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GUIDELINES FOR PREPARATION OF BID SPECIFICATIONS AND BID EVALUATIONS FOR CONTINUOUS EMISSIONS MONITORING SYSTEMS (CEMS)

INSTITUTE OF CLEAN AIR COMPANIES

Guidelines for Preparing Bid Specifications and Comparing Bids for Continuous Emissions Monitoring Systems (CEMS)

ICAC

The Institute of Clean Air Companies, the nonprofit national association of companies that supply stationary source air pollution monitoring and control systems, equipment and services, was formed in 1960 to promote the industry and encourage improvement of engineering and technical standards.

The Institute's mission is to assure a strong and workable air quality policy that promotes public health, environmental quality, and industrial progress. As the representative of the air pollution control, the Institute seeks to evaluate and respond to regulatory initiatives and establish technical standards to the benefit of all.

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Summary: This document provides guidelines for specifying and collecting information necessary to solicit bids from suppliers of continuous emissions monitoring systems (CEMS) and continuous opacity monitoring systems (COMS). It includes an example bid specification, a bid evaluation form, and a proposal checklist, with supporting discussion. The emphasis of this document is on the DEMS; it does not address auxiliary components such as stack flow monitors and data acquisition systems. The focus is directed on fully extractive and dilution-based systems. In situ systems are not addressed primarily due to limited numbers of installations and applications. Issues dealing with CEMS/COMS applications such as probe locations, monitoring feasibility, and flue gas (sample) composition associated with the measurement process have been omitted, as they can be very complex, and require separate discussions.

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1. HISTORY

The ICAC Emissions Measuring Division prepared ICAC-CEM-1 to ease the process of purchasing CEMS and COMS, and to help customers specify and obtain systems which best meet their needs.

The members of the ICAC Emissions Measuring Division are companies which supply emissions and opacity monitoring and stack testing products and services. Those members of the Division who contributed to ICAC-CEM-1 were:

- Anarad, Inc.
- Baldwin Environmental, Inc.
- BOVAR Western Research
- Graseby STI
- Horiba Instruments, Inc.
- Land Combustion
- KVB
- M & C Products Analysis Technology, Inc.
- Praxair, Inc.
- Rosemount Analytical, Inc.
- Spectra Gasses, Inc.
- Testo, Inc.
- Universal Analyzers, Inc.

2. OBJECT AND SCOPE

The object of ICAC-CEM-1 is to help end users of continuous emissions monitoring systems to prepare a specification for the solicitation of bids from suppliers. The intent is to provide a foundation for development of a purchase specification that can be prepared directly by the buyer, if desired, to reduce acquisition costs by minimizing or eliminating the need for third party consultants.

ICAC-CEM-1 does not recommend specific values, suppliers, or designs. The general specifications provided are based on accepted practices, and are offered for informational purposes. Specific site conditions, applications, and monitoring requirements will dictate the actual system specifications and performance criteria.

3. DEFINITIONS

3.1 Bid Specification – A document containing equipment specifications, performance criteria, and scope of work sought which is distributed to vendors to describe the requirements of the CEMS intended for purchase.

3.2 Calibration Standard – Gaseous or liquid standards used to calibrate CEM instruments, and typically including a zero point, and one to three additional standards to generate a response curve. For each application, an individual must determine the applicable regulatory requirements for standards traceability and analytical certification tolerances.

3.3 CEM – A continuous emissions monitor.

3.4 CEMS – A continuous emissions monitoring system.

3.5 COMS – A continuous opacity monitoring system.

3.6 Certification Testing – Performance testing of the CEM according to a specific testing protocol approved by the applicable regulatory agency for the purposes of demonstrating compliance to regulatory monitoring requirements.

3.7 Construction Services – Electrical and mechanical labor required to physically mount, secure and install the system and its ancillary components at the site.

3.8 Enclosure – A cabinet, shelter or rack used to contain sampling components, system controls, and analyzers.

3.9 Factory Acceptance Tests – Testing of the system and components at the manufacturer's site to ensure the system conforms to the specifications.

3.10 Supervision of Installation Services – Services provided by factory-trained or factory-authorized service personnel that involve checking or making final system mechanical and electrical terminations.

3.11 Moisture – Combination of particulate and condensate (as defined as a liquid of any nature).

3.12 Probe – The CEM direct interface to the sample gas. The device used to extract a sample for analysis from the stream of flue gas.

3.13 Sample Conditioner – Components integrated into the CEMS which filter and condition the sample gas before introduction into the analyzers.

3.14 Start-up Services – Services performed to calibrate and verify system operation and functionality following installation at the site.

3.15 Umbilical – The bundle of sample tubing and signal cables used to interface the sample probe with the gas analyzers.

4. BUYER'S RESPONSIBILITY

Purchasing a CEMS requires planning and foresight. The buyer must define specifications for the CEMS, and these specifications influence the overall cost and performance of the system.

A CEMS/COMS specification extends beyond a simple list of instrument specifications. Development of a bid specification requires input from multiple disciplines, including mechanical, electrical, instrumentation, and environmental engineering. Installation requirements must be defined for components such as sample umbilical supports, mounting and securing of CEMS enclosures, and gas cylinders. Electrical engineering support may be required to review system load demands and the availability of circuits. Instrumentation engineers will define the performance requirements, the types of analyzers, and possibly the sample conditioning requirements. Environmental engineering input is needed to ensure that the system satisfies the applicable regulatory requirements.

Additionally, other disciplines may also be called upon for support. For example, civil engineering input may be required to review plant structural conditions to ensure the CEMS/COMS can be installed at a specific location, or to determine the feasibility of making penetrations in the stack to mount the equipment.

If properly developed, the specification serves as the basis for buying an operational system configured to meet the monitoring application at the lowest possible cost.

The purpose of the CEMS specification is to help the buyer not only to secure competitive bids from vendors, but also to identify and define specific designs. It is important that the buyer develop a specification that is both informative to the supplier, and useful as an evaluation tool when selecting a supplier. A CEMS specification should address the following topics:

4.1 Purpose

The purpose should be a brief statement defining the equipment and services sought, followed by a brief explanation of the application and the installation site. For example, "Acme, Inc. will be installing a continuous emissions monitoring system (CEMS) to monitor CO and O2 emissions from a thermal oxidizer (Anywhere, USA)."

4.2 Scope of Supply

The scope-of-supply section should clearly identify the equipment and services that the vendor is to provide. Equipment lists should identify the number and type of systems, and ancillary equipment such as calibration gasses, regulators, pressure reducing devices, and sample conditioning hardware. Expected services should identify any requirements for construction, installation, certification testing, training, and maintenance.

While specifications often include multiple options and alternate approaches, this may result in problems when evaluating the bids. Requests for options thus should be minimized.

4.3 Plant Description

The plant description must give the supplier a thorough understanding of the conditions under which work must be performed and under which the CEMS will function. This section should identify the ambient and process conditions in which the CEMS equipment will operate. This plant description should also contain flue gas characteristics, and may include a description of the sample port location and general access to the system components being requested.

4.4 Plant Permits – Title V Operating Permit, and All Applicable State and Local Permits

The specification should list all permits governing plant operating parameters, emission limits, and monitoring, recording and reporting requirements. A copy of each permit should be provided with the specification.

