

**GUIDELINES  
FOR  
PREPARING BID  
SPECIFICATIONS  
AND  
BID  
EVALUATIONS  
FOR  
PARTICULATE  
MATTER  
CONTINUOUS  
EMISSIONS  
MONITORING  
SYSTEMS  
(PM CEMS)**



INSTITUTE OF  
CLEAN  
AIR  
COMPANIES

# 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 industry, the Institute seeks to evaluate and respond to regulatory initiatives and establish technical standards to the benefit of all.*

## **Guidelines for Preparing Bid Specifications and Bid Evaluations for Particulate Matter Continuous Emissions Monitoring Systems (PM CEMS)**

### **SUMMARY:**

This document provides guidelines for specifying and collecting information necessary to solicit bids from suppliers of Particulate Matter Continuous Emissions Monitoring Systems (PM CEMS) as defined in 40 CFR 60, Appendix B, Performance Specification 11 and Appendix F, Procedure 2. It includes an example bid specification, a bid evaluation form, and a proposal checklist, with supporting discussion. Issues dealing with PM CEMS applications such as location, 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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*Note: This guideline is limited to the apparatus that senses and quantifies the particulate matter. It does not attempt to specify the technological approach, accuracy, tolerance, compatibility ranges, etc. of any ancillary temperature or pressure information that might be used for normalization of raw PM data.*

## 1. HISTORY

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

The members of the ICAC Emissions Measuring Division are companies that supply emissions and opacity monitoring and stack testing products and services. Members of the division who made special contributions and provided oversight to the development of ICAC-PM CEMS were SICK MAIHAK, Ametek Process Instruments, Thermo Fisher Scientific, Teledyne Monitor Labs and Cemtek Instruments.

## 2. OBJECTIVE AND SCOPE

The objective of ICAC-PM CEMS is to help end users of Particulate Matter Continuous Emissions Monitoring Systems to prepare a specification for the solicitation of bids from particulate monitor 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.

This document 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

Note: following is a partial list of applicable definitions applicable to these guidelines. For a complete list, consult the referenced documents.

- 3.1 Audit Standard** - means a reference material or procedure that produces a known and unchanging response in the PM CEMS. Three Audit Standards are required to perform periodic checks (Absolute Correlation Audits) of the response of the PM CEMS at three levels.
- 3.2 Bid Specification** - A document containing equipment specifications, performance criteria, and scope of work sought which is distributed to suppliers to describe the requirements of the PM CEMS intended for purchase for use in compliance with 40 CFR 60, Appendix B, Performance Specification 11 (PS-11) and Appendix F, Procedure 2 (P-2), along with any additional requirements per local or state regulations.
- 3.3 Calibration Standard** - Any devices not intrinsic to the PM CEMS which is used to

- 4 establish or verify its correct operation. Neutral density filters are used to calibrate PM CEMS, and include a three-filter set, consisting of a low, mid and high range value as defined in ASTM D6216. For each application, an individual must determine the applicable regulatory requirements for standard values and analytical certification tolerances.
- 3.4 Certification Testing** - Performance testing of the PM CEMS according to specific testing protocol approved by the applicable regulatory agency for the purposes of demonstrating compliance to regulatory monitoring requirements. This will usually be the protocol specified in PS-11 and P-2.
- 3.5 Construction Services** - Electrical and mechanical labor required to physically mount, secure and install the system and its ancillary components at the site.
- 3.6 Continuous Emissions Monitoring System (CEMS)** - A CEMS includes all of the equipment required for determination of PM mass concentration in units of the emissions standard. The sample interface, pollutant monitor, diluent monitor, other auxiliary data monitor (s), and data recorder are the major subsystems.
- 3.7 Correlation** - PM CEMS are correlation-based instruments. This means that a PM CEMS does not ship from the vendor pre-calibrated for a particular application. At best, a PM CEMS will ship with an approximate calibration but will achieve its final calibration in the field via comparison with results from a manual reference method. This also means that Reference Standards and Audit Standards (defined below) also are defined by their reading on a specific PM CEMS for which a field correlation has been established per PS-11.
- 3.8 Enclosure** - A cabinet, shelter or rack used to contain sampling components, system controls, and analyzers.
- 3.9 Interference** - Any non-particulate constituent in the flue gas which adds to or subtracts from the PM CEMS response in a manner that invalidates the correlation or stability thereof. Typically, entrained water droplets, or high quantities of acid mist are the most likely to produce interferences in a PM CEMS.
- 3.10 Moisture** - Combination of particulate and condensate (as defined as a liquid of any nature).
- 3.11 Particulate Matter** - For purposes of evaluating PM CEMS, the EPA defines Particulate Matter as that material which will be collected and weighed by an applicable reference method (usually EPA Test Methods 5, 5I, and 17, but other methods may be required based on the applicable regulations).

