technical panel discussions (when available) to provide input to the test design.
- Review and provide input to the TQAP, TQAP amendments, and TQAP deviations.
- Review and provide input to the verification report(s)/verification statement(s).

In addition, during its development in 2008, Version 1 of the TQAP was reviewed by engaged stakeholders in the AMS Center Air Stakeholder Committee.

Section A6.2 – The text in the second paragraph and dates in Table 1 are revised to the following to reflect changes in testing schedule:

Table 1 includes the planned schedule of testing, QC, data analysis, and reporting activities to be conducted for this verification. The period of operation of the monitoring systems at the air monitoring site will be 30 days, with routine operation expected to begin on September 1, 2010

and continue until September 30, 2010, or until all testing activities are completed. During testing, duplicate denuder/filter pack reference samples will be collected twice each day, with each sampling period covering 12 hours.

Table 1. Planned Verification Test Schedule

Estimated 2010 Date(s)	Testing and QA Activities	Data Analysis and Reporting
August 16	Technical Systems Audit of reference laboratory	N/A
August 25-31	Shakedown and familiarization with all equipment at test site	Prepare report template
September 1- 30	Routine operation Technical Systems Audit and Audit of Data Quality #1 of verification activities PE audit samples submitted for analysis Reference sampling periods Remove monitoring systems from test site Analysis of reference samples	Review and summarize field testing staff observations Compile data from monitoring systems Begin draft report(s)
October 15	Complete analysis of reference samples Audit of Data Quality #2	Perform data analysis Continue preparation of draft report(s)
November 15	Audit of Data Quality #3	Complete draft report(s)
December 15	N/A	Complete review of draft report(s)
December 31	N/A	Revise draft report(s) Submit final report(s) for EPA approval

Section A6.3 – The text is revised to the following to reflect changes in testing venue:
The monitoring site is located at EPA's campus in Research Triangle Park, NC. This monitoring station is fully operational, with ongoing ambient air monitoring performed by EPA for ambient gaseous and particulate air pollutants. The site also serves as a test facility for evaluation of environmental monitoring equipment. The technologies to be verified will be housed in an environmentally controlled instrument shelter provided by EPA. This instrument shelter will also serve as a work space for the testing staff. The duplicate reference method filter/denuder samplers will be located on top of the instrument shelter.

Section B3 – The text in Section B3 is revised to the following:
Sample handling procedures are designed to minimize handling of the denuder/filter pack components and limit the number of transfers of the denuder/filter packs. When not in use, the denuders and assembled filter packs will be sealed or capped in their original packaging, to

prevent contamination. Clean, lint-free gloves will be used when handling the denuder/filter pack components. Clean forceps will be used when handling filters. Special care will be taken during all sample handling procedures to avoid breathing on components of the denuder/filter pack reference samples. The denuders and filter packs will be prepared in MACTEC's laboratory facilities, packaged, and shipped to the monitoring site by MACTEC for sampling. The sampling media will be received by Battelle Field Testing Staff and stored in an environmentally controlled shelter until use. The sampling media will be retrieved within 24 hours of completion of sample collection. After retrieval, the samples will be sealed and stored at 4 (±2) ºC in a refrigerator provided by EPA until shipment to MACTEC for extraction and analysis. The temperature of the refrigerator will be measured and documented daily. The collected samples will be shipped to MACTEC on blue ice by overnight delivery based on the shipping/delivery schedule provided by MACTEC.

The sample fractions from each denuder/filter pack will include the following:

- Na_2CO_3 coated denuder;
- H_3PO_3 coated denuder;
- Teflon® filter;
- Nylon filter; and
- H_3PO_3 coated denuder chaser.

Each fraction of each sample collected will be uniquely labeled and extracted separately within 48 hours of receipt in the laboratory. During extraction each denuder will be capped on one end, a measured aliquot (10 mL) of deionized water will be added to the open end of the denuder and then it will be capped. The capped denuders will be rotated 20 times within 1 minute to facilitate complete extraction of the target analytes, and the extract will be poured into a clean vial and placed in a refrigerated storage unit at 4 (±2) ºC. Filter samples will be removed from the filter pack holders and placed into separate vials with measured aliquots of the respective extraction solutions as required in CASTNET SOP GLM3180-001. The labeled vials will be capped and

placed in a refrigerated storage unit at 4 (±2) ºC. The stored samples will be analyzed within 10 days of extraction.

