QUALITY ASSURANCE PROJECT PLAN & SITE-SPECIFIC TEST PLAN

FORMALDEHYDE EMISSIONS TESTING FROM ASPHALT HEATERS

Prepared for:

National Asphalt Pavement Association
5100 Forbes Boulevard
Lanham, Maryland 20706-4413

March 19, 2003
Revision 1

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APPROVAL SIGNATURE SHEET

Quality Assurance Project Plan &
Site-Specific Test Plan
February 24, 2003, Revision No. 0

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James Paumier, QA Officer MACTEC Federal Programs, Inc.	Date
Franklin Meadows, Project Manager MACTEC Federal Programs, Inc.	Date
Una Connolly, Project Director National Asphalt Pavement Association	Date
Michael L. Toney, QA Manager OAQPS, EMAD, EMC U. S. Environmental Protection Agency	Date

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DISTRIBUTION LIST

The MACTEC Project Manager will send copies of this plan and all subsequent revisions to the following individuals:

Una Connolly, Director of Environmental & Safety Services, National Asphalt Pavement Association

John T. Chehaske, MACTEC Program Manager

James O. Paumier, MACTEC QA Officer

1.0 PROJECT/TASK ORGANIZATION

Figure 1.1 illustrates the program organization for the Formaldehyde Emissions Testing From Asphalt Heaters project. Each organization and individual shown in Figure 1.1 is described in the following subsections.

1.1 NATIONAL ASPHALT PAVEMENT ASSOCIATION (NAPA)

This study is being funded by the National Asphalt Pavement Association (NAPA) and the State Asphalt Pavement Association (SAPA). NAPA is located in Lanham, Maryland.

1.1.1 NAPA Project Director (NAPA PD)

The NAPA Project Director (NAPA PD) is the NAPA counterpart to the MACTEC Federal Programs, Inc. (MACTEC) Project Director (MACTEC PD). The NAPA PD and the MACTEC PD will work in coordination to ensure all parties are properly prepared and informed. The NAPA PD for this project is Ms. Una Connolly.

1.2 MACTEC FEDERAL PROGRAMS, INC.

MACTEC Federal Programs, Inc. (MACTEC, formerly Pacific Environmental Services, Inc.) will provide overall project management and supervision for each aspect of the project. MACTEC is a nationwide environmental engineering and industrial hygiene firm.

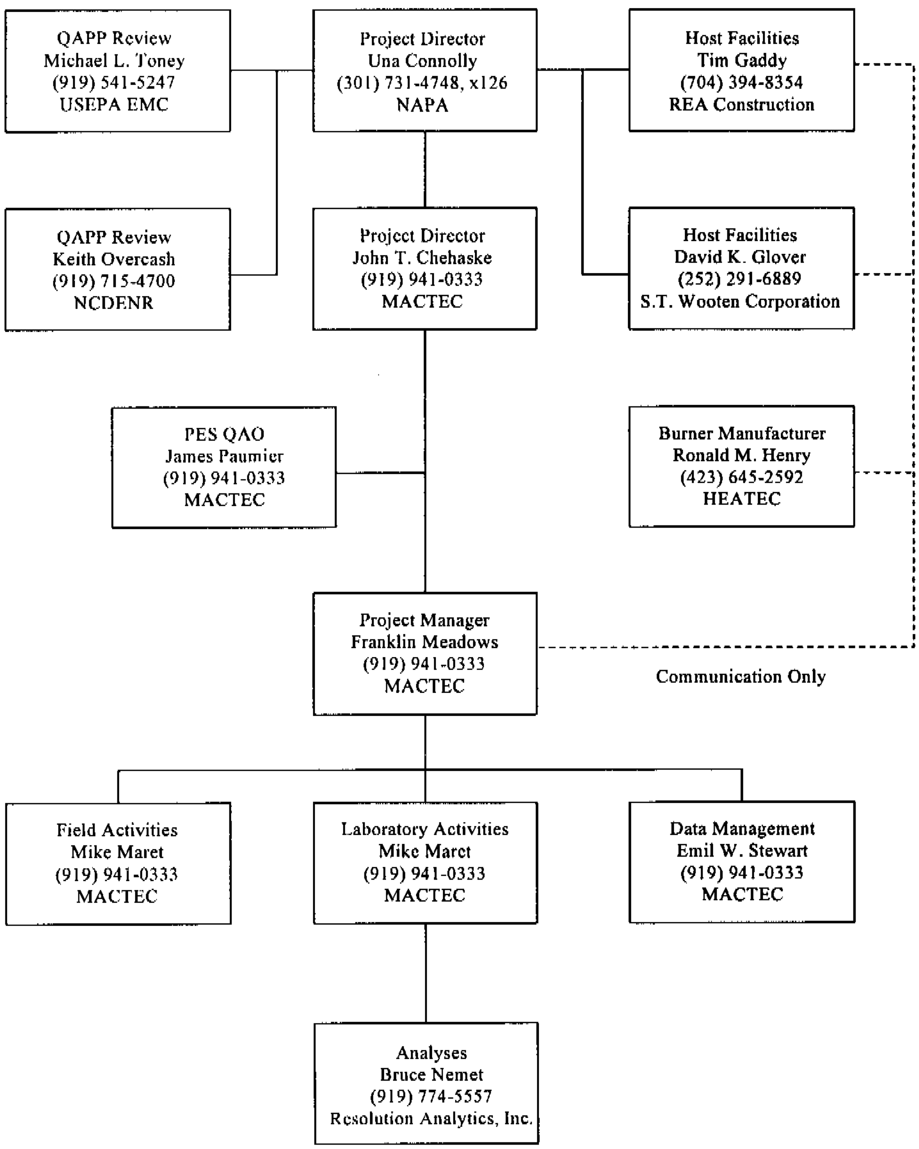

Figure 1.1. Project Organization

1.2.1 MACTEC Project Director

Mr. John T. Chehaske will serve as the MACTEC Project Director (MACTEC PD) and manage the day-to-day activities of the contract. These include selecting the MACTEC Project Manager (PM), tracking project costs, coordinating activities, and communicating project status to the NAPA. Mr. Chehaske is MACTEC's Corporate Director of Air Monitoring with over 30 years of experience in the field of air pollution monitoring. He has directed a variety of test programs, including: hazardous waste burns at cement kilns, VOC testing at printing and coating processes, method development, refuse derived fuel evaluations, and many others.

1.2.2 MACTEC Project Manager (PM)

The MACTEC PM has ultimate responsibility for the successful completion of this project. He is responsible for coordinating activities with the facility personnel, regulatory personnel, and MACTEC employees. The PM is Mr. Franklin Meadows. Mr. Meadows has over 37 years of experience in emissions measurement studies. He has managed complex field testing assignments in support of standards setting and method evaluations. Mr. Meadows served as the PM on numerous assignments under which he developed Site Specific Test Plans, Quality Assurance Project Plans, and report documentation.

1.2.3 MACTEC Quality Assurance Officer (QAO)

The MACTEC QAO is responsible for assuring that all project QA/QC requirements are met. The MACTEC QAO is James Paumier. Mr. Paumier has 10 years of experience executing projects following strict QA/QC requirements.

1.2.4 MACTEC Field Sampling Crew

During the field testing, Mr. Meadows will be assisted by experienced personnel in the assembly, operation, sample recovery activities associated with the sampling trains being used, sample analysis, data reduction and interpretation of results, and report documentation. MACTEC will provide platforms (scaffold or man lifts) to support the test team personnel and test equipment.

1.2.5 Resolution Analytics, Inc. (RAI)

Under contract to MACTEC, Resolution Analytics, Inc., located in Sanford, North Carolina, will be responsible for analyzing the formaldehyde samples. The analyses will be performed under the direction of Mr. Bruce Nemet.

1.3 HOST FACILITIES

NAPA has selected four facilities located in North Carolina as host facilities for the planned testing program. Two are owned and operated by REA Construction and two are owned and operated by S. T. Wooten Corporation. They include:

REA Construction	REA Construction
North Mecklenburg Plant	Mallard Creek Plant
Charlotte, NC	Charlotte, NC
No. 2 Oil-fired HOS	Natural Gas-fired HOS

Mr. Tim Gaddy, Commercial Contracts Manager is the point of contact for both REA Construction facilities.