- 3.12 Particulate Matter Continuous Emissions Monitoring System (PM CEMS)** - as defined by PS-11, which is capable of being maintained via Procedure 2 of Appendix F. A variety of technologies may be employed in the design of a PM CEMS, including but not limited to optical extinction (the core technology used in opacity monitors), light scattering, and beta-ray attenuation through a sample collected on a filter. Some designs are in-situ, where the measurement is made within the stack or duct, while others may extract a sample from the stack for measurement.
- 3.15 Reference Standard** - means a reference material or procedure that produces a known and unchanging response in the PM CEMS. Reference Standards are used to evaluate daily zero and upscale drift but are not used to establish the PM CEMS correlation.
- 3.14 Sample Volume Audit** - For PM CEMS which require extracting a sample of the effluent prior to measurement of the particulate matter, a procedure to verify that the sample rate has remained sufficiently constant over time since establishment of correlation.
- 3.15 Start-up Services** - Services performed to calibrate and verify system operation and functionality following installation at the site.
- 3.16 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.

## 4. BUYER'S RESPONSIBILITY

Purchasing a PM CEMS requires planning and foresight. The buyer must define specifications for the PM CEMS, and these specifications influence the overall cost and performance of the system. A PM CEMS 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 mounting and securing of the particulate monitor, air purge system enclosures and provide proper accessibility for maintenance and operation. 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 PM CEMS can be installed at a specific location, or to determine the feasibility of making penetrations in the stack structure 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 PM CEMS specification is to help the buyer not only secure competitive bids from suppliers, 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 PM 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 particulate matter continuous emissions monitoring system (PM CEMS) to monitor particulate emissions from a combustion boiler (*Anywhere, USA*).

#### 4.2 Scope of Supply

The scope-of-supply section should clearly identify the equipment and services that the supplier is to provide. Equipment lists should identify the number and type of systems, and ancillary equipment such as air purge (blower) systems.

Expected services should identify any requirements for construction, installation, correlation testing, training, and maintenance.

#### 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 PM CEMS will function. This section should identify the ambient and process conditions in which the PM CEMS equipment will operate.

This plant description should also contain flue gas characteristics (e.g., moisture content and entrained droplets), particulate matter controls, and must include a description of any existing or proposed sample port location and general access to the system components requested.

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

The specification should list all regulatory issues including 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

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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 electrical power, 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. Instrument specifications, performance criteria, operational requirements, and materials of construction are necessary to define the PM CEMS 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 PM CEMS suppliers to use their experience and proven system designs.

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 PM CEMS often cannot be built at a reasonable cost.

In most cases, the measurement techniques should not be mandated, as many different analytical techniques can be used to measure particulate matter and more than one could be applicable to any specific application.

#### 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., CD ROM), using popular software to allow the buyer to later modify these documents with minimal labor. Typically, a PM CEMS supplier will provide all documentation within the standard Operations and Maintenance Manual.

#### 4.8 Supplier Services

Supplier services include items such as factory acceptance testing, training, commissioning services, correlation test planning and correlation 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, correlation testing protocols, and if desired, project management functions, such as progress reports and project schedules.

## 6 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, correlation testing results, and maintenance requirements should be defined and assigned measurable performance criteria.

A specification developed according to the principles outlined above is provided in Appendix 1 of this document. 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.

