

## Continuous Emissions Monitoring System – CEMS Application Data Sheet

**A. GENERAL INFORMATION**

Name: \_\_\_\_\_  
 Phone Number: \_\_\_\_\_ Email: \_\_\_\_\_  
 Title: \_\_\_\_\_  
 Company: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 \_\_\_\_\_

**B. SOURCE INFORMATION**

Application Description: \_\_\_\_\_  
 Source Type: \_\_\_\_\_  
 Size or Capacity: \_\_\_\_\_  
 Air Pollution Control Devices: \_\_\_\_\_  
 Shelter or Analyzer Enclosure Location: \_\_\_\_\_  
 DAHS Computer Location: \_\_\_\_\_  
 CEMS Sample Probe Location: \_\_\_\_\_

**C. FLUE GAS STREAM CONSTITUENTS AT SAMPLE PROBE LOCATION**

Constituent	Expected	Max/Min Range
SO <sub>2</sub>	_____ ppm	_____ to _____ ppm
NO <sub>x</sub>	_____ ppm	_____ to _____ ppm
CO	_____ ppm	_____ to _____ ppm
H <sub>2</sub> S	_____ ppm	_____ to _____ ppm
NH <sub>3</sub>	_____ ppm	_____ to _____ ppm
HCl	_____ ppm	_____ to _____ ppm
Hydrocarbons	_____ ppm	_____ to _____ ppm
O <sub>2</sub>	_____ %	_____ to _____ %
CO <sub>2</sub>	_____ %	_____ to _____ %
Opacity	_____ %	_____ to _____ %

**D. FLUE GAS CONDITIONS AT SAMPLE PROBE LOCATION**

<u>Condition</u>	<u>Expected</u>	<u>Max/Min Range</u>
Flue Gas Temperature	_____ Deg. F	_____ to _____ Deg. F
Flue Gas Static Pressure	_____ in.w.c	_____ in.w.c
Flue Gas Velocity	_____ fps	_____ fps
Water Vapor	_____ %	_____ %
Dust/Particulate Loading	_____ gr/dscf	_____ gr/dscf
Water Drops	_____ Yes _____ No	
Fuels Burned	_____ Oil _____ Nat. Gas _____ Coal _____ Other	

**E. AMBIENT ENVIRONMENT AT CEMS ENCLOSURE LOCATION**

Elevation above sea level: \_\_\_\_\_ Feet

Temperature: \_\_\_\_\_ Min. Deg. F \_\_\_\_\_ Max. Deg. F

Unusual Atmosphere: \_\_\_\_\_

Relative Humidity: \_\_\_\_\_ Min. % \_\_\_\_\_ Max. %

Facility Electrical Power Available: \_\_\_\_\_ VAC \_\_\_\_\_ Phase

UPS Electrical Power Available: \_\_\_\_\_ VAC \_\_\_\_\_ Phase

Instrument Air Available: \_\_\_\_\_ psig

**F. PHYSICAL ARRANGEMENT AT PROBE LOCATION**

Hazardous Area Electrical Classification \_\_\_\_\_

Measurement Location: \_\_\_\_\_ Stack \_\_\_\_\_ Duct Shape: \_\_\_\_\_ Circ. \_\_\_\_\_ Rect.

Distance From CEMS to Probe: \_\_\_\_\_ Feet Platform Elevation: \_\_\_\_\_ Feet

Flow Disturbance Location: \_\_\_\_\_ Feet Up Stream \_\_\_\_\_ Feet Down Stream

Inside Diameter: \_\_\_\_\_ Feet Outside Diameter: \_\_\_\_\_ Feet

Wall Thickness: \_\_\_\_\_ Inches

Exit Inside Diameter: \_\_\_\_\_ Inches

Flange Size: \_\_\_\_\_ Inches Bolt Pattern: 12:00 \_\_\_\_\_ Degrees Straddle Center Line: \_\_\_\_\_

Flange Type: \_\_\_\_\_ Raised Face (RF) \_\_\_\_\_ Flat Faced (FF)

Stack Outside Wall to Flange Face (Spool) Length: \_\_\_\_\_ Inches

Stack/ Duct Material of Construction: \_\_\_\_\_

**G. AIR PERMIT**

Please attach a copy of current air permit or permit to construct issued by regulatory agency.

**H. STACK DRAWINGS**

Please attach a copy of dimensioned stack or duct location drawings

**I. PROCESS DESCRIPTION**

Please include a description of the process including air pollution controls upstream and down stream of the measurement location.

## **IMPORTANT INFORMATION – TAKE NOTICE!**

This document is a checklist of items to be completed before Cemtek Environmental will arrive on-site to do any CEMS installation supervision and/or startup as provided in your contract. Also included is a list of Cemtek Environmental's responsibilities on-site during installation. The client responsibilities must be completed before Cemtek Environmental arrives on site. After all of the applicable pre-installation items are finished by the client and Cemtek Environmental, the entire system will be tested by Cemtek Environmental and any problems encountered will be corrected.

These activities should be cross-checked with the drawing package provided by Cemtek Environmental. Specific dimensional and signal requirements are contained in the drawing package.

A space is provided next to each Item number to enter the Item completion date and signature or initials.