S.T Wooten Corporation	S. T. Wooten Corporation
255 Material Drive	2710 Commerce Road
Franklinton, NC	Wilson, NC
No. 2 Oil-fired HOS	No. 2 Oil-fired HOS

Mr. David K. Glover, Asphalt Production Manager, is the point of contact for both S. T. Wooten Corporation facilities.

1.4 HEATEC

HEATEC is the manufacturer of the burners used at the four host facilities. HEATEC will be responsible for installing heat sinks on each burner so that the burners can operate continuously for the duration of the testing. Also, HEATEC will modify the burner exhaust stacks per MACTEC direction and measure fuel usage during each measurement run. HEATEC is represented by Mr. Ronald M. Henry, Service Manager and Mr. Mark D. Moon, P.E., Design Engineering Manager.

1.5 U. S. ENVIRONMENTAL PROTECTION AGENCY (USEPA)

At the request of the NAPA, the USEPA's Emission Measurement Center (EMC) has agreed to review this QAPP/SSTP. The QA Manager at the EMC responsible for reviewing the QAPP/SSTP is Mr. Michael L. Toney.

1.6 NORTH CAROLINA DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES (NCDENR)

The NCDENR representative is Mr. Keith Overcash, Director of Air Quality.

2.0 PROBLEM DEFINITION/BACKGROUND

In 2000, the U.S. Environmental Protection Agency's (USEPA) Office of Air Quality Planning and Standards (OAQPS) published Section 11.1 in their Compilation of Air Pollutant Emission Factors, 5th Edition, Volume 1: Stationary Point and Area Sources, more commonly know as AP-42. Section 11.1 provides emission factors for Hot Mix Asphalt (HMA) manufacturing facilities and ancillary operations. Ancillary operations include the heating system for the asphalt cement storage facilities. There are three types of heating systems that are used to maintain requsite asphalt cement temperatures in the storage tanks: hot oil heat transfer, direct-fired, and electric probes. The hot oil heat transfer system is the most common system in use today and the direct-fired system is phasing out.

The hot oil heat transfer system involves heating a specially designed heat transfer oil to specified temperatures and pumping the hot oil through a piping system that passes through the asphalt cement storage tank. The heat is provided by burning a fossil fuel. The flue gas generated from the combustion of the fossil fuel is emitted into the environment. The flue gas consists of typical products of combustion and incomplete combustion.

The heat input capacity of the burners in hot oil systems (HOS) generally range in size from less than 1 million BTUs per hour to 1.5 million BTUs per hour. The burners are operated to heat oil on an as-needed basis, which is based on the desired asphalt cement storage temperature. Once the asphalt cement reaches the specified temperature, the burner will shut down and remain inactive until the asphalt cement cools and its temperature drops below the temperature setting, just like any household heating system. The asphalt cement storage tanks are insulated to slow down the cooling process. The result is that the burners do not run continuously around the clock. HEATEC will install heat sinks on each burner so that the burners can operate continuously for the duration of the testing.

The list of emission factors for a HOS published by the USEPA in AP-42 Section 11.1 includes only hazardous air pollutants, including formaldehyde, for a HOS burning No. 2 fuel oil. They were derived from a single stack test conducted in the 1980s. Because of the small size of the burners in terms of heat input capacity, HOS emissions have been considered insignificant when estimating emissions from a HMA facility, or they have been exempted by state regulations because the heat input rating falls below state regulatory thresholds. However, in 2002, several states have insisted that emissions be calculated for HOS at HMA facilities, and concerns have been raised by the states and the HMA industry regarding the reliability of the HOS emission factor for formaldehyde.

When the formaldehyde emission factor for asphalt HOS was compared to the formaldehyde emission factor published for combustion of fuel oil in an industrial furnace or boiler in AP-42 Section 1.3, the HOS emission factor was found to be three orders of magnitude higher. While it is accepted that small combustion units are not as efficient as industrial sized combustion units, the USEPA agreed with NAPA that the combustion efficiency of a small combustion burner is unlikely to be three orders of magnitude lower. Summarized below are the AP-42 emission factors from fuel oil combustion and hot oil heaters.

Source	Emission Factor $lb/10^3$ gal
Fuel Oil Combustion	0.035-0.061
Hot Oil Burner	27

On May 1, 2002, HMA Industry representatives met with representatives from the USEPA and the North Carolina Department of Environment and Natural Resources (NCDENR) in Raleigh, North Carolina, to discuss the situation regarding the formaldehyde emission factor for HOS as listed in Section 11.1, Table 11.1-13. This emission factor was based on data from a single stack test. The USEPA recognizes that a single stack test does not constitute a statistically significant database. However, if that is all they have, they will use a single stack test to determine and publish emission factors. They account for the small quantity of data by assigning the lowest condfidence rating from the confidence rating scale established by the OAQPS. The USEPA representative at the meeting stated that he believes at least four separate HOS need to be stack tested to establish an emission factor that would be assigned a higher confidence rating.

The USEPA representative discussed his review of the original stack test from which the original formaldehyde emission factor was derived (the emission factor was actually derived by a firm contracted by the USEPA to conduct this type of work). He found that there was probably some deficiencies in the report and insufficient information to verify the derivation of the emission factor. He was able to verify that Method SW846/0011 was used. After considerable discussion among the participants of the meeting, it was determined that stack testing should be conducted to establish a more reliable emission factor for formaldehyde from asphalt cement HOS. It was also determined that Reference Method 316 would be used for this stack testing project.

3.0 PROJECT/TASK DESCRIPTION

NAPA is conducting this testing effort to develop emission factors for formaldehyde emissions from HOS burners at HMA plants. This project entails working with personnel representing NAPA, MACTEC, REA Construction, S. T. Wooten Corporation, USEPA, NCDENR, and HEATEC. NAPA has contracted the testing efforts to MACTEC. The primary objective of this testing project will be to accurately determine formaldehyde concentrations and mass emission rates from HOS burners. Because carbon monoxide (CO) is also a product of incomplete combustion, determinations of CO concentrations and mass emission rates will also be made. The results will be used by NAPA to develop emission factors for formaldehyde and CO. This Quality Assurance Project Plan/Site-Specific Test Plan (QAPP/SSTP) presents an overview of the procedures MACTEC proposes to follow to accomplish this objective.

3.1 WORK TO BE PERFORMED

The USEPA has recommended to NAPA that at least four different HOS burners be tested in order to obtain sufficient data to constitute a statistically significant data base. In order to satisfy this recommendation, NAPA has selected four HMA plants, all located in North Carolina, to serve as host facilities for the planned testing program. Three of the burners are No. 2 oil-fired and one of the burners is natural gas-fired. The testing program includes preparation of this QAPP/SSTP, field testing, and report documentation.

3.1.1 Field Testing

At each of the four facilities, testing will be performed at the exhaust stack of the HOS burner for the following pollutants: formaldehyde as per EPA Method 316 and CO as per EPA

Method 10. This will require accurate determinations of burner exhaust gas volumetric flow rates, pollutant concentrations, and fuel usage during each individual test run. Accurate determinations of these pollutants/parameters are considered to be critical to the success of this test program. The test methods used in this test program will comply with the technical criteria described in the reference methods and the quality standards described in this document.

Once on-site at each facility, the MACTEC test crew will set up the test equipment and perform miscellaneous pretest activities including: measuring the stacks and calculating sample traverse point locations, conducting cyclonic flow checks, conducting preliminary velocity and temperature traverses, performing initial calibrations and bias checks on the CO analyzer, and making final preparations for testing. The actual testing at each facility will consist of a minimum of three valid test runs. The minimum sample time for each test run will be one hour.

At the conclusion of the field test, MACTEC will pack up the samples and test equipment, restore the test sites, and return to the MACTEC office in Research Triangle Park, NC. Post test activities will include cleanup, maintenance, and calibration of MACTEC's test equipment, and transfer of the formaldehyde samples to RAI for analysis.

3.2 SCHEDULE FOR IMPLEMENTATION

Specific test dates have not been established pending approval of this QAPP/SSTP. Testing will be conducted in early 2003. The S.T. Wooten facilities in Wilson and Franklinton will be tested first during the same field trip. The REA North Mecklenburg and Mallard Creek facilities will be tested during the next field trip.