4.5 Existing Services and Services to Be Provided by Others

The work scope should clearly note any work that the buyer will perform. Items to be identified include but are not limited to: access routes to installation locations such as platforms, elevators, and ladders, utility services such as plant air and water supplies, drains, foundations, labor for construction, mechanical installation, and electrical wiring. The importance of this section is dependent on the extent of turnkey services requested.

4.6 Design Parameters

This section details the system parameters, lists major system components, instrument specifications, performance criteria, operational requirements, and materials of construction. In short, this section defines the CEM hardware. Specification requirements are critical to ensuring that the system meets the buyer's expectations. Simultaneously, however, the specification should provide enough latitude for the CEMS suppliers to use their experience and proven system design.

Care must be taken to ensure the requirements in the specification define a system that can be reasonably manufactured. Occasionally, buyers combine instrument specifications from various manufacturers into a single specification in the hope of creating the perfect system. Unfortunately, such a strictly defined CEMS often cannot be built at a reasonable cost.

4.7 Documentation

The type, number, and quality of system documents to be provided should be clearly specified. For example, specifications for drawings and manuals should include the number of copies and the format. As an option, the specification may call for drawings and manuals on electronic media (e.g., floppy disks, CD ROM) using popular software to allow the buyer to later modify these documents with minimal labor.

Documentation is crucial for systems with unique engineering designs. Documentation of all calculations specific to the system should be requested, along with a detailed explanation describing the parameters, measurements, and other information used to derive the calculated results.

4.8 Vendor Services

Vendor services include items such as factory acceptance testing, training, commissioning services, and certification testing services. As these items may be subjective and open to interpretation, specificity is important. Requirements for these services should address items such as the type, extent, and duration of training, protocols for factory acceptance testing, certification testing protocols, and if desired, project management functions, such as progress reports and project schedules.

4.9 Performance Requirements

Performance requirements include the applicable regulatory requirements, and any additional requirements imposed by the buyer. More specifically, system availability (up time) requirements, certification testing results, and maintenance requirements should be defined and assigned measurable performance criteria.

A specification developed according to the principles outlined above is provided as Appendix 1. This specification is offered only as a guideline. Site-specific conditions, regulations, and permit conditions will dictate the precise parameters and designs for a given application.

5. QUALIFYING CEM/COM VENDORS

Before writing a specification, the buyer must decide which companies to consider as qualified suppliers. Potential sources of suppliers include the list of ICAC members, and various buyers' guides which list CEMS/COMS manufacturers and system integrators. In selecting suppliers, the buyer should note the important distinction between manufacturers and system integrators.

CEMS/COMS manufacturers are specialized companies dedicated to manufacturing equipment and analyzers specifically designed for continuous emissions monitoring applications. These companies engage in system design and configure systems specific to application conditions.

System integrators are firms that purchase analyzers (from instrument suppliers) and components, and then configure them into a functional system.

Which type of supplier is best? The answer to this question depends on the application and on the buyer's preferences, CEMS background, and engineering expertise, and on the labor allocated for the CEMS project. The intent herein is not to specify one type of CEMS supplier, but to provide guidance for narrowing the supplier field to those suppliers of either kind best able to meet plant-specific needs.

The buyer should pre-qualify bidders before issuing a bid request. This practice will eventually make the final selection process easier by reducing the number of firms being considered. Reducing the field of suppliers will allot more time for the buyer to study and review proposals of interest from those suppliers most qualified to meet the specific requirements.

Criteria for pre-qualification of CEMS suppliers include:

- experience, size, and resources of the supplier;
- end-user references;
- quality assurance aspects;
- technical competence, staffing, and inventory of spare parts;
- after-sales support and service; and,
- general comfort factors (e.g., rapport with the supplier's engineering personnel).

Experience and company size say a lot about a CEMS supplier. Experience is critical and cannot be overlooked. Company size may provide an indication of the resources that are available and the ability to stand behind the system warranties and guarantees extended to customers.

Pre-bid site qualification is recommended to reduce the number of bids with many exceptions. This normally takes the form of a meeting of all potential bidders at the site, with a plan walk-through and a question-and-answer period to allow the bidders to understand plant needs.

While references are important, customers should avoid placing too much emphasis on them. Because no supplier would knowingly submit a bad reference to a potential customer, comments from references will usually endorse the supplier. When contacting references, questions relating to the customer experience when dealing with the prospective supplier may reveal important underlying information. References can best be used with in-person site visits to directly observe the systems in operation and their installation.

The number of references a supplier will have for CEMS on units very similar to that of the prospective buyer will vary greatly by industry. In some industries few plants have CEMS because the industry encompasses few plants, because of limited regulatory requirements to install CEMS, or for other historical reasons. For example, the number of chemical plants producing pigments is small, so references for installations at such plants may not be available.

A CEMS/COMS supplier should follow a consistent, documented, quality program, such as ISO 9000, DOD QS 9000, or an equivalent self-written program.

The remaining factors, such as inventory, staffing, and after-sales support, are also important in the qualification process. Unfortunately, improper evaluation of these factors may lead to incorrect conclusions about a supplier. For example, in the case of after-sales support, purchasers of CEMS often ask the location of the closest service technician to their location. This is the wrong question, given that the availability of service technicians, and not their location, is the real concern.

Another significant buyer concern is the technical capability of the supplier. CEMS are systems that integrate many components. A supplier should be technically capable of accepting total system responsibility. When repairs are necessary, the supplier should possess the technical competence to troubleshoot and repair the entire system down to the level of circuit board components.

An important aspect of any monitoring system is its cost. There are two types of costs associated with a CEMS: procurement costs, and ownership costs. Procurement costs are those expenditures associated with the initial purchase. Although the procurement cost is important, the more important cost in the end is the cost of ownership, including costs associated with operating and maintaining the CEMS. It is therefore important to review CEMS operating performance in terms of required maintenance. Information regarding the labor commitment and required maintenance on a system is invaluable, and usually can be obtained from the CEMS supplier or previous customers. Careful inspection of a CEMS's design (components and component layout) also can provide insight into the expected maintenance and labor support required to keep the system operating.

Any advantage of a CEMS that has an initial low capital cost can be quickly offset if it is labor intensive or if it leads to the imposition of fines by regulatory agencies because of excess plant emissions. Plant downtime attributable to an inoperable CEMS will affect plant revenues and offset any savings at time of purchase. Costs associated with plant downtime can be very large compared with the added initial cost of a reliable, low maintenance system.

Normally, a system requiring infrequent maintenance will have lower operating costs. An achievable and expected standard is for a CEMS to require less than one hour of maintenance per week (except in extreme environments), exclusive of routine daily inspections. Ownership costs can and should be well defined by the supplier.

Keeping these ideas in mind, CEMS vendors can be quickly pre-qualified. The pre-qualification process should give the buyer a short list (at least three) of vendors that, in the buyer's confidence, can supply a CEMS meeting the buyer's specifications and expectations. Exploring the capability and compliance to specifications is left to the evaluation process.

6. EVALUATING THE PROPOSAL

After soliciting bids from the group of pre-qualified bidders, the buyer then faces the most important task: evaluating the bids and selecting the CEMS supplier. Each CEMS supplier will have submitted a response to the bid specification: either a proposal or a notification not to bid on the project. A carefully written specification will usually assure that bids will be received for services and hardware tailored to the buyer's needs.