All reference method sampling media will be prepared by MACTEC. Prepared reference sampling media will be documented, assigned a unique sample identification number that is directly traceable to the preparation records to ensure traceability, packaged to prevent potential damage or contamination, and shipped to the field in appropriate shipping containers accompanied by completed chain-of-custody (CoC) forms. The CoC forms will be used to document sample custody throughout preparation, shipment, collection, storage, recovery, and analysis. Each CoC form will be signed by the person relinquishing samples once that person has verified that the CoC form is accurate. Upon receipt at the laboratory, CoC forms will be signed by the person receiving the samples once that person has verified that all samples identified on the CoC forms are present in the shipping container. Any discrepancies will be noted on the form and the sample receiver will immediately contact the MACTEC technical lead to report missing, broken, or compromised samples. Copies of all CoC forms will be delivered to the VTC upon request, and maintained with the test records.

Section C1 – Revise text:

> The responsibility for interpreting the results of these checks and resolving any potential problems resides with the VTC.

with the following:

> The responsibility for interpreting the results of these checks and resolving any potential problems resides with the VTC, who will contact the Battelle AMS Center Manager, Battelle AMS Center Quality Manager, EPA AMS Center Project Officer, and EPA AMS Center Quality Manager if any deviations from the TQAP are observed. The VTC will describe the deviation in a teleconference or by e-mail, and once a path forward is determined and agreed upon with EPA and stakeholders, the deviation form will be completed.

Section C1.1 – Revise first sentence of this section to read:

An analytical PE audit and a denuder/filter pack PE audit will be carried out within the first two weeks of field testing to assess the quality of the critical measurements associated with the reference sampling and analysis methods.

Replace text in Section C1.2 with the following:

The Battelle QAO will perform TSAs of the reference laboratory and field testing activities. The purpose of these audits is to ensure that the verification test is being performed in accordance with the AMS Center QMP and this TQAP. In this TSA, the Battelle QAO will compare actual test procedures to those specified or referenced in this plan, and review data acquisition and handling procedures. The Battelle QAO will prepare a project-specific checklist based on the TQAP requirements to guide the TSA, which will include a review of the test location and general testing conditions, observe the testing activities, and review laboratory record books. He will also check gas standard certifications and data acquisition procedures, and may confer with the vendor and collaborator support staff. The Battelle QAO will prepare an initial TSA report and will submit the report to the EPA Quality Manager (with no corrective actions documented) and VTC within 10 business days after completion of the audit. A copy of each final TSA report (with corrective actions documented) will be provided to the EPA AMS Center Project Officer and Quality Manager within 20 business days after completion of the audit. At EPA's discretion, EPA QA staff may also conduct an independent on-site TSA at the laboratory or during the verification test. The TSA findings will be communicated to technical staff at the time of the audit and documented in a TSA report.

Replace section C1.3 with the following:

The Battelle QAO, or designee, will audit at least 10% of the sample results data acquired in the verification test and 100% of the calibration and QC data versus the TQAP requirements. Three ADQs will be conducted for this verification test: The first batch of data from the verification test will be audited within 10 business days of receipt and assessed using a project-specific checklist. The second ADQ will be conducted within 10 business days of receipt of all data from the verification test. During these audits, the Battelle QAO, or designee, will trace the data from initial acquisition (as received from the vendor's technology), through reduction and statistical comparisons, to final reporting. All calculations performed on the data undergoing the ADQ will be checked. Data must undergo a 100% validation and verification by technical staff (i.e. VTC,

or designee) before it will be assessed as part of the data quality audit. All formulae applied to the data will be verified as part of the audit. Results of each ADQ will be documented using the checklist and reported to the VTC and EPA within 10 business days after completion of the audit. The third and final ADQ will assess overall data quality, including accuracy and completeness of the verification report. This ADQ will be prepared as a narrative and distributed to the VTC and EPA within 10 business days of completion of the ADQ. Table 9 summarizes the schedule for conducting and reporting each of the three ADQs.

Table 9. Summary of Audits of Data Quality

Audit	Subject of Audit	Audit Schedule	Reporting Schedule
First ADQ	First batch of reference method data from verification test, and corresponding data from technologies being verified	Within 10 business days of receipt of data	Within 10 business days of completion of audit
Second ADQ	Complete set of all data from the verification test	Within 10 business days of receipt of complete data set	Within 10 business days of completion of audit
Third ADQ	Overall data quality including review of the verification report	Within 10 business days of receipt of draft verification report	Within 10 business days of completion of audit