3.3 REPORTS

MACTEC will prepare and submit a draft report summarizing the results of MACTEC's test results to the NAPA Project Director. The draft report will include a summary and discussion of the results as well as copies of field data and any laboratory results. Once NAPA has reviewed the draft report and provided written comments, MACTEC will make any revisions and submit a final report.

4.0 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

4.1 DATA QUALITY OBJECTIVES

The overall objective of this test program is to quantify the uncontrolled formaldehyde and carbon monoxide (CO) emissions from HOS burners. The data will be used by NAPA to develop emission factors for HOS burners. To obtain data which will satisfy this objective, the test design must provide enough representative data to be statistically useful and standards for accuracy, precision and completeness of data must be met. Section 8.0 discusses the specific quality control procedures and criteria used to determine compliance with these quality objectives.

4.2 CRITERIA FOR MEASUREMENT DATA

The following standards for representativeness, precision, accuracy and completeness have been established for this project:

- The representativeness of the formaldehyde and CO data will be insured by testing four separate HOS burners, three oil-fired and one natural gas-fired.

- The HOS burners will be operated at high-fire, constant load conditions.

- Triplicate samples for formaldehyde and CO, each 60 minutes in duration, will be collected simultaneously over a several hour work day to account for fluctuations over time. If any test runs need to be aborted, a replacement test run will be performed to ensure three data points for each parameter. The USEPA has established three test runs as the minimum number for statistical purposes.

- The formaldehyde detection limit is 11.3 ppbv based on a sample volume of 30 dry standard cubic feet.

- The carbon monoxide detection limit is 0.2 ppmv on a range of 0-100 ppm.

- Formaldehyde sample break-through must be < 20%.

- The targets for precision, accuracy and completeness are summarized below

Precision	Formaldehyde CO	< 20% RSD 5% RSD
Accuracy	Formaldehyde CO	90% 10%
Completeness	Formaldehyde CO	100% 100%

RSD - Relative Standard Deviation

5.0 SPECIALIZED TRAINING

Personnel involved in this project have been trained in equivalent or similar tasks and have from 2 to 38 years of experience in the duties similar to the ones they will be performing. All MACTEC personnel have basic field safety training.

Each of the four sites will require the test personnel to work from scaffold or portable man lifts. Fall protection consisting of full body harnesses and lanyards will be required for all personnel working on scaffold or man lifts.

The field sampling crew will be equipped with standard personal protective gear (e.g., hard hats, safety shoes, eye goggles, and gloves). In addition, each person will be equipped with hearing protection. All personnel will be required to wear DOT approved safety traffic vests. Traffic cones will be used for traffic control in close proximity to the work areas.

The formaldehyde analyses will be performed by Resolution Analytics, Inc. whose laboratory personnel are qualified and trained in all aspects of wet chemical analyses.

6.0 DOCUMENTATION AND RECORDS

Records for this project will include a field test log, field data sheets, sample custody records, computer data files for each run, and QA reports to management. These records and the draft final report will be subject to an internal review before submission to NAPA.

6.1 FIELD OPERATION RECORDS

Field testing activities will be documented on standardized pre-formatted forms. Test personnel will record data on "Field Data Sheets" designed for documentation of stack gas parameters, sampling equipment operating parameters, and ambient conditions. CO concentrations will be continuously monitored and the results will be logged using a data logger and a chart recorder. Sample recovery activities will be recorded on a "Sample Recovery Data Sheet" that will document moisture catch, sample description, and sample identification and labeling. Quality Control samples such as field and reagent blanks will also be documented on the "Sample Recovery Data Sheet." A sample "Chain-of- Custody" will be completed for each set of formaldehyde samples from each facility. If corrective action is required during any segment of the field testing activities, the reason for the correction and the action taken will be noted on the "Corrective Action Report." All entries on these forms will be written in indelible ink. If correction action is required on the form, a single line will be made through the error and the correction will be dated and initialed. Any blank spaces will have a line drawn through to ensure it is not later filled in. Example field data sheets appear in Appendix A.

Field test personnel will have access to this QAPP/SSTP and general field procedures in the form of expanded USEPA reference methods. If any procedure becomes unclear the test crew can refer to these as a step-by-step reference.

6.2 LABORATORY RECORDS

RAI will provide sample tracking forms, case narratives describing the analytical procedures used, including any anomalies and any modifications to procedures, data handling records, and lab notes, for inclusion in the final report.

6.3 DRAFT AND FINAL REPORTS

The final report will include all raw field data, analytical data, and records. A summary of any outliers or findings will be presented in the report. The report will undergo an internal review before submittal. After submittal, the report will be filed at MACTEC for a period of no less than three years. The file will also include disk copies of all electronic data used in the development of the report.

7.0 SAMPLING PROCESS DESIGN

The emission factors for formaldehyde and CO published in AP-42, Section 1.3, for oil-fired HOS burners are expressed as pounds of pollutant per 1,000 gallons of fuel burned (lb/10^3 gal), specifically 0.024 - 0.061 lb/10^3 gal for formaldehyde and 5 lb/10^3 gal for CO. The goal of this testing program is designed to gather the necessary emissions and process data necessary for the development of emission factors expressed in the same units. This will entail the accurate measurement of formaldehyde and CO concentrations and mass emission rates, and accurate determination of fuel usage during each test.

Formaldehyde and CO will be determined using EPA Methods 316 and 10, respectively. When applied and used correctly, these methods produce accurate results. Testing will consist of conducting triplicate 1-hour measurement runs for formaldehyde and CO at each facility.

The sampling process design at each of the four facilities is identical. Each burner has a single stack that will need to be modified to meet the requirements of EPA Method 1 (REA North Mecklenburg, REA Mallard Creek and S.T. Wooten, Wilson) or EPA Method 1A (S.T. Wooten, Franklinton). The REA North Mecklenburg facility is unique in that the HOS burner has a heat exchanger on the stack. This stack will require a taller stack extension because of the heat exchanger.

TABLE 7.1

TEST SCHEDULE

Date(s)	Activity	Comments
Day 1	Prepare/mobilize	
Day 2	Travel to site, set-up equipment, perform preliminary measurements	
Day 3	Conduct three 1-hr sampling runs for CO and formaldehyde, pack up equipment, return travel	
Day 4	Cleanup /calibrate equipment, transport samples to lab	

TABLE 7.2

SAMPLE & ANALYSIS MATRIX

Collection Media	**Analyte**	**Analysis By**	**Number of Samples**
CARBON MONOXIDE - EPA METHOD 10			
Continuous NDIR	Carbon monoxide	MACTEC	12 samples[a]
FORMALDEHYDE - EPA METHOD 316			
Probe & 1st impinger	Formaldehyde	RAI	12 samples[a]
2nd & 3rd impinger	Formaldehyde	RAI	12 samples[a]
Blanks	Formaldehyde	RAI	4 reagent blanks[b] 4 field blanks[c]

[a] Three samples at each facility.
[b] One water and one reagent blank at each facility
[c] One field blank at each facility

8.0 SAMPLING METHOD REQUIREMENTS

The sampling methods and procedures used for this field test are discussed below. MACTEC anticipates performing three test runs at each facility, using standard operating procedures specified in the reference sampling methods. Copies of the EPA Test Methods are included in Appendix B.

8.1 LOCATION OF MEASUREMENT SITES

The measurement sites at each of the four facilities will be modified to exceed the minimum requirements of EPA Methods 1 or 1A. The measurement sites at the four facilities are schematically similar, although different in size. Dimensional data on the measurement sites follow.

8.1.1 REA Construction - North Mecklenburg Facility

Depicted in Figure 8.1 is a simplified schematic of the existing stack and the modifications that will be required. The modifications will include removal of the mesh bird screen and installation of a stack extension. The stack extension will be 48 inches in length.