Selection of the bidder based simply on instrument specifications and purchase price is insufficient. An exclusive focus on the lowest price may lead to omitting services or equipment that must be purchased later, usually at a higher cost, or to selecting a system with high maintenance requirements.

The complexity of bids received depends directly upon the types of services requested. Whenever options are requested, the evaluation process becomes more difficult. Too often, an option involves more that simply adding or substituting a component or analyzer, and instead may require a vendor to restructure the entire base bid to accommodate the purchaser's request. Bids for replacing an existing system will typically be less complicated and require a less complicated review process.

Nevertheless, reviewing bids can seem overwhelming. To make the process easier, the buyer should develop a process that assists in and documents the results of the evaluation. During this process, a set of questions and/or data sheets should be created to summarize each bidder's offer. Appendix 2 provides an example bid evaluation form.

Before evaluating the proposal details, it is common practice to develop a checklist to ensure that each proposal has addressed the requests of the solicitation. This practice helps to identify those bidders that have omitted items, or that have not submitted complete information. Reviewing each proposal for completeness can explain major cost differences between vendors. Appendix 3 offers a sample proposal checklist.

Evaluating any bid will require careful comparison of design features of the system and its components, including:

Type and length of sample line (if appropriate)

- system tolerance to ambient conditions and vibration
- signal output capabilities for data acquisition
- serviceability and access to components
- enclosure type, air conditioning and heating source
- system operation such as response times, calibration, and blowback capabilities
- system expansion capabilities
- normal expected system maintenance

Commercial terms, conditions, and turnkey services also require consideration when appropriate. These should include but not be limited to:

- System warranties and guarantees
- Calibration gases and supplies (or matrix of gases required)
- Testing services
  - Factory acceptance testing
  - Certification testing
- Training
- Payment terms
  - Performance bonding
  - Delayed payment
  - Delayed delivery
  - Progress payments

6.1 System Design Considerations

All continuous emissions monitoring systems consist of three primary integrated subsystems:

- sample interface/sample probe;
- sample transport and conditioning; and,
- instruments.

6.1.1 Sample Interface/Sample Probe

Sample probes are specifically designed for the type of CEMS to be supported. The probes are either dilution-based, or designed for full extractive

CEMS. An important consideration for a sample probe is its tolerance to the flue gases in which it will be mounted. The materials of construction should resist corrosion, as well as abrasion from airborne particulate matter.

Sample probes should be designed to ensure that calibration gases can be injected into the probe upstream of all out-of-stack components to comply with EPA requirements, and to allow the calibration gas to flow through the same path as the sample gas. Another sample probe design feature requiring consideration is the probe's ability to dislodge blockages continuously or periodically which may result in the probe's filters. Filters are an integral component of most probes. For dilution probes, it is important to determine where the dilution process occurs. Some dilution probes filter the sample, then add a diluent gas. The "post filter" dilution can take place either inside the flue (in-situ dilution) or outside the duct (ex-situ dilution). Dilution probes that dilute the sample before the filter are termed differential dilution probes.

6.1.2 Sample Conditioning

Sample conditioning subsystems in dilution-based CEMS include filters, the diluent gas, eductor and critical orifices. Systems must be constructed from materials that are compatible with the sample gas and should be designed to facilitate maintenance.

The source of diluent gas is an important consideration when a dilution system is proposed. Normally, plant instrument air is used for the diluent gas. The plant air source must be evaluated to ensure a sufficient supply can be continuously provided to the CEMS. Further, a sub-system usually called an air cleanup package is required. The air cleanup package must be capable of purifying the diluent gas by reducing contaminant gases and other interfering components to trace levels. If the purification is inefficient, the diluent gas may have a contaminant gas concentration that is similar to that of the component being measured. Hence, it is important to have a cleanup system sized appropriately to accommodate the required flow of diluent gas, and able to remove interfering components.

Fully extractive continuous emissions monitoring systems may use sample conditioning hardware to prepare the transported sample before its introduction into the gas analyzers. The sample conditioning hardware will depend upon the components to be measured and the analysis method.

The key feature of the sample conditioning system is its ability to eliminate sample moisture, control sample temperature, and provide a controlled flow of sample under constant pressure to the analyzers. Where the flue gas may be laden with acidic vapors, it is imperative that measures are taken to completely remove these vapors. Failure to do so could lead to rapid deterioration of internal components of the analyzers, resulting in measurement errors and costly instrument repairs.

Sample conditioning hardware may include any or all of the following components:

- Filter(s)
- Moisture removal system
- Flow control
- Pressure control
- Temperature control
- Sample pump

Filters eliminate particulate from the analyzers. Typically, filtering is incorporated as part of the extractive probe, although additional filtering may be used before the analyzer(s).

Most gases are measured on a dry basis, meaning that the moisture in the sample is removed before analysis. Moisture removal is normally accomplished by reducing the gas temperature and condensing the moisture.

Water-soluble gases, e.g., HCl andNH_3, are analyzed on a wet basis, since moisture removal would significantly lower the gas concentration, thus yielding incorrect readings. In these types of CEMS, the temperature of the sample system and analyzers are maintained above the dew point of the gas stream.

The control of flow, pressure, and temperature will be determined by the requirements of the analyzers used in the particular system.

6.1.3 Gas Analyzers

The analytical subsystem of any CEMS consists of the analyzers used to measure the concentration of constituents of interest in the flue gas. Analyzer designs vary between manufacturers, and their principles of operation may sometimes differ.

6.1.3.2 Analyzer Operating Range

Most analyzers have selectable ranges, or at least ranges that are adjustable to accommodate the expected concentrations of the gas constituent being measured. A good rule-of-thumb to determine the desired range of an analyzer is to use a range that will envelop the average gas concentration. The average concentration of the gas being measured should fall between 20 and 80% of the chosen range setting. Gas measurements, when made within this range, ensure the greatest degree of accuracy is obtained from the analyzer. When measurements fall outside the 20-80% range, instrument sensitivity may suffer, dependent on available technology, and errors can result as the detection limits of the analyzer are approached.

For some applications, such as where multiple fuels will be combusted, gas concentrations can vary widely. In such situations, analyzers with multiple ranges are required. Multi-range analyzers should be configured to automatically switch between ranges when the detected gas concentration falls outside the selected measurement range.

6.1.3.2 Analyzer Interference

Every analyzer will provide false positive responses to interfering gases. This is another reason to include a complete and accurate stream composition in the specification. Any analyzer selected for an application should be resistant to interference. A U.S. EPA specification [cite] requires that analyzers should exhibit responses of less that 2% of their full scale, based on the total of all interfering components present within the sample.

6.1.3.3. Instrument Drift

The drift of an analyzer refers to the deviation of the measured value from the true value over time. Zero drift describes the drift that an analyzer exhibits during analysis of a gas with zero concentration of the constituent gas. Span drift refers to the drift shown by the analyzer when subjected to a calibration gas or standard having a known concentration.

Because instrument drift is inevitable, it is important to consider analyzer drift in the overall system evaluation. Temperature fluctuations of the sample can contribute to instrument drift. The ability of the sample conditioning subsystem to control the sample temperature is vital. An instrument designed for CEM use should drift less than 2% of its full scale value for any 10 °F step change over the recommended operating temperature range for the instrument.