- after-sales support and service;
- general comfort factors (e.g., rapport with the supplier's engineering personnel).
- technology;
- warranty.

Experience and company size are considerations when selecting a PM 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.

When contacting references, questions relating to the *customer experience* when dealing with the prospective supplier may reveal important underlying information.

The number of references a supplier will have for PM CEMS on units very similar to that of the prospective buyer will vary greatly by industry. In some industries, few plants have PM CEMS, because the industry encompasses few plants, because of limited regulatory requirements to install PM 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.

The PM CEMS supplier should follow a consistent, documented, quality program, such as ISO certification or equivalent.

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 PM CEMS often ask the location of the closest service technician to their location. This may be the wrong question, as the availability of service technicians, and not their location, is the real concern.

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

## 5. QUALIFYING PM CEMS 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 PM CEMS manufacturers and system integrators. In selecting suppliers, the buyer should note the important distinction between manufacturers and system integrators:

*PM CEMS manufacturers* are specialized companies dedicated to manufacturing equipment and analyzers specifically designed for particle matter 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 other components, and then configure them into a functional system.

Which type of supplier is best? The answer to this question depends on the application, Buyer's preferences, PM CEMS background, engineering expertise, and labor allocated for the PM CEMS project. The intent herein is not to specify one type of PM 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 best qualified to meet the specific requirements.

Criteria for pre-qualification of PM CEMS suppliers include:

- experience, size, and resources of the supplier;
- end-user references;
- quality assurance aspects;
- technical competence, staffing, and inventory of spare parts;

## 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 PM CEMS supplier. Each PM 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. Bids for replacing an existing system will typically be less complicated and require a less complicated review process. 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 of this document 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.

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

- analytical methods: extractive or in-situ system;
- control room unit required;
- purge blower or instrument air requirements;
- system tolerance to ambient conditions and vibration;
- signal output capabilities for data acquisition (e.g. Modbus);
- serviceability and ease of calibration audits;
- National Electrical Manufacturers Association (NEMA) or Ingress Protection Ratings (IP) rating;
- standard factory system test specifications and test procedures;
- system expansion capabilities;
- normal expected system maintenance requirements;
- materials of construction

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

- system warranties and guarantees;
- testing services;
- training

## 6.1 Analytical Method

The analytical system of any PM CEMS consists of the analyzer used to measure the concentration of dust in the flue gas. Analyzer designs vary between manufacturers, and their principles of operation may sometimes differ.

**6.1.1 PM CEMS** - Most analyzers have selectable ranges, or at least ranges that are adjustable to accommodate the levels of particulate matter to be measured as defined in the site-operating permit. The majority of site requirements are set with ranges of 0-5/ up to 0200 mg/m<sup>3</sup>. However, accuracy is generally based upon range and should be considered carefully. The site permit and PM mitigation systems should determine range.

**6.1.2 Instrument Drift** - The drift of an analyzer refers to the deviation of the measured value from the true value over time. Zero and span drifts are determined by comparison of the reading from the applicable zero and span reference standards (refer back to definition section 3.0) with the values for these reference standards during the most recent correlation process. Drift tolerances are defined in P-2, paragraphs 10.1(1) and 10.1(2) and PS-11.

**6.1.3 Instrument Response Time** - Response time is defined in PS-11 and ASTM D6216 for their respective applications.

**6.1.4 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 analyzer, as well as the time for the data to be recorded. System response time is defined in P-2, paragraph 15.3.

## APPENDIX 1 SAMPLE PM CEMS SPECIFICATION

### 1. PURPOSE

XYZ Corporation issues this specification to solicit proposals for a particulate matter continuous emissions monitoring system (PM CEMS). The PM 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 and or, incinerator, etc.

### 2. SCOPE OF SUPPLY

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

#### 2.1 Base Equipment

- 2.1.1 Stack mounting flange(s) as required.
- 2.1.2 One (1) PS-11 compliance PM CEMS designed with capability to be maintained in concordance with Appendix F, Procedure 2.
- 2.1.4 Purge blower system adequate for site environment (if required).
- 2.1.5 One (1) set of three (3) audit standards, complete with any applicable fixtures.