Once the modifications are complete, the measurement site will meet the requirements of EPA Method 1, ***"Sample and Velocity Traverse for Stationary Sources"***. The sample test ports will be located 62 inches (4.4 stack diameters) downstream of the nearest flow disturbance (asphalt tank heater) and 28 inches (2.0 stack diameters) upstream of the nearest flow disturbance (atmosphere). According to EPA Method 1 criteria, this location requires 24 sample traverse points, 12 along each of two perpendicular diameters. An additional port (1" pipe

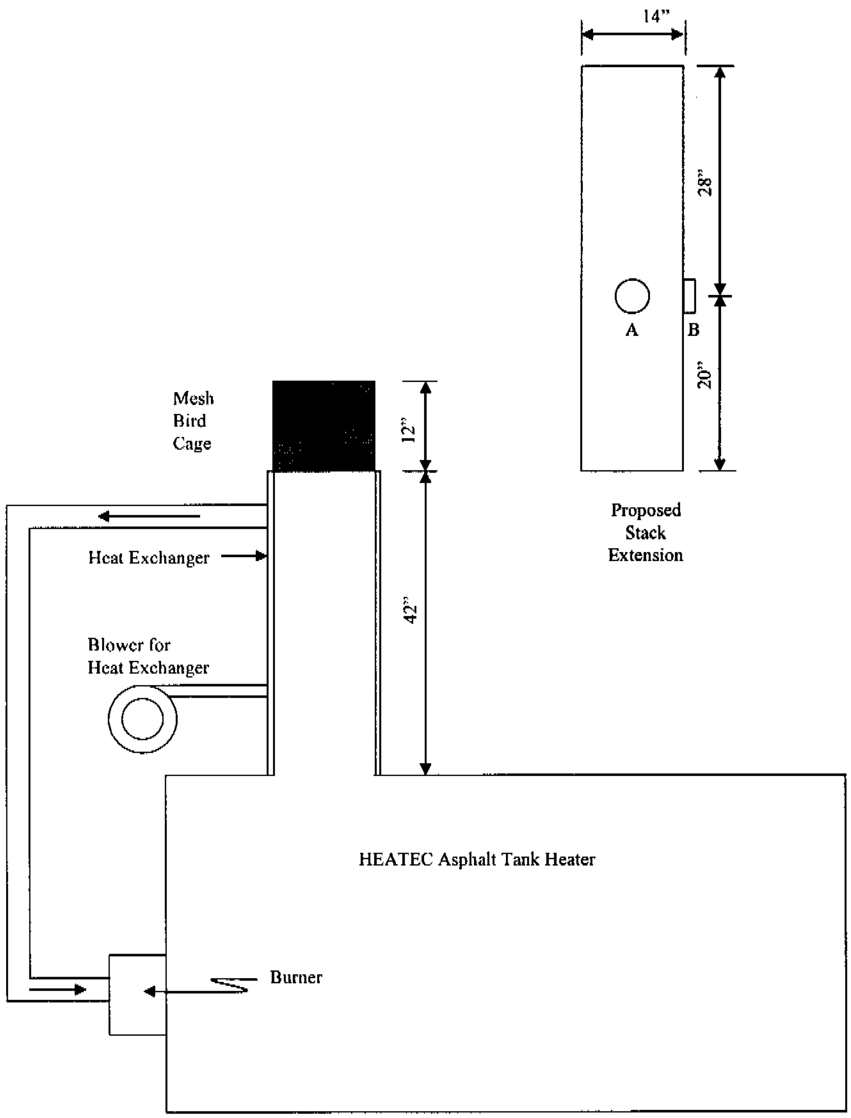

Figure 8.1 Proposed Stack Modifications for the REA North Mecklenburg Facility

coupling) will be installed 12 inches upstream (not shown) of the asphalt tank heater and will be used for the CO sample probe.

8.1.2 REA - Mallard Creek and S.T. Wooten - Wilson Facilities

The measurements sites at these two facilities are identical. Depicted in Figure 8.2 is a simplified schematic of the existing stack(s) and the modifications that will be required. The modifications will include removal of the mesh bird screen(s) and installation of a stack extension. A stack extension, 49 inches long, will be added to facilitate testing.

Once the modifications are complete, the measurement sites will meet the requirements of EPA Method 1, ***"Sample and Velocity Traverses for Stationary Sources"***. The measurement site will be located in a 14-inch inner diameter (ID) round, vertical stack 63 inches (4.5 stack diameters) downstream of the nearest flow disturbance (asphalt tank heater) and 28 inches (2.0 stack diameters) upstream of the nearest flow disturbance (atmosphere). According to EPA Method 1 criteria, this location requires 24 sample traverse points, 12 along each of two perpendicular diameters. One additional port (1" pipe coupling) will be installed 34 inches downstream of the asphalt tank heater and will be used for the CO sample probe.

8.1.3 S.T. Wooten - Franklinton Facility

The HOS burner and stack at the S.T. Wooten, Franklinton facility is schematically identical to the REA Mallard Creek and S.T. Wooten, Wilson facilities, except it is a much smaller system. The existing stack has an inner diameter of nine inches; therefore, this stack and measurement site will be subject to the requirements of EPA Method 1A, ***"Sample and Velocity Traverses for Stationary Sources With Small Stack or Ducts"***. EPA Method 1A requires two measurement sites, one for pollutant sampling and one for velocity measurements.

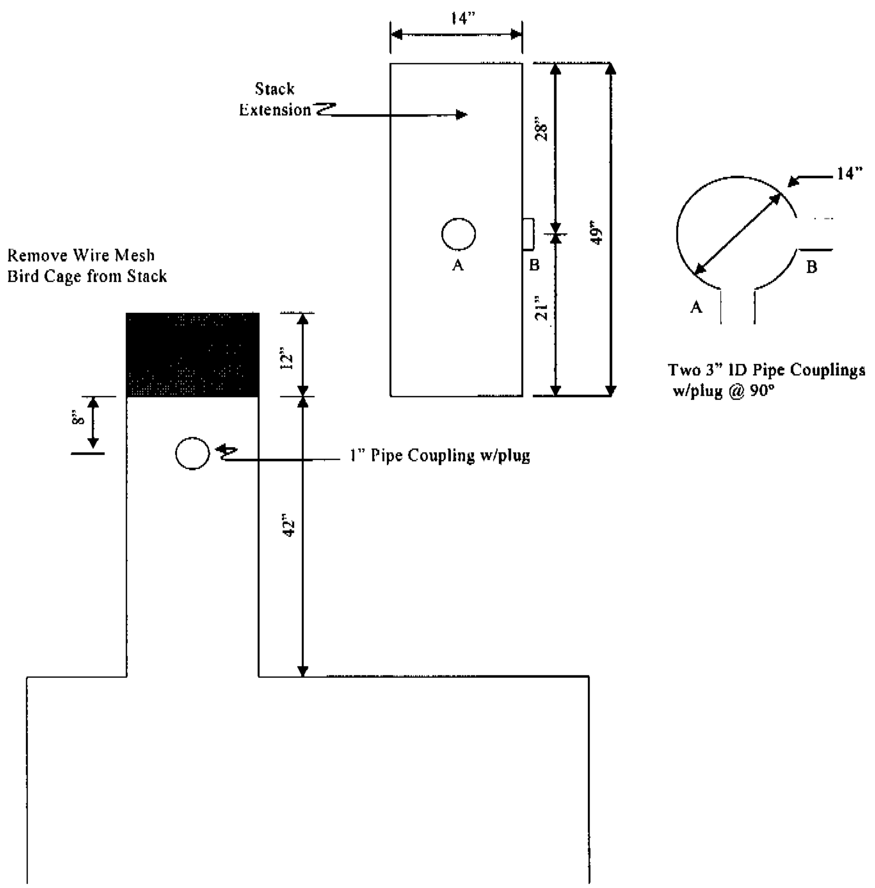

Figure 8.2 Proposed Stack Modifications for the REA Mallard Creek and Wooten Wilson Facilities.

Figure 8.3 depicts a simplified schematic of the existing stack and the modifications that will be required. The modifications will include removal of the mesh bird screens and installation of a stack extension. Once the modifications are complete, the pollutant measurement site will be located 42 inches (4.7 stack diameters) downstream of the nearest flow disturbance (asphalt tank heater) and 54 inches (6.0 stack diameters) upstream of the nearest flow disturbance (atmosphere). According to EPA Method 1A criteria, this location requires 24 sample traverse points, 12 along each of two perpendicular diameters. The velocity measurement site will be located 36 inches downstream of the sampling measurement site and 18 inches (2.0 stack diameters) upstream of the nearest flow disturbance (atmosphere). Twenty four velocity traverse points, 12 along each of two diameters, will be used to be consistent with the sample traverse points. One additional port (1" pipe coupling) will be installed near the base of the stack and will be used for the CO sample probe.