6.1.3.4 Instrument Response Time

The response time of an instrument is usually specified as the time required for the instrument to show a 90% response to a 200% process step change. Response times become important when timesharing systems are considered. In a timesharing or sample-stream-switching CEMS, one system monitors gases taken from two or more sample points. Sample gases from different probes are alternately directed through the sample conditioning system and the analyzers. Although the capital procurement cost of timesharing systems is lower than that of multiple dedicated systems, the inherent risks of the design must be understood. Failure of the system's sequencer or failure of one analyzer results in the loss of data from all sample points, not just one sample point. The data time average dictated by some regulations may also disfavor timesharing systems. For example, the boiler and industrial furnace (BIF) rules defined in 40 CFR 260 require one-minute average values. With timesharing systems, the lowest practical cycle time must be evaluated to ensure that it meets applicable requirements.

6.1.3.5 System Response Time

The time required for a system to detect and respond to a process change is known as the system response time. System response time is affected by the response time of the analyzers, but also is directly dependent on the sample transport time. Sample transport time is the time required to withdraw a sample from the stack and deliver it to the analyzers, and typically includes the time required to flush the sample line with at least three complete volumes of sample. The sample transport rate depends on the sample flow rate, sample pump capacity, and sample line length and diameter. System response time is a far more important consideration than instrument response whenever a timesharing system is being considered.

APPENDIX 1 – SAMPLE CEMS SPECIFICATION

1.0 Purpose
XYZ Corporation issues this specification to solicit proposals for a continuous emissions monitoring system (CEMS). The CEMS will be required to monitor emissions in combustion flue gases from a stack serving a (gas-fired boiler, oil-fired boiler, coal-fired boiler, incinerator, etc.)

2.0 Scope of Supply
This specification is for the purchase (and optionally, delivery, installation, and commissioning) of a fully assembled, tested and operational continuous emissions monitoring system as described in this document.

2.1 Base Equipment

2.1.1 One (1) heated (composition) sample probe with standard (diameter) mounting flange.

2.1.2 One (1) continuous length of heated sample transport line, approximately XX ft. in length.

2.1.3 One (1) sample conditioning system as required to condition and prepare samples for analysis.

2.1.4 One (1) set of gas analyzers to measure the concentration of (CO, CO2, SO2, NOx, etc.) in stack flue gas.

2.1.5 Calibration gases, cylinder regulators, supply manifold and auxiliary devices necessary to perform daily system calibrations.

2.1.6 A system enclosure designed to house, protect and maintain the system's sample conditioning system and analyzers within an acceptable ambient operating climate.

2.1.7 One (1) set of special tools and calibration fixtures or devices.

2.1.8 All interconnecting signal cables necessary to ensure proper operation of the system.

2.2 Services to be Supplied

2.2.1 Startup and commissioning services as required to render the CEMS operational for normal continuous monitoring.

2.2.2 Certification testing as required by local, state and federal regulatory requirements to demonstrate compliant system operation.

2.2.3 Training of plant technical personnel in the operation and maintenance of the CEMS.

2.3 Documentation

2.3.1 Provide system documentation in the form of a CEMS Operation and Maintenance Manual, as-built system drawings, bill of materials, recommended spare and consumable spare parts.

2.3.2 Prepare and submit certification testing reports to applicable regulatory agencies.

2.3.3 QA/QC Program for maintenance and system operation in accordance with applicable regulatory guidelines.

3.0 Plant Description
The XYZ Corporation Plant is located in Any City, Any State, approximately twenty miles southeast of Someplace. At this plant the CEMS shall be installed and made operational on the No. 1 stack servicing the plant's domestic boiler. The installation shall consist of stack mounted equipment rated for outdoor exposure and supporting analyzer system to be located inside of the adjacent boiler building. The intended location for the sample probe is at the 75 ft. level of the metal stack. Access to the sampling platform is available from a catwalk on the boiler building roof or from ground level using the metal ladder attached to the stack.

3.1 External Ambient Conditions

3.1.1 Plant Elevation: ____ft. above sea level

3.1.2 Maximum Wind Speed: ___ mph

3.1.3 Ambient External Temperature

- Extreme minimum temperature: ____ °F
- Extreme maximum temperature: ____ °F
- Annual average temperature: ____ °F

3.1.4 Relative Humidity: ____ %

3.1.5 Other Related Environmental Conditions

- Vibration of stack
- Dust loading of ambient atmosphere
- RF interference or proximity of microwave transmitters

3.2 Internal Ambient Conditions

3.2.1 Ambient temperature range controlled between 55 and 80 °F

3.2.2 Clean, relatively dust free environment

3.2.3 Area is dry and vibration free

3.3 Process Conditions

3.3.1 Stack Conditions

- Stack Temperature
- Stack Pressure
- Flue Gas Velocity

3.3.2 Stack Gas Stream Expected Constituent Concentrations

- CO ____ ppm
- CO_2 ____ %
- O_2 ____ %
- NO_X ____ ppm
- SO_2 ____ ppm
- SO_3 ____ ppm
- Hydrocarbons ____ ppm
- Moisture ____ %
- HCl ____ ppm
- Dust Loading ____ mg/scfm
- Interfering Components ____ ppm

3.3.3 Boiler Specifications

- Unit Rating 1. lbs./hr.
- Primary Fuel ____
- Alternate Fuel ____
- Fuel Flow Rate 2. ____
  3.
- Exhaust Gas Flow Rate ____

4.0 Services to be provided by Others

4.1 All system utilities shall be provided by the buyer

4.2 Utility services shall consist of electrical power and plant compressed air. 4.

4.2.1 Electrical power shall be available as:

- 480 V ac, 60 Hz, 3 phase, 3 wire
- 220 V ac, 60 Hz, 3 phase, 3 wire
- 120 V ac, 60 Hz, 1 phase

4.2.2 Plant air shall be made available at:

- 80 psi
- Oil-free with a dew point of -40°C

4.3 The buyer shall be responsible for performing all tasks associated with construction labor. These tasks and services shall include:

4.3.1 Unloading and storage of all CEMS equipment

4.3.2 Mounting and installing CEMS hardware, cabinetry and probes

4.3.3 Installing conduit, signal cables and sample umbilical

4.3.4 Installing hardware in the form of scaffolding, ladders, platforms and all necessary structural components necessary to install and service the CEMS equipment

4.3.5 Tie-ins to electrical supplies and calibration gas supplies shall be performed under the guidance of the CEMS supplier

4.3.6 Mounting and securing system components in accordance with approved CEMS installation drawings

4.3.7 Installing other associate support equipment as necessary for permanent support and operation of the CEMS

5.0 System Design Parameters

5.1 Sample Umbilical

5.1.1 Umbilical Design

1. The sample gas umbilical shall contain the required number of tubes necessary to accommodate transport of sample, calibration gas, and compressed gas for probe blowback. For dilution systems, a vacuum line shall also be available to monitor the eductive forces required for sampling.

2. Tubes within the sample umbilical shall be corrosion and chemically resistant to sample gases. Materials of composition should also be selected to minimize sample deposition, sample adsorption and loss of sample gas resulting from diffusion.

3. For convenience of installation, sample probe electrical and signal cable should be incorporated in a single tube bundle when codes permit.

4. All tubing and wiring within the sample umbilical must be continuous.

5. Materials of construction for the sample umbilical shall conform to applicable NFPA and IEEE standards.

6. Exterior sheathing for the sample umbilical shall be inert, abrasion resistant and flame retardant.

5.1.2 Umbilical Heat Tracing

1. Heat tracing of the sample umbilical shall be provided as applicable. Heat tracing for freeze protection must be adequately designed to prevent freezing of accumulated moisture within the sample line.