#### 2.2 Services to be supplied

- 2.2.1 Start-up and commissioning services as required to render the PM 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 PM CEMS.

#### 2.3 Documentation

- 2.3.1 Provide system documentation in the form of a PM CEMS Operation and Maintenance Manual, system drawings, bill of materials, recommended spare and consumable spare parts.
- 2.3.2 Prepare and submit certification testing reports to the customer in a format that can be submitted to the applicable regulatory agencies.
- 2.3.3 QA/QC Program for maintenance and system operation in accordance with applicable regulatory guidelines.

### 3. PLANT DESCRIPTION

The plant description should provide information describing the particular application so the supplier can adequately design the PM CEMS system. An example of a general description would be, the XYZ Corporation Plant is located in Any City, Any State, approximately twenty miles southeast of Someplace. At this plant the PM 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. The intended location for the PM CEMS 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. The plant currently does/(does not) use a wet scrubber.

#### 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/maximum  
Temperature: \_\_\_ °F – \_\_\_ °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 between \_\_\_ °F and \_\_\_ °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 \_\_\_\_\_ °F
  - Stack Pressure \_\_\_\_\_ psi
  - Flue gas velocity \_\_\_\_\_ ft/s
- 3.3.2 Stack Gas Stream Expected Constituent Concentrations
  - Moisture \_\_\_\_\_ %
  - Dust loading \_\_\_\_\_ mg/m<sup>3</sup>
- 3.3.3 Boiler Specifications  
Unit Rating \_\_\_\_\_ lbs./hr.  
Primary Fuel \_\_\_\_\_  
Alternate Fuel \_\_\_\_\_  
Fuel Flow Rate \_\_\_\_\_ gpm  
Exhaust Gas Flow Rate \_\_\_\_\_ scfm

## 4. 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.
  - 4.2.1 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 Instrument 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 PM CEMS equipment.
  - 4.3.2 Mounting and installing PM CEMS hardware.
  - 4.3.3 Installing conduit and signal cables.
  - 4.3.4 Installing hardware in the form of scaffolding, ladders, platforms and all necessary structural components necessary to install and service the PM CEMS equipment.
  - 4.3.5 Tie-ins to electrical supplies and calibration equipment shall be performed under the guidance of the PM CEMS supplier.
  - 4.3.6 Mounting and securing system components in accordance with approved PM CEMS installation drawings.
  - 4.3.7 Installing other associate support equipment as necessary for permanent support and operation of the PM CEMS.

## 5. SYSTEM DESIGN PARAMETERS

- 5.1 Particulate Matter Monitors
  - 5.1.2 Analyzer Quality
 

The analyzer shall be manufactured under a quality management system meeting ISO certification requirements.
  - 5.1.3 Analyzer Sensitivity
 

Monitors provided and integrated into the system shall incorporate only approved methods consistent with Performance Specification 11 and Appendix F, Procedure 2.

The PM CEMS shall be capable of satisfying all additional EOA and/or local regulations as listed in the operating permit for relative accuracy.

### 5.2 Analyzer Output Signals

- 5.2.1 Analyzers shall output an isolated 4-20mA signal directly to the plant control system or existing Data Acquisition System. The output signal shall be linearly proportional to the correlated value of PM for entire scale in use.
- 5.2.2 Digital communications by RS485 Modbus, or Foundation Fieldbus or other industry standard shall be available.

### 5.3 Relay Output

- 5.3.1 Discrete output signals must be available. At a minimum, discrete outputs must be available for:
  - Analyzer malfunction
  - Analyzer is in calibration
  - Measured concentration exceeds predefined limits.

### 5.4 Analyzer Specifications

- 5.4.1. Analyzers shall be capable of satisfying all performance criteria of PS-11
- 5.4.2. Analyzers shall be equipped with a direct readout display, or an independent output for a local panel display device.
- 5.4.3. Analyzer displays shall provide readings in accepted engineering units.