8.2 DETERMINATION OF STACK GAS VELOCITY

EPA Method 2, ***"Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)"***, will be used to determine gas velocity at the sampling point. A Type S pitot tube, constructed according to Method 2 geometric criteria and having an assigned coefficient of 0.84, will be connected to a differential pressure gage (manometer) and to measure velocity pressure (ΔP) at each sample traverse point. The exhaust gas temperature will also be measured at each sample traverse point using a Type K thermocouple connected to a potentiometer. The average exhaust gas velocity will be calculated using the average square roots of the velocity pressure, average exhaust gas temperature, exhaust gas molecular weight, and absolute stack pressure.

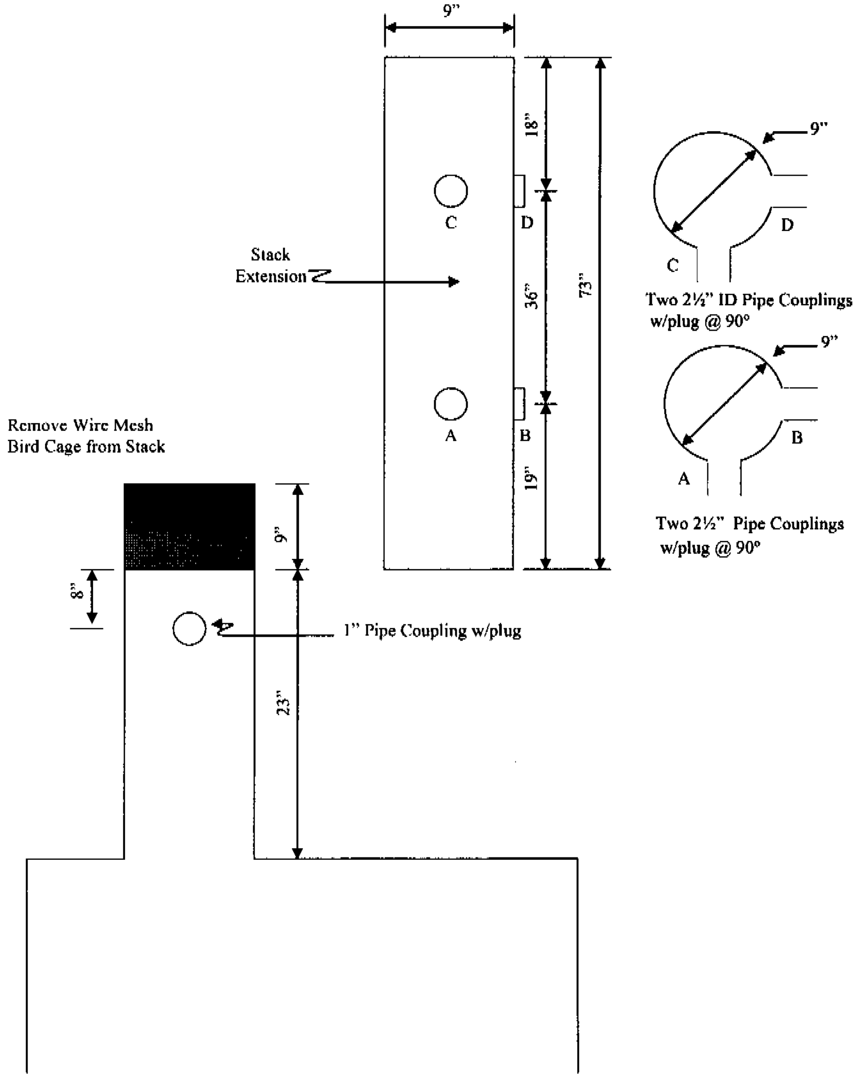

Figure 8.3 Proposed Stack Modifications for the Wooten Franklinton Facility.

8.3 DETERMINATION OF CARBON DIOXIDE, OXYGEN, AND DRY MOLECULAR WEIGHT

EPA Method 3, ***"Gas Analysis for the Determination of Dry Molecular Weight"***, will be used to determine dry molecular weight of the stack gas. During each formaldehyde and CO measurement run, grab samples will be collected using Fyrite® analyzers for determination of percent (%) concentrations carbon dioxide (CO_2) and oxygen (O_2). The balance will be assumed to be nitrogen (N_2). These data will be used to calculate dry molecular weight.

8.4 DETERMINATION OF STACK GAS MOISTURE CONTENT

EPA Method 4, ***"Determination of Moisture Content in Stack Gases"***, will be used to determine stack gas moisture content. This method will be conducted simultaneously with the EPA Method 316 formaldehyde measurement run. The impingers will be weighed on a top-loading balance before and after each measurement run. The net weight gain will be converted to an equivalent volume of air and compared to the total sample volume to calculate moisture content.

8.5 DETERMINATION OF FORMALDEHYDE CONCENTRATIONS

EPA Method 316, ***"Sampling and Analysis for Formaldehyde Emissions from Stationary Sources in the Mineral Wool and Wool Fiberglass Industries",*** will be used to determine formaldehyde concentrations. This method is applicable to the determination of formaldehyde concentrations from stationary sources. Gaseous and particulate pollutants are withdrawn isokinetically from the stack and are collected in high purity water. Formaldehyde present in the emissions is highly soluble in high purity water. The high purity water sample containing formaldehyde is then analyzed using the modified pararosaniline method.

Formaldehyde in the sample reacts with acidic pararosaniline, and sodium sulfite, forming a purple chromophore. The intensity of the purple color, measured spectrophotometrically, provides an accurate and precise measure of the formaldehyde concentration in the sample. Using this method, formaldehyde can be detected as low as 11.3 parts per billion by volume (ppbv) or as high as 23,000,000 ppbv, based on a 1-hour sampling period and a sample volume of 30 cubic feet.

8.6 DETERMINATION OF CARBON MONOXIDE CONCENTRATIONS

EPA Method 10, ***"Determination of Carbon Monoxide Emissions From Stationary Sources"***, will be used to measure carbon monoxide concentrations in the stack gas. During each formaldehyde measurement run, a stack gas sample will be extracted continuously from the sampling point and analyzed for CO using a non-dispersive infrared analyzer (NDIR) with gas filter correlation (GFC). The NDIR/GFC will be operated on the range of 0-100 parts per million by volume (ppmv). The output from the NDIR will be monitored using a data logger and chart recorder.

8.7 DETERMINATION OF FUEL USAGE

Fuel usage rates will be the responsibility of NAPA and will be determined using data on the fuel nozzle and fuel pressure. The nozzle size and pressure relates to a specific flow rate. MACTEC has been assured by HEATEC that the fuel usage rates can be determined to within ±1% accuracy using this procedure. No. 2 fuel oil usage rates will be expressed in gallons per hour. Natural gas usage will be expressed in cubic feet per hour.

8.8 SELECTION AND PREPARATION OF SAMPLE CONTAINERS

Glass containers used to collect and/or transport formaldehyde samples will be commercially pre-cleaned prior to use.

8.9 PRESERVATION METHODS AND MAXIMUM HOLDING TIMES

All formaldehyde samples will be stored and transported in sealed containers away from dust and other ambient causes of contamination. The samples will be stored in coolers with blue ice to maintain a temperature at 2 °C until analysis. The formaldehyde samples will be analyzed within 14 days of collection.

8.10 IDENTIFY INDIVIDUALS RESPONSIBLE FOR CORRECTIVE ACTION

The MACTEC Field Team Leader will be on-site during all sampling and cleanup procedures, and will serve as the individual responsible for devising and implementing any corrective actions which may be necessary while in the field. As necessary, the MACTEC PM will provide assistance in devising and implementing any corrective actions deemed necessary.

9.0 SAMPLE HANDLING AND CUSTODY

9.1 SAMPLE CUSTODIANS

The sample custodians are identified below. These individuals will be responsible for maintaining the proper chain of custody procedures during this testing program. They are also responsible for the samples during substrate preparation, sample collection, sample recovery, and analysis.

Mike Maret
MACTEC Federal Programs, Inc.
5001 S. Miami Blvd, Suite 300
RTP, NC 27709-12077
919/941-0333 (ph) 919/941-0234 (fax)

Bruce Nemet
Resolution Analytics, Inc.
2733 Lee Avenue
Sanford, NC 27330
919/774-5557 (ph) 919/776-6785 (fax)

9.2 SAMPLE LABELING SCHEME

Table 9.1 shows the formaldehyde sample labeling scheme.