2. Heat tracing shall be designed to accommodate the climatic conditions. Heating shall be consistent with the temperature limitations of the sample line's tube materials.

3. A temperature sensor may be required to monitor or control the umbilical temperature.

5.1.3 Umbilical – Physical Specifications

1. Sample tubes shall be appropriately sized to minimize sample transport and lag times.

2. Overall physical characteristics such as diameter, overall length, bending radius and weight shall be minimized to facilitate installation.

5.2 Sample Probe Design

5.2.1 The standard probe shall be constructed of materials that are corrosion resistant and chemically inert with respect to the process gases being sampled.

5.2.2 The probe pipe shall be fabricated to a length that ensures representative samples are obtained for analysis. For larger stacks, the probe pipe extend a minimum one meter into the stack and for smaller stacks, the probe should be extended to 1/3 the diameter of the stack.

5.2.3 Sampling probes shall be designed to incorporate a series of filters or other suitable technology to mitigate plugging resulting from uptake of particulate matter. Porosity size of the filters shall be engineered to maximize removal of particulate matter without restricting sample flow.

5.2.4 Filtering media integrated into the sample probe shall be temperature controlled and maintained at a temperature which prevents condensation of moisture.

5.2.5 Replacement of probe filters shall be possible and require minimal effort.

5.2.6 Mounting of the sample probe to the stack shall be accomplished using standard 150# ASA RF flanges sized 2 to 4 inches.

5.2.7 Sample probe components mounted externally to the stack shall be completely enclosed within an enclosure suitable for protection from the specific environment. The enclosure shall be appropriately sized to facilitate maintenance and to prevent overheating of electrical elements.

5.2.8 Sample umbilical shall connect to the sample probe with standard tubing fittings, either compression type or quick disconnect.

5.2.9 Optional Probe Capabilities

1. The sample probe shall be designed to have the capability to accommodate cleaning of its filters either continuously or intermittently in such a fashion as to not interrupt required data retrieval time.

2. The sample probe shall have the capability to accept and introduce calibration gas directly into the probe's sampling orifice to simulate the sample flow path.

3. Operational status of the probe shall be provided at the system controller to indicate the probe's mode of operation; sampling, calibration, blowback, etc.

5.3 Sample Conditioning System

5.3.1 Conditioning System Components

1. All system components shall be fabricated from materials that are corrosion resistant and chemically inert to the gases in the sample stream.

2. The sample conditioning system shall incorporate all necessary components to prepare the sample gases for introduction into the analyzers. At a minimum, the sample conditioner must ensure that sample delivered to the analyzers is consistent with the sample requirements of each analyzer. Consideration must be provided to appropriately adjusting or controlling the sample gases for the following:

   A. Pressure

B. Temperature
C. Sample Flow Rate
D. Particulate Concentration
E. Moisture Content
F. Removal of interfering components and acidic mist such as HF, SO_3, HCl, etc.

3. The sample conditioning system shall have the capability to condition and control calibration gases identical to the manner in which sample gas is conditioned.

5.3.2 Sample Conditioning System Design

1. Components comprising the sample conditioning system shall be located in such a way to allow access for maintenance.

2. For extractive systems, a device shall be required for moisture removal from sample. Sample dew points must be lowered to a temperature that adequately removes excess moisture, subsequently preventing carryover to the analyzers.

3. The system shall be designed to have the capability to integrate alarms that monitor operation of the system and provide warning whenever sample conditions exceed specified limits such as flow, temperature, pressure or moisture content.

5.3.3 Dilution Air Supply System (if applicable)

1. Dilution air conditioning equipment shall supply treated dry air from either plant service air or from an independent compressor dedicated to the CEMS. This system shall consist of an air supply station, pre-conditioner, final conditioner and required accessories.

2. The dilution air clean up package shall incorporate a coalescing filter to remove oil from the plant air source.

3. A compressed air cylinder bank or accumulator shall automatically provide emergency air for sample dilution upon system failure or upon the loss of plant air.

4. The air dilution system shall be capable of supplying the dilution-extraction sampling system with test air (zero gas) for total system performance, system calibration and certification testing.

5.4 Analyzers

5.4.1 Analyzer Quality

1. Analyzers provided and integrated into the system shall incorporate accepted methods of detection.

2. Analyzers shall be capable of satisfying EPA and/or local regulations as listed in the operating permit for relative accuracy.

3. Ambient analyzers (when applicable) shall attain EPA and/or local regulatory agency approval. Documentation in the form of approved protocol or equivalency certification shall be required.

5.4.2 Analyzer Sensitivity

1. Detectors of the gas analyzers shall respond to a minimum of 2% of full scale step changes for the gas being monitored.

2. Analyzer detectors shall be tolerant to interfering components. A twofold concentration change of any single or combination of interfering constituents in the sample gas stream shall not affect the analyzer reading.

5.4.3 Analyzer Output Signals

1. Analyzers shall have the capability of communicating a signal directly to the CEM controller unit. The output signal shall be linearly proportional to the concentration of the gas constituent sensed for entire scale in use.

2. Analog output signals shall be 4-20 mA and isolated.

3. Digital output signals may be used in lieu of isolated analog output signals.

5.4.4 Discrete Output Signals of System Controller

1. Discrete output signals must be available. As a minimum, discrete outputs must be available for:

   A. Analyzer malfunction
   B. Analyzer is in calibration
   C. Measured concentration exceeds predefined limits

5.4.5 Analyzer Specifications

1. Analyzers shall be capable of satisfying applicable EPA and/or local agency specified performance criteria.

2. In-situ analyzers shall not be acceptable for use unless accepted techniques for calibration are provided.

3. Analyzers shall be equipped with a direct readout display, or an independent output for a local panel display device.

4. Analyzer displays shall provide readings in accepted engineering units.

5. Analyzers shall be ranged appropriately to ensure that average readings of the gas being analyzed fall within the design criteria for analyzer scale determination as defined in 40 CFR 60.

6. Analyzers shall be capable of range changes either manually or automatically whenever gas concentrations exceed 90% of the full scale value.

7. Analyzers shall exhibit a zero drift response of less than 2% of the full scale reading for any 10 °C temperature change over the recommended operating temperature range for the instrument.

8. Analyzers when used in series shall respond in accordance with required sample cycles (i.e. one complete set of sample measurements for constituent gases being monitored must be completed within 15 minutes or less).

9. Analyzers must be capable of providing a 90% response to a 200% concentration step change within 200 seconds or less.

5.5 System Enclosure

5.5.1 All Sample conditioning components exclusive of emergency air supplies (accumulator tanks) and analyzers shall be housed in standard instrument enclosures. The purpose of the enclosures is to provide mounting and storage of system devices. Analyzers and components enclosed shall be protected from the elements and maintained in an ambient environment that is compatible with the recommended ambient conditions at the designated installation site. Acceptable enclosures may include:

1. NEMA 1 – (acceptable for indoor installations where the environment is climatically controlled, e.g., control rooms or environmental equipment shelters)

2. NEMA 12 – (acceptable for indoor installations where dirt and dist is not completely removed, e.g., plant equipment rooms)

3. NEMA 3R – (acceptable in locations where system components must be protected from the elements including rain)

4. NEMA 4 – (acceptable for use when system components must be protected from streams of water such as those used when hosing down equipment)

5. NEMA 4X – (acceptable for use when system components must be protected from streams of water such as those used when hosing down equipment) and also be resistant to corrosion.