## 6. 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 a Bill of Materials for the system as built.
- 6.1.4 The Operation and Maintenance Manual shall list the recommended spare and consumable Controller components for the system with recommended quality and part number.

**10 6.2 System Drawings**

**6.2.1** One complete set of drawings for the 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 as appropriate as an electronic file or as a hard copy document.

**6.3 Test Reports**

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

**6.3.2** Manufacturer's factory testing documentation must be included with the analyzer shipment. 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.

**6.3.3** When applicable, test reports for correlation testing, shall be supplied.

**7. SUPPLIER SERVICES****7.1 Start-up Services**

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

**7.1.2** The PM CEMS supplier shall provide all consumable items, special tools, calibration fixtures and support equipment necessary to start up and commission the PM CEMS.

**7.1.3** At a minimum, the PM CEMS supplier shall provide training in the operation and maintenance of the system to end user personnel.

**8. PERFORMANCE REQUIREMENTS****8.1 System Certification**

**8.1.1** The PM CEMS supplier shall provide a warranty for systems installed to meet or exceed requirements of PS-11, including successful correlation with PM.

**8.2 System Up Time Guarantee**

The PM CEMS supplier should guarantee system availability excluding the time required for system calibration, normal preventive maintenance as described in the owners manual, and process outages.

**8.3 Equipment Warranty**

The PM CEMS supplier shall warrant the system to be free from defects and general failure as a result of workmanship or component failure for a predetermined period from start-up.

**9. CODES AND STANDARDS**

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

**9.1 Title 40 Code of Federal Regulations, Part 60 Appendix B PS-11 (as required)**

**9.2 Title 40 Code of Federal Regulations, Part 63 (as required)**

## APPENDIX 2 PM CEMS BID EVALUATION FORMS

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

FACILITY DESCRIPTION	SUPPLIER 1	SUPPLIER 2	SUPPLIER 3
What type of enclosure is provided?			
What is the NEMA rating of the enclosure?			
<b>ANALYZER</b>			
Analyzer			
Manufacturer			
Model No.			
Analytical Method			
Range(s)			
Zero Drift			
Span Drift			
Linearity			
Repeatability			
Response Time (T90)			
Process Conditions			
Minimum Temperature (°C/°F)			
Maximum Temperature (°C/°F)			
Minimum Pressure (inches W.C.) (Vacuum)			
Maximum Pressure (inches W.C.)			
Maximum Humidity (% R.H.)			
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			
Signal Type			
RS-232/422/485			

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<b>ANALYZERS</b> <i>Continued from page 11</i>	<b>SUPPLIER 1</b>	<b>SUPPLIER 2</b>	<b>SUPPLIER 3</b>
Analog			
Signal Type			
Number			
Digital			
Type			
Number			
Are outputs isolated?			
Instrument Inputs			
Type			
Number			
Power Requirements			
Voltage/ Frequency			
Power Consumption (VA)			
Physical Characteristics			
Dimensions (HxWxD)			
Weights (kg/lbs)			
<b>INSTALLATION AND COMMISSIONING SERVICES</b>	<b>SUPPLIER 1</b>	<b>SUPPLIER 2</b>	<b>SUPPLIER 3</b>
Installation			
Are installation services provided?			
Mechanical			
Electrical			
Are inter-connecting cables and piping supplied?			
Are installation terms 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 test be performed?			
Will a system alarm set points be assigned?			
Commissioning Services			
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?			

<b>SYSTEM DOCUMENTATION</b>	<b>SUPPLIER 1</b>	<b>SUPPLIER 2</b>	<b>SUPPLIER 3</b>
Which system documentation will be supplied?			
Systems Operations and Maintenance Manual			
Training Manual			
Instrument Manual			
QA/QC Program			
Test Reports			
Certification Testing Reports (MCOC)			
As-built System drawings			
Instrument drawings			
How many copies of documentation will be provided?			
Will documentation be provided on electronic media?			
<b>AUDIT STANDARDS</b>			
Will filters be supplied?			
Will filters be EPA certified?			
Filter Values			
Low Value			
Mid Value			
High Value			
<b>DELIVERY</b>			
Does delivery date meet needs?			

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