Each test run will have a unique alpha-numeric code to be used only for sample components from that test run. This code will include information on the run number and sample component. The sample components are described in a one or two word phrase such as: rinse, etc.

TABLE 9.1

FORMALDEHYDE SAMPLE LABELING SCHEME

Facility/Run No.	Pollutant	Sample Description	Sample ID Code
REA North Mecklenburg			
NM-F-1	Formaldehyde	Probe & 1st Impinger 2nd & 3rd Impinger	NM-F-1(A) NM-F-1(B)
NM-F-2	Formaldehyde	Probe & 1st Impinger 2nd & 3rd Impinger	NM-F-2(A) NM-F-2(B)
NM-F-3	Formaldehyde	Probe & 1st Impinger 2nd & 3rd Impinger	NM-F-3(A) NM-F-3(B)
NM-F-FB	Formaldehyde Field Blank	Probe & 1st Impinger 2nd & 3rd Impinger	NM-F-FB(A) NM-F-FB(B)
NM-F-RB	Formaldehyde	Reagent Blank	NM-F-RB
REA Mallard Creek			
MC-F-1	Formaldehyde	Probe & 1st Impinger 2nd & 3rd Impinger	MC-F-1(A) MC-F-1(B)
MC-F-2	Formaldehyde	Probe & 1st Impinger 2nd & 3rd Impinger	MC-F-2(A) MC-F-2(B)
MC-F-3	Formaldehyde	Probe & 1st Impinger 2nd & 3rd Impinger	MC-F-3(A) MC-F-3(B)
MC-F-FB	Formaldehyde Field Blank	Probe & 1st Impinger 2nd & 3rd Impinger	MC-F-FB(A) MC-F-FB(B)
MC-F-RB	Formaldehyde	Reagent Blank	MC-F-RB

TABLE 9.1 (Concluded)

Facility/Run No.	Pollutant	Sample Description	Sample ID Code
Wooten Franklinton			
WF-F-1	Formaldehyde	Probe & 1st Impinger	WF-F-1(A)
		2nd & 3rd Impinger	WF-F-1(B)
WF-F-2	Formaldehyde	Probe & 1st Impinger	WF-F-2(A)
		2nd & 3rd Impinger	WF-F-2(B)
WF-F-3	Formaldehyde	Probe & 1st Impinger	WF-F-3(A)
		2nd & 3rd Impinger	WF-F-3(B)
WF-F-FB	Formaldehyde	Probe & 1st Impinger	WF-F-FB(A)
	Field Blank	2nd & 3rd Impinger	WF-F-FB(B)
WF-F-RB	Formaldehyde	Reagent Blank	WF-F-RB
Wooten Wilson			
WW-F-1	Formaldehyde	Probe & 1st Impinger	WW-F-1(A)
		2nd & 3rd Impinger	WW-F-1(B)
WW-F-2	Formaldehyde	Probe & 1st Impinger	WW-F-2(A)
		2nd & 3rd Impinger	WW-F-2(B)
WW-F-3	Formaldehyde	Probe & 1st Impinger	WW-F-3(A)
		2nd & 3rd Impinger	WW-F-3(B)
WW-F-FB	Formaldehyde	Probe & 1st Impinger	WW-F-FB(A)
	Field Blank	2nd & 3rd Impinger	WW-F-FB(B)
WW-F-RB	Formaldehyde	Reagent Blank	WW-F-RB

9.3 SAMPLE STORAGE AND PRESERVATION

All MACTEC formaldehyde samples will be stored and transported in sealed containers away from dust and other ambient causes of contamination. The samples will be stored in either a freezer or coolers with blue ice to maintain a temperature at 2 °C.

9.4 FIELD DATA

All data sheets from the test location and sample recovery activities will be collected at the end of each test day by the Field Team Leader and kept in his custody. The original field data sheets will remain in MACTEC custody. Copies will be included with the draft and final reports.

9.5 CHAIN OF CUSTODY PROCEDURES

Chain of custody records will be implemented once sample substrates are prepared. After collection, each sample container will be labeled and inspected prior to packaging for transport. MACTEC will maintain custody of the samples during transport back to the MACTEC office in Research Triangle Park, NC. Samples will be stored in MACTEC's RTP laboratory which has restricted access. MACTEC will be utilizing RAI for formaldehyde sample analyses and will relinquish the samples to them using appropriate Sample Chain of Custody protocol. An example Chain of Custody form appears in Figure 9.1.

PACIFIC ENVIRONMENTAL SERVICES, INC.

Central Park West
5001 South Miami Boulevard, P.O. Box 12077
Research Triangle Park, North Carolina 27709-2077
(919) 941-0333 FAX (919) 941-0234

Chain of Custody Record

Project Number 4913.001	Project Name VMAPA			Analysis Requested							Remarks
Samplers:											
Date	Time	Field Sample ID	Sample Description								

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received for lab by: (Signature)	REMARKS		Page:____ of ____

Figure 9.1 Example Chain of Custody Form.

10.0 ANALYTICAL METHOD REQUIREMENTS

Formaldehyde samples will be analyzed in accordance with the procedures specified in EPA Method 316. The analyses will be performed by Resolution Analytics, Inc. (RAI) of Sanford, North Carolina. Analyses will include samples, and field, reagent, and laboratory blanks.

Fourteen days has been established as the holding time for sample analysis after sample collection. Once the samples are in the laboratory, RAI will prepare a formaldehyde standard solution. The standard solution is stable for a period of four weeks if kept refrigerated between analyses. Using the standard solution, RAI will prepare formaldehyde working standards daily. The laboratory must establish that the formaldehyde working standards are stable. This will be demonstrated by actual testing. The working standards will be analyzed and a calibration curve will be calculated for each day's analysis. The standards will be analyzed first to ensure that the method is working properly prior to analyzing the samples. In addition, a sample of the laboratory's high purity water will be analyzed and used as a "0" formaldehyde standard. The formaldehyde content of the water must be <0.005 μg/ml. The quality of the laboratory water used to prepare standards and make dilutions is critical.

The procedure for analysis of standards and samples is identical. The standards and samples will be analyzed following the procedures in Section 11.0 of Method 316 using a spectrophotometer wave length of 570 nm and set to read in Absorbance Units. The calibration curve will be calculated using linear regression. All samples from the four facilities will include analysis of the "A" and "B" fractions of the sample, so that formaldehyde sample break-through can be ascertained.

11.0 QUALITY CONTROL REQUIREMENTS

The goal of the QC program is to ensure, to the highest degree possible, the accuracy of the data collected and quantify the accuracy. This section describes specific procedures for equipment preparation, on-site sampling, and sample recovery that affect sample quality, and laboratory analysis.

11.1 REAGENTS AND GLASSWARE PREPARATION

All sample train glassware and sample recovery apparatus will be preconditioned following the procedures of Method 316. All sampling train components and sample recovery apparatus coming in contact with the sample will be soaked in hot soapy water (Alconox®), followed by three rinses each with tap water, and high purity water. All glassware will then be capped with cleaned aluminum foil (or other inert material).

High purity water (ASTM Type I) or equivalent will be used to collect formaldehyde in the impingers and to recover the samples. The water will be provided by the analytical laboratory (RAI) and will be analyzed before use for formaldehyde content. All samples will be recovered into and stored in certified, pre-cleaned glass sample bottles.

11.2 CALIBRATION OF APPARATUS

The preparation and calibration of source sampling equipment is essential in maintaining data quality. Brief descriptions of the calibration procedures to be used by MACTEC follow.

11.2.1 Barometric Pressure

MACTEC uses aneroid barometers which are calibrated against a barometric pressure value reported by a nearby National Weather Service station, and corrected for elevation.

11.2.2 Temperature Sensors

Type K thermocouples will be checked for proper operation using the procedures described in Section 3.4.2 of the Quality Assurance Handbook, Volume III, 1994. Each temperature sensor will be initially checked over the expected range of use against an ASTM 3C or 3F thermometer. Electronic temperature readouts will be checked using a thermocouple simulator having a range of 0-2400 °F.

11.2.3 Pitot Tubes

MACTEC uses S-type pitot tubes which are constructed according to EPA Method 2 specifications. Pitot tube dimensions are checked against EPA Method 2 dimensional criteria. Pitot tubes not meeting these criteria are rejected. Pitot tubes meeting these criteria are assigned a baseline coefficient of 0.84 and need not be calibrated.