5.5.2 The enclosure selected for installation shall provide complete access to all components. Depending on vendor design, this may require front or both front and rear access. If both front and rear access are required, the system cabinets shall be equipped with full front and rear doors.

5.5.3 System enclosures shall be designed to maintain the environmental conditions consistent with the ambient specifications of the analyzers (i.e., cabinets shall have the inherent capability to accept heaters and/or air conditioners to maintain the enclosure temperature within the operating temperature range for the analyzers

5.5.4 System enclosures shall be finished as appropriate to prevent corrosion.

5.5.5 Enclosures shall be fitted with bulkheads to accommodate gas lines and terminal blocks or circuit breakers for cable/wire termination.

5.5.6 The sample system enclosure shall be designed and supplied to facilitate movement for installation. The enclosure shall be provided with lifting eye bolts or skid plate compatible with standard sized forklift or hydraulic hand truck blades.

5.6 Calibration Gases

5.6.1 Gas Quality

5.6.1.1 Certified gases shall be supplied and used for all daily system calibrations, quarterly linearity tests (if applicable) and quarterly gas audits. The following alternatives are available:

1. United States EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (September 1997 or latest revision).

2. United States National Institute of Standards and Technology (NIST) traceable, compared:
    1. directly, or,
    2. indirectly.

3. Gas manufacturer certified standards.

5.6.1.2 For each installation the customer must specify the:

1. gas standard grade

2. analytical specification, and,

3. traceability (directly or indirectly) to NIST to ±1% or ±2%, as required.

5.6.1.3 Calibration gas mixtures shall only be supplied and used in mixtures that remain chemically inactive.

5.6.1.4 Calibration gases shall not be supplied nor used for system calibrations beyond their identified expiration date.

5.6.2 Calibration Gas Supplies

5.6.2.1 Pressure regulation of calibration gases from cylinders shall be performed in a dual stage via a regulator or adjustable regulating valve.

5.6.2.2 A pressure relief valve shall be present in the gas line prior to the pressure reducing component.

5.6.2.3 Composition of regulators shall be compatible with the reactivity and corrosive characteristics of the calibration gas they regulate.

5.6.2.4 Compressed gas cylinder saddles or other retaining devices shall be installed to guarantee safe, secure storage of gas cylinders in accordance with OSHA requirements.

5.6.2.5 Calibration gases shall be plumbed from the cylinder to the bulkhead of the analyzer enclosure.

5.6.2.6 Calibration gases shall be located as close as practicable to the analyzer enclosure to minimize tubing runs.

5.6.2.7 The calibration gas supply system shall have the capability to integrate pressure switches and alarms to alert the operator whenever a gas cylinder has fallen below the acceptable delivery pressure.

5.6.3 Calibration Gas Supply (Quantity Required)

5.6.3.1 Sufficient calibration gases shall be supplied to start up, commission and provide daily system calibration for one calendar month.

5.6.3.2 A sufficient supply of calibration gases shall be supplied to complete all necessary certification testing.

6.0 Documentation

6.1 Operation and Maintenance Manuals

6.1.1 A minimum of one operation and maintenance manual shall be supplied for the "as built" system.

6.1.2 Operation and Maintenance Manuals shall provide instructions for operation, system calibration, preventive maintenance, and troubleshooting each system analyzer in addition to the system as a whole.

6.1.3 The supplier shall have the capability to provide in the Operation and Maintenance Manual a Bill of Materials for the "as built" system.

6.1.4 The Operation and Maintenance Manual shall list the recommended spare and consumable components for the system with recommended quantity and part number.

6.2 System Drawings

6.2.1 One complete set of drawings for the "as built" system shall be supplied. These drawings shall be signed, dated and clearly labeled as an approved drawing. Approval can be denoted via signature, stamp, etc.

6.2.2 System drawings shall be provided on a 3.5-inch floppy diskette formatted using AutoCad™ Version 12 software.

6.3 Test Reports

6.3.1 Test reports shall be supplied for testing performed on the system.

6.3.2 Certification test reports for system analyzers, relative accuracy audits, factory acceptance tests, etc., shall be supplied. Test reports shall clearly state the type and purpose of the test, testing protocol, test data, and summary of the testing results as a minimum.

6.4 Calculations

6.4.1 If measurements require data manipulation using special or unique calculations, documentation of the calculations is required.

6.4.2 Documented calculations shall include all information necessary to clearly advise the end user of how the calculations are used in the treatment of data. All assumptions, system variables, component volumes, etc., shall be provided to permit the revision of the calculations should future system modifications be made.

7.0 Vendor Services

7.1 Factory Acceptance Testing

7.1.1 The CEMS supplier shall provide facilities and support for a factory functional checkout of the system before shipment. The CEMS supplier shall do and document testing and quality assurance measures during manufacturing and assembly. After completion of assembly, wiring, system configuration, the supplier shall perform a factory test of the CEM system to verify system operability before shipment. As required for this testing, the CEMS supplier shall furnish all necessary support equipment, calibration gases, etc.

7.1.2 Before conducting the factory acceptance testing, the CEMS vendor shall provide notice of the testing schedule at least ten (10) days in advance to the customer who reserves the right to witness and/or participate in the testing process.

7.2 Start-up Services

7.2.1 The CEMS supplier shall provide start-up services of a trained field service engineer to perform initial system start-up and commissioning services for the system following installation.

7.2.2 The CEMS vendor shall provide all consumable items, special tools, calibration fixtures and support equipment necessary to start-up and commission the CEMS.

7.2.3 At a minimum, the CEMS supplier shall provide at least one day of on-site hands-on training in the operation and maintenance of the system to end user personnel.

7.3 System Certification Services

7.3.1 The CEMS supplier shall furnish the services of an experienced organization cognizant of certification testing protocol to test the system in accordance with the applicable local, state and federal regulations.

7.3.2 Results of the testing shall be documented and formatted in compliance to applicable regulations for direct submittal to the regulatory agency.

7.3.3 As part of the certification testing services, a QA/QC plan shall be developed and provided to the customer to meet the requirements of the local and/or state regulations.

7.3.4 A pre-certification meeting shall be held to review and define the certification process. This meeting shall include representatives of the cognizant agency, the purchaser, the stack testing company, and the CEMS vendor, and shall be held at the installation site.

8.0 Performance Requirements

8.1 System Certification

8.1.1 The CEMS vendor shall warrant that the system installed will meet or exceed certification testing requirements, i.e., it will successfully pass certification tests.

8.1.2 Failure of the system to attain certification shall require the CEMS vendor to bear the costs associated with modifying the system as necessary to meet certification requirements and to pay for additional testing.

8.2 System Up Time Guarantee

8.2.1 The CEMS vendor shall guarantee system availability of at least 90% uptime excluding the time required for system calibration, normal preventive maintenance as described in the owners manual, and process outages.

8.3 Equipment Warranty

The CEMS vendor shall warrant the system to be free from defects and general failure as a result of workmanship or component failure for a period of at least twelve months from start-up.

9.0 Codes and Standards

The equipment and services supplied by the CEMS vendor shall be in accordance with the following applicable codes and requirements.