11.2.4 Differential Pressure Gauges

MACTEC uses Dwyer differential pressure gauges (inclined/inclined-vertical manometers). Manometers are primary standards and need no calibration.

11.2.5 Dry Gas Meter and Orifice

The EPA Method 316 metering system consists primarily of a dry gas meter for measuring sample volume and an orifice for adjusting sampling rate. Calibration of the metering system will include initial calibration of the dry gas meter and orifice, and post-test calibration of the dry gas meter. The calibrations will follow the procedures given in Section 10.3 of Method 316. The initial calibration requires the dry gas meter to be within ± 1% of a reference value. The post-test dry gas meter calibration must be within 5% of the initial calibration.

11.3 ON-SITE SAMPLING

MACTEC will perform the following checks on the sampling equipment.

11.3.1 Measurement Sites

The dimensional data on the stacks in this QAPP/SSTP are based on preliminary information obtained during the pretest site surveys. Prior to sampling, all stacks and stack extensions will be carefully measured and sketches will be made showing the sample test port locations, up and down stream distances to obstructions, and inner stack diameters. Inside dimensions will be checked to determine uniformity of the stack cross-sectional area and the sample test ports will be checked to verify that they do not extend beyond the inside wall. The stack inside dimensions, wall thickness, and sample port depths will be measured to the nearest 1/16 inch.

Once the dimensional data are obtained, MACTEC will calculate the number of sample traverse points as per EPA Method 1, and conduct tests on each stack to check for the presence of cyclonic or non-parallel flow.

11.3.2 Barometric Pressure.

Barometric pressure will be recorded at the beginning and end of each test run. The average will be used for test run calculations. If necessary, adjustments will be made for elevation depending on the actual location of the barometer.

11.3.3 Velocity Measurements

All velocity measurement apparatus will be assembled, leveled, zeroed, and leak-checked prior to use and at the end of each test run. The static pressure will be determined at a single point near the center of the stack cross-section. The stack gas stream will also be checked for cyclonic flow. If cyclonic conditions are evident, they will either be eliminated, or if no other options are possible, the "alignment method" will be used for sampling.

Apparatus	QC Check	Criteria	Corrective Action
Manometer	Leveled and zeroed before and after each test.	Bubble leveler must indicate level conditions. Manometer must read zero.	Re-level and re-zero. Note in test log.
Pitot	Check for chips in Pitot. Perform leak check on pitot lines before and after each test run.	Pitot lines must indicate no leak over a 15 second period at a ΔP of 3 inches of water.	Repair or replace pitots. A post test leak check failure indicates the run must be voided and repeated.

11.3.4 Moisture

The EPA Method 316 trains will be used to determine stack gas moisture. During sampling, the exit gas of the last impinger will be maintained below 68°F to ensure adequate condensation of the stack gas water vapor. The total moisture will be determined gravimetrically using an electronic platform balance with 0.1 gram sensitivity.

Apparatus	QC Check	Criteria	Corrective Action
Impinger Glassware	Monitor Exit Temperature	Exit temperature to be kept below 68°F.	Add more ice.
Electronic Balance	Reference Weight	Reading within 0.1 grams of known standard	Recalibrate and reweigh.

11.3.5 EPA Method 316 Sampling Trains

The field sampling QA/QC for EPA Method 316 will begin in the sample recovery area. The impingers will be charged with high purity water and silica gel, then weighed to the nearest 0.1 gram on a top loading electronic balance. The sample trains will be assembled without attaching the sample probe. At the sampling site the sample probe will be attached to the sample train and a leak check will be conducted. Any leaks found in excess of 0.02 cfm will be corrected prior to beginning the test runs. Leak checks will also be conducted before and after any sample train component changes, and upon completion of each test run. Probe heaters will be maintained within allowable ranges throughout the test runs.

Apparatus	QC Check	Criteria	Corrective Action
Probe Heaters	Monitor Temperature	Temperature to be kept 248 ± 25°F.	Adjust Heater Setting.
Isokinetic Sampling Train	Leak Check	Leak Rate of less than 0.02 cfm.	Adjust Sample Volume or Retest.

11.3.6 EPA Method 10 Carbon Monoxide Analyzer

The field sampling QA/QC activities for EPA Method 10 will be more vigorous than specified in the reference method. Specific QA/QC activities include:

Activity	Criteria
– Calibration error	< 5% of calibration gas value
– Sampling system bias	< 5% of span
– Zero and calibration draft test	± 3% of span

In addition, initial up- and down-scale response time checks will be conducted.

11.4 EPA METHOD 316 SAMPLE RECOVERY

Sample recovery will be performed in an on-site laboratory van under the supervision of the MACTEC Field Team Leader. Recovery of the formaldehyde sample trains will be performed following the procedures of Method 316. In addition to the field blank, blanks will be taken of the reagent grade water. The sample recovery apparatus will be made of pre-cleaned Teflon® or glass. Before recovery, the impingers will be weighed to the nearest 0.1 grams so that the moisture content of the gas stream can be calculated. The sample train cleanup will be accomplished by rinsing each sample train component from the nozzle up to and including the "U" bend between the third and fourth impingers. The rinse up to and including the first impinger will be recovered separately from the rest of the sample train so that separate analyses can be performed on each fraction for the purpose of calculating formaldehyde collection efficiency. All sample containers will be tared and then re-weighed following sample recovery, so that sample integrity can be ascertained.

11.5 EPA METHOD 316 LABORATORY ANALYSIS

The formaldehyde samples will be analyzed following the procedures of EPA Method 316. Field blanks and reagent blanks will be used to check for contamination. They will be processed in the same way the field samples are processed. Field blank concentrations will be subtracted from the appropriate sample formaldehyde concentrations. Blank concentrations above 0.25 μg/ml will be considered suspect and will not be subtracted from the sample formaldehyde concentrations.

12.0 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

Prior to the field test, MACTEC will prepare a packing list identifying the sampling equipment, instrumentation, and supplies necessary for the planned field testing. As part of this activity, MACTEC will inspect each piece of sampling equipment to ensure that it is in good repair and that the initial calibrations are still current. MACTEC will also prepare spare sampling systems and supplies, so that interruptions in the testing program can be minimized in the event of equipment malfunctions. All the equipment and supplies will be readied in a staging area in MACTEC's laboratory, then loaded onto a MACTEC van for transport to the test sites.

Upon arrival at the test site, MACTEC will inspect all the sampling equipment to verify that it arrived in good condition. After inspecting the equipment, MACTEC will set up the sample preparation and recovery area, and organize the equipment and work area, so that it is functional and safe, and commence the pre-test activities.

13.0 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

MACTEC's sampling equipment is calibrated according to the criteria specified in the EPA Methods 2, 316 and 10. The range of calibration is specified for all environmental measurements to encompass the range of probable experimental values.

13.1 CALIBRATION AND PREPARATION OF SAMPLING APPARATUS

The preparation and calibration of source sampling equipment is essential in maintaining data quality. MACTEC will follow the calibration routines described in the EPA Methods.

13.2 CALIBRATION OF ANALYTICAL INSTRUMENTS

All formaldehyde sample analysis for this effort will be conducted by MACTEC's subcontractor, RAI. MACTEC has assurances from RAI that all analytical instruments and equipment used to process and analyze the samples will be calibrated according to standard operating procedures for laboratory standards.

14.0 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Typically the manufacturer states purity levels on the packages of reagents and sampling media. High purity water used for collection of formaldehyde and the rinsing of the train will meet the requirements of ASTM Type I water. MACTEC will ensure that blanks of all water and reagents used in the test are analyzed as discussed in Section 11 for the reagents.

15.0 NON-DIRECT MEASUREMENTS

For this project, data will either be measured directly (e.g., temperature, velocity head, etc.) or calculated from directly measured data. Project data will be recorded manually for Method 316 and on a data logger for Method 10. Method 316 observations will be recorded in ink on preformatted data sheets.

16.0 DATA MANAGEMENT

16.1 USE OF NON-MEASUREMENT DATA

All data used in this project will be measured directly, calculated from direct measurement data, or consist of notes and observations concerning any problems implementing the procedures. The notes and observations recorded during the field testing will be provided for assessment in a separate section of the draft final report.