9.1 Title 40 Code of Federal Regulations, Part 60 (as required)

9.2 Title 40 Code of Federal Regulations, Part 75 (as required)

9.3 The International Society for Measurement and Control (ISA)

9.4 The American National Standards Institute (ANSI)

9.5 The Scientific Apparatus Makers Association (SAMA)

9.6 The American Society of Mechanical Engineers (ASME)

9.7 The Institute of Electrical and Electronic Engineers (IEEE)

9.8 The National Electrical Manufacturers Association (NEMA)

9.9 The American Society for Testing and Materials (ASTM)

9.10 The Nationals Institute of Standards and Technology (NIST)

9.11 The National Fire Protection Association (NFPA)

APPENDIX 1 –
SAMPLE CEMS SPECIFICATION

Note: Because these example forms encompass a variety of designs and situations, some of the items included may not be relevant in all cases.

SAMPLE UMBILICAL	Vendor 1	Vendor 2	Vendor 3
Will sample umbilical be provided?			
What are the features of the sample umbilical?			
What is the composition of the tubing?			
Will signal wires be supplied in the umbilical?			
How many signal wires will be supplied?			
What are the wire gages of the signal wires?			
Is the sample umbilical heat traced or freeze protected?			
Is the heat tracing self limiting?			
Is the heat tracing of constant power density design?			
How is heating monitored? Will a TC be included? Type?			
What is the jacket material of the umbilical?			
What are the physical characteristics of the umbilical?			
What are the tube diameters?			
How many tubes will be supplied?			
What types of fittings are used?			
What are the fitting sizes?			
What is the material of composition of the fittings?			
What is the bending radius?			
What is the weight of the umbilical?			
What is the expected transport time for installation length?			
Is the sample umbilical pre-terminated?			
Are special installation requirements needed?			
Must the umbilical be installed within conduit? Cable tray?			
Can cable trays be used to support the umbilical?			

SAMPLE PROBE	Vendor 1	Vendor 2	Vendor 3
What type of probe will be supplied?			
Who is the manufacturer of the probe?			
What are the design features of the sample probe?			
What is the construction of the probe pipe?			
What is the flange size of the probe?			
What is the length of the probe?			
What is the diameter of the probe pipe?			
Is the sample probe heated?			
What is the temperature limitation for the probe?			
What is the NEMA rating of the external portions of the probe?			
What types of filters are used?			
How many filters are used?			
What are the materials of construction for the filters?			
Where are the filters located?			
Can the filters be changed without probe removal?			
Are the filters heated?			
What is the porosity of the filters?			
Where is calibration gas injected into the probe?			
Does the probe have blow back capabilities?			
Is the probe designed to accommodate excessive moisture?			
Does the probe design include moving parts such as valves, pumps?			
What types of valves are used?			
What is material of construction of the valves?			

SYSTEM ENCLOSURE	Vendor 1	Vendor 2	Vendor 3
What type of enclosure is provided?			
What is the NEMA rating of the enclosure?			
Does the enclosure provide access to components?			
Is front access available?			
Is rear access available? Always? Necessary?			
Is side access available?			
Does the enclosure include heating/cooling components?			
Is an air conditioner provided?			
Is a cabinet air cooler (fan) provided?			
Does the cabinet include a heater?			
What are the physical characteristics of the enclosure?			
List the dimensions for height, width and depth.			
List the weight of the enclosure.			
Are lifting lugs provided?			
Is a mounting base provided?			
Are latching mechanisms and locks provided for the doors?			
What are the materials of construction?			
Does the enclosure have windows for remote data viewing?			
How is the enclosure finished?			
Do all analyzers and conditioning equipment reside in a cabinet?			
Does the enclosure allow for future system expansion?			

ANALYZERS	Vendor 1	Vendor 2	Vendor 3
Manufacturer			
Model No.			
Method of Analysis			
Range(s)			
Zero Drift			
Span Drift			
Linearity			
Repeatability			
Response Time (T90)			
Sample Flow Rate			
Process Conditions			
Minimum Temperature (°C/°F)			
Maximum Temperature (°C/°F)			
Minimum Pressure (inches W.C.)			
Maximum Pressure (inches W.C.)			
Maximum Humidity (%R.H.)			
Minimum Flow			
Maximum Flow			
Maximum Dust Loading			
Maximum Total Interfering Component Concentration (ppm/%)			
Ambient Conditions			
Minimum Temperature (°C/°F)			
Maximum Temperature (°C/°F)			
Minimum Pressure (inches W.C.)			
Maximum Pressure (inches W.C.)			
Maximum Humidity (%R.H.)			
Instrument Alarms			
Type			
Number			
Rating			
Instrument Outputs			
Analog			
Signal Type			
Number			
Digital			
Type			
Number			
Are outputs isolated?			
Instrument Inputs			
Type			
Number			
Power Requirements			
- Continued on page XX			

ANALYZERS – *CONTINUED FROM PAGE XX*	Vendor 1	Vendor 2	Vendor 3
Voltage/Frequency			
Power Consumption (VA)			
Physical Characteristics			
Dimensions (HxWxD – mm/inches)			
Weight (kg/lbs.)			
Enclosure type			

INSTALLATION AND COMMISSIONING SERVICES	Vendor 1	Vendor 2	Vendor 3
Are installation services provided?			
Do installation services include unloading of equipment?			
Do services include installation of support equipment?			
Will cable trays, conduit, etc. be included in installation?			
Will calibration gas lines be installed?			
Will foundations be provided for shelters?			
Will flanges be provided and welded into place?			
Is mechanical and electrical installation provided?			
Are inter-connecting cables and piping supplied?			
Are installation services defined in terms of schedule or time?			
Are system start-up services offered?			
Do services offered ensure complete system start-up?			
Will a complete system functionality test be performed?			
Will analyzers be calibrated and scaled for the application?			
Will system alarm set points be assigned?			
Are start-up services defined in terms of time or schedule?			
Will supplier's personnel witness certification testing?			
Does system start-up include consumable parts?			
Are special installation tools or calibration fixtures included?			
Are start-up services provided by supplier personnel?			

SYSTEM DOCUMENTATION	Vendor 1	Vendor 2	Vendor 3
Which system documentation will be supplied?			
System Operations and Maintenance Manual			
Training Manual			
Instrument Manuals			
QA/QC Program			
Test Reports			
Certification Testing Reports			
Factory Acceptance Test Reports			
Calibration gas certification reports			
Drawings – mechanical and electrical			
As-built System drawings			
Instrument drawings			
How many copies of documentation will be provided?			
Will documentation be provided on electronic media?			
Will project status reports be issued?			

CALIBRATION GASES	Vendor 1	Vendor 2	Vendor 3
Will gases be supplied?			
Will gases be EPA Protocol grade?			
Gas grade (refer to 5.6.1)			
Will gases be supplied for operation beyond startup?			
How long can supplied gases be expected to last?			
Will gas cylinders be supplied for ownership?			
Will cylinder demurrage fees be required?			
Will cylinder regulators be supplied?			
Will cylinder regulators be single or dual stage?			
Will Cylinder regulators be brass or stainless steel?			
Will calibration gas lines have flow/pressure alarms?			
Will a cylinder rack or securing devices be provided?			
Will interconnecting lines from gases to CEMS be supplied?			
What cylinder sizes will be supplied?			
Will gases be supplied for certification testing?			
List the gases to be supplied and expected concentrations.			
Indicate if mixtures will be provided and the contents of the mixtures.			