16.2 USE OF CALCULATED DATA

EPA Method 316 will be used to determine the concentration of formaldehyde. The laboratory analytical results provide total mass of formaldehyde per sample. The total formaldehyde concentration in the stack gas will be calculated using the mass of formaldehyde in the sample and the volume of air sampled. Using the concentration and the stack gas volumetric flow rate, the formaldehyde mass emission rate will be calculated. The mass emission rate (pounds per hour) and the fuel rate (gallon per hour) will be used by NAPA to calculate the emission factor expressed as pounds of pollutant per gallon of fuel fired.

16.3 LIFE CYCLE OF DATA

Project data will be recorded in ink on preformatted data sheets. Method 10 instrument readouts will be saved to a disk file and subsequently printed. These data sheets and samples will be returned from the field to MACTEC. The samples will be transferred by MACTEC to RAI for analysis. RAI will use standard laboratory tracking procedures. The field data will be input into software designed to generate information on gas stream conditions based on data provided.

When the laboratory analysis is complete, MACTEC will receive laboratory analytical reports from RAI and will combine the analytical data with the MACTEC field data to calculate the concentrations. Calculated results, copies of field data sheets, and raw analytical data will all be included in the draft and final reports. The original data sheets, analytical data, and disk copies of the software used in the calculations will be stored on file at MACTEC for a period of no less than three years after the end date of the project.

16.4 DATA RECORDING

Extreme care will be exercised to ensure hand recorded data are written accurately and legibly. Additionally, the forms have been formatted for easy use. Errors and discrepancies will be noted in the field log book.

16.5 DATA COLLECTION AND VALIDATION

The MACTEC Field Team Leader will review field data sheets looking for inconsistencies in such parameters as: temperatures, pressures, velocity head, sample volume, etc. The Field Team Leader will also review sample components and sample recovery sheets looking for inconsistencies. Errors and discrepancies will be noted in the field log book.

16.6 DATA PROCESSING AND TRACKING

Individual data points will be transformed into calculated results using a series of equations. The equations have been incorporated into software for efficiency. As a QC check, dummy values will be input to the software and the results will be checked against expected values. The MACTEC PM will keep a data tracking log during the data processing and reporting phase of the project.

16.7 DATA STORAGE AND RETRIEVAL

The original data sheets, analytical data, and disk copies of the software used in the calculations will be stored on file at MACTEC for a period of no less than three years after the end date of the project.

17.0 ASSESSMENTS AND RESPONSE ACTIONS

17.1 ON-SITE PROCEDURE AUDIT

There will be no QA coordinator on-site to observe testing. Data collected will be evaluated according to the criteria listed in Section 4.0.

17.2 INTERNAL DATA REVIEW

MACTEC personnel with technical expertise in the field of air emissions testing, who have had minimal or no involvement with the field data collection, will provide a thorough review of the data. Reviewers will determine if the project activities were technically adequate, competently performed, and properly documented.

17.3 ASSESSMENTS

Using the quality indicators and associated criteria as listed in Section 4.0 and tabulated in Table 17.1, NAPA will make assessments as to whether the results are adequate for their intended use. Results and any recommendations will be documented in the Draft Final Report.

TABLE 17.1

QUALITY INDICATORS & CRITERIA

Activity	Quality Indicator	Criteria
1	Method 316 sample volume	> 30 cubic feet
2	Method 316 sample time	> or equal to 60 minutes
3	Method 316 formaldehyde concentration	> 11.3 parts per billion by volume
4	Method 316 formaldehyde break-through	< 20%
5	Average isokinetic ratio	> 90 & < 110 %
6	Perform 12 one-hour Method 316 runs	100 % completeness
7	Perform 12 one-hour Method 10 runs	100 % completeness

18.0 REPORTS TO MANAGEMENT

Because each of the four field tests are short-term tasks, no written formal reports to management will be generated. Informal communications (voice mail, email, fax, letter, or memo) with the NAPA PD will be made on an as-needed basis. A formal report of the test and its results will be submitted to the NAPA PD after the test is completed. The report will include documentation of the outcome of the test, all test results, the results of QA assessments, the comparisons of the data to the criteria given in Section 4.0, the procedures and methodologies followed, and any conclusions and recommendations derived from evaluating the results of the test.

19.0 DATA REVIEW, VERIFICATION, AND VALIDATION

The purpose of this section is to state criteria for accepting, rejecting, or qualifying the test data. This discussion focuses on the quality indicators and criteria listed in Table 17.1.

The main objective is to accurately determine formaldehyde emissions from HOS burners, so it is imperative that sufficient sample is collected and that formaldehyde is detected in the samples.

Variability or failure to meet all the criteria in Table 17.1 may be an indicator of inconsistent or erroneous data, and will require examination of possible causes of data rejection.

As stated earlier, this sampling project will consist of 12 test runs, three at each of the four facilities. MACTEC's goal is to have at 12 successful runs.

20.0 VERIFICATION AND VALIDATION METHODS

The purpose of validation is to assess the degree to which the data meets the quality specifications outlined in the QAPP. If deviations are noted, the validation procedures can be used to assess the effect the deviation will have on test data usability.

20.1 SAMPLING DESIGN

This test program is designed to gather data that will be used by NAPA to develop formaldehyde emission factors for HMA plant's HOS burners.

20.2 SAMPLE COLLECTION PROCEDURES

Actual procedures documented in field logs and data sheets will be checked against the procedures described in the QAPP. Deviations from the QAPP will be classified as acceptable or unacceptable, and critical and non-critical. Significant changes will be documented in the draft and final reports.

20.3 SAMPLE HANDLING

Sample custody will be maintained for each sample component. Sample custody from the field to the laboratory and within the departments of the laboratory will be checked. All deviations will be documented in the draft and final reports.

20.4 ANALYTICAL PROCEDURES

The analytical procedures performed during the test program will be checked against those described in the QAPP. Deviations from the QAPP will be classified as acceptable or unacceptable, critical and non-critical, and will be documented in the draft and final reports.

20.5 QUALITY CONTROL

QC samples and procedures performed during the test program will be checked against those described in the QAPP. Omissions will be discussed in the final report. QC results of the blank analyses will be reviewed and described in the draft and final reports.

20.6 CALIBRATION

Documentation of equipment calibration (nozzles, dry gas meter, thermocouples, etc.) will be checked against the values used in data collection. Errors and omissions will be discussed in the draft final report.

20.7 DATA PROCESSING

The data processing system will be checked by using example raw data for which calculated values are already known. The example data are input into the system and the calculated results are compared to the known. Hand calculations will be used to spot check the data processing system.

21.0 RECONCILIATION WITH USER REQUIREMENTS

Results obtained from the project will be evaluated with respect to the quality indicators described in Section 4.0 of this document. Results will be checked for collection efficiency (accuracy), precision, and completeness. Qualitative assessments will be made on meeting sampling, sample recovery, and analytical precision requirements of the methods. These will be discussed with the NAPA PD during preparation of the draft and final reports. The NAPA PD will evaluate whether the project met the objectives of the sampling design, and whether departures from the QA/QC guidelines are acceptable. The conclusions will be included in the draft and final reports. The following subsections show the calculations involved.

21.1 SAMPLE BREAK-THROUGH DETERMINATION

Sample break-through is a measure of the amount of a compound of interest that passes through the sample media without being collected in the media. The amount of formaldehyde sample break-through will be determined by analyzing the contents of the 1st and 2nd impingers separately from the 3rd impinger. The percent break-through (% BT) will be calculated as follows:

$$\% BT = \frac{Amt.\ in\ 2^{nd}\ \&\ 3^{rd}\ impingers}{Amt.\ in\ 1^{st},\ 2^{nd}\ \&\ 3^{rd}\ impingers}\ x\ 100$$

21.2 PRECISION

Precision is the repeatability of the result. In this project, precision will be measured using the results of the three replicate measurement runs at each site. The precision is expressed as relative standard deviation (RSD).

21.3 COMPLETENESS

Completeness refers to the amount of data gathered compared to the amount of data required in the project design. MACTEC has a 80 % completeness standard for this project.

$$\%Completeness = \frac{Amount\ of\ Data\ Collected}{Amount\ of\ Data\ Required\ by\ QAPP} \times 100$$

APPENDICES

Appendix A

Example Field Data Sheets

Appendix B

EPA Test Methods 1, 1A, 2-4, 10 and 316