TRAINING SERVICES	Vendor 1	Vendor 2	Vendor 3
Will training be provided?			
Will formal classroom training be provided?			
Can training be altered for student backgrounds?			
Will a special training syllabus be provided?			
Will training be conducted by an engineer or service technician?			
What is length of training?			
What is the recommended class size?			
Will hands-on training be provided?			
Will students be capable of system operation after receiving training?			
Is in-depth factory training available?			
Does training include:			
System operation?			
System maintenance?			
System troubleshooting?			
Instrument repair?			
System repair?			
QA/QC protocol?			
Review of local, state and federal regulations?			
Recordkeeping requirements?			

CERTIFICATION TESTING	Vendor 1	Vendor 2	Vendor 3
Is certification testing supplied?			
What tests will be performed?			
Relative Accuracy Testing Audit (RATA)			
Calibration Gas Audits (CGA quarterly requirement)			
168 hr. drift test (performed by buyer; data evaluated by supplier)			
Will all data be collected by the testing team?			
Will supplier prepare pre-test protocol?			
Will supplier prepare test reports?			
Will supplier respond to agency requests or issues?			
Pre-testing issues and questions			
Post-testing issues and questions			
Will Protocol gases be supplied for testing?			

GUARANTEES & WARRANTIES	Vendor 1	Vendor 2	Vendor 3
What guarantees will be provided for the system?			
What is the system up time or availability?			
How is the system availability or up time calculated?			
Is system certification guaranteed?			
What testing protocol is used for certification testing?			
What are consequences of certification failure?			
Are RATA results guaranteed to a specific value?			
What is the length of warranty for system components?			
Who is responsible for replacement parts?			
Who is responsible for service to install replacement parts?			
Does the warranty include service labor?			
Does the warranty include travel expenses?			
Do provisions exist for extended warranties?			
Do provisions exist for maintenance contracts?			
Do provisions exist for controlling replacement part costs?			
Does the CEM supplier accept responsibility for total system reliability?			

APPENDIX 3 –
CEM PROPOSAL CHECKLIST

1. BACKGROUND

1.1 Company Name: ____________________

1.2 Industry: ____________________

1.3 Description of application (type, size, etc.): ____________________

____

1.4 Number of locations to be monitored: ____________________

1.5 Proposed DAS location: Proximity to CEM? ____________________

1.6 Analyzers required: ____________________

1.7 Ambient conditions: temperature range (°F) ________ to ________ ; humidity ________ ;

dust ________ ; weather ____________________

1.8 Regulatory agency: ____________________

2. COMPONENTS IN STREAM

		Typical Range				
2.1	O_2	________	%	________	to	________
2.2	SO_2	________	ppm	________	to	________
2.3	NO_X	________	ppm	________	to	________
2.4	CO	________	ppm	________	to	________
2.5	CO_2	________	5	________	to	________
2.6	Opacity	________	ppm	________	to	________
2.7	H_2S	________	ppm	________	to	________
2.8	NH_3	________	ppm	________	to	________
2.9	H_2S	________	ppm	________	to	________
2.10	H_2SO_4	________	ppm	________	to	________
2.11	Other ________	________		________	to	________
2.12	Other ________	________		________	to	________

3. CONDITION OF STREAM

3.1 Normal Temperature (°F) Min ___________ Max ___________

3.2 Particulate concentrations Typical________ GR/SDCF Max_________ GR/SDCF

3.3 Stack Static pressure __________ INWC

3.4 Fuel used: ☐ Oil ☐ Gas ☐ Coal ☐ Other: ______________

3.5 Water Vapor Concentration: Water Drops: ☐ Yes ☐ No

3.6 Probe mounting location: Stack _________ Duct ________ Shape or configuration: ___________

3.7 I.D. ______ Flange-to-flange distance _______ Wall thickness __________ Material __________

3.8 Size ________ ; Type ___________ ; Annulus _________

4. SPECIAL FEATURES OF PROCESS AND MONITORING

4.1 Describe any special features of conditions of the process being monitored? ____________________________________

____

____

4.2 Type of data reporting required:

Chart recorder:	☐ Yes	☐ No
Data acquisition system:	☐ Yes	☐ No, Part 60 or 75
Signals to plant DCS	☐ Yes	☐ No

Standard 4-20mA, data highway, other ____

4.3 Correlation (lb/MMBTU) required	☐ Yes	☐ No
4.4 Correlation (lb/hr) required:	☐ Yes	☐ No
4.5 Power availability:		
50 or 60 Hz	☐ Yes	☐ No
208 VAC/3phase	☐ Yes	☐ No
240/120 single phase	☐ Yes	☐ No
4.6 Clean & dry instrument air available @ 80 psig:	☐ Yes	☐ No
4.7 General purpose area electrical classification	☐ Yes	☐ No

4.7.1 Area Classification ____

4.7.2 Proposed analyzer cabinet location: NEMA 12 with or without HVAC, NEMA 4 with HVAC, Shelter?

____

5. SERVICES NEEDED

5.1	Installation supervision:	☐ Yes	☐ No
5.2	Start-up:	☐ Yes	☐ No
5.3	Training:	☐ Yes	☐ No
5.4	Certification:	☐ Yes	☐ No
5.5	QA/QC plan:	☐ Yes	☐ No
5.6	Maintenance	☐ Yes	☐ No

6. PROJECT INFORMATION

6.1 When does a system need to be installed? ______________________________

6.2 What other people will be involved with this project?

____

Members

ABB Environmental Systems
Anarad, Inc.
Anguil Environmental Systems, Inc.
Babcock & Wilcox
Beaumont Environmental Systems
Belco Technologies Corporation
BOVAR Western Research
Croll-Reynolds Clean Air Technologies
CSM Environmental Systems, Inc.
Engelhard Corporation
Environmental Elements Corporation
FLS miljø, Inc.
Fuel Tech
Graseby STI
Horiba Instruments, Inc.
Huntington Environmental Systems/Air Pol
Land Combustion
McGill Airclean Corporation
Mitsubishi Heavy Industries America, Inc.
Munters Corporation
Noell, Inc.
Procedair Industries
Research-Cottrell, Inc.
DB Riley, Inc.
Rosemount Analytical Inc.
Sargent & Lundy
Smith Environmental Corporation
Wahlco, Inc.
Wheelabrator Air Pollution Control

Associate Members

3M Company
Acme Structural, Inc.
Albany International Corporation
Baldwin Environmental, Inc
BASF Corporation
Bellefonte Line Company, Inc.
BHA Group, Inc.
BOC Gases
Carmeuse North America
Carus Chemical Company
Chemical Lime Company
Church & Dwight Co., Inc.
Coors Ceramics Company
Cormetech, Inc.
Corning Incorporated
CRI Catalyst Company
Dravo Lime Company
Entropy, Inc.
W. L. Gore & Associates, Inc.
M & C Products Analysis Technology
The McIlvaine Company
Medwesco Filter Resources, Inc.
NWL Transformers
Praxair, Inc.
Prototech Company
PSP Industries
Siemens AG
Spectra Gases, Inc.
Structural Steel Services, Inc.
Testo, Inc.
Universal Analyzers, Inc.
Williams Union Boiler Company

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