**This document must be completed and faxed to Cemtek Environmental before the service department will schedule an installation or startup visit!** Please fax to the attention of the Service Department at:

714-437-7177

Any additional on-site labor, waiting time, and/or additional mobilizations will be billed at Cemtek Environmental's current published labor rates.

### **Note on heat trace sample line:**

Any heat trace sample line included in your contract is ordered and shipped directly to the site location after the final lengths are communicated to the Cemtek Environmental Project Engineer. The delivery time for heat trace sample line is 4-6 weeks. Please be sure to communicate the desired lengths in a timely manner.

### **Note on calibration gases:**

Any calibration gases included in your contract are ordered and shipped directly to the site location. Since protocol calibration gases have a expiration period of from 6 months to 1 year, they are ordered to be delivered in accordance with the anticipated startup date communicated to the Cemtek Environmental Project Engineer. The delivery time for calibration gases is 4-8 weeks. Please be sure to communicate the anticipated startup date in a timely manner. Cemtek Environmental is not responsible for any expired calibration gases due to delays caused by others.

### **Note on calibration gas cylinders:**

Calibration gas cylinders remain the property of the gas supplier. Upon delivery of the gases to the site, the owner/operator will be required to assume responsibility for the cylinders in accordance with the Uniform Commercial Code § 7-204 (Duty of Care). Additionally, the owner/operator will be required to assume responsibility for the demurrage (monthly rental) costs on the cylinders and the return of any cylinders no longer being used to the gas supplier. Appropriate transfer forms will be sent to facilitate the proper application of demurrage. Lost cylinders and cylinders not returned as required are subject to a loss of use fee up to \$700 per cylinder.

If you have any questions or need any assistance, please contact our Service Department or your Project Engineer. Thank you for your cooperation.

### **Cemtek Environmental Service Department:**

3041 South Orange Avenue  
Santa Ana CA 92707  
Phone: 714-437-7100 Fax: 714-437-7177

## A. CEMS ANALYZER CABINET INSTALLATION

**CLIENT:** (Prior to Cemtek Environmental's arrival)

### **ANALYZER CABINET**

1. \_\_\_\_\_ The analyzer cabinet must be positioned as per drawings and mounted to the floor. Disconnect switches. Breakers for cabinet power must be located within proximity of cabinet.
2. \_\_\_\_\_ Power wiring of sufficient rating, in conduit, must be run to the analyzer cabinet "Main Power In" cabinet entry point. Leave excess wiring for internal routing (10'). (NOTE: Sample lines require 24 watts/ft.)
3. \_\_\_\_\_ Leave at least 3' clearance around all sides of the cabinet for opening the front or back door and removing side panels for maintenance. (Inform Cemtek Environmental of any problems with cabinet location.)
4. \_\_\_\_\_ Good lighting and ventilation (heat and A/C) sufficient to maintain a constant temperature of between 60-90 Deg. F is required.
5. \_\_\_\_\_ External signal wiring, in conduit, must be run to the analyzer cabinet "External signal wires" cabinet entry point. Leave excess wire for internal routing (10'). Consult drawings for the number of signal wires needed plus spares.

**Cemtek Environmental:** (On-site during installation)

1. \_\_\_\_\_ All wires brought into the cabinet will be terminated.
2. \_\_\_\_\_ All of the above items will be checked.

## B. SAMPLE PROBE INSTALLATION

**CLIENT:** (Prior to Cemtek Environmental's arrival)

1. \_\_\_\_\_ A 4", 150 lb., raised face, 8 bolt, ANSI mating flange must be mounted to a mating flange (provided by Others) in the proper place on the stack (correct number of diameters downstream from the nearest flow disturbance.) The flange should have the 8 holes aligned so that there is **NOT** a hole at the top, middle position or 12 o'clock. A flange gasket is taped to the inside of the probe box door for the flange.
2. \_\_\_\_\_ If required, Cut the "stinger" tube so that the tip is a minimum of 1 meter (39.4") from the inside wall of the stack **OR** in the centroid of the stack, whichever is the shortest distance. Install the "stinger" tube provided onto the probe flange. This is typically a 1/2" pipe that threads into the center of the 4" flange on the probe.
3. \_\_\_\_\_ The sample probe must be mounted to the flange. Ensure that the flange allows mounting of the probe at the specified angle. This will decrease maintenance of the primary filter and other system components.

**Cemtek Environmental:** (On-site during installation)

1. \_\_\_\_\_ All power and signal wiring are terminated at the probe converter location and at the analyzer cabinet location.
2. \_\_\_\_\_ The NOx/NH3 converter are tested for efficiency using ammonia calibration gas before delivery to the site, and if necessary, tested after installation on-site.

### C. SAMPLE LINE INSTALLATION AND TERMINATION

**CLIENT:** (Prior to Cemtek Environmental's arrival)

1. \_\_\_\_\_ The sample line must be mounted per Cemtek Environmental supplied drawings and the manufacturers written instructions. ***(The manufacturer includes a one page instruction sheet usually attached to the sample line. If the sample line is too long, with 10' or more of unusable length, please notify Cemtek Environmental.)*** The sample line should be installed with the proper downward slope and mounted according to Cemtek Environmental drawings. The sample line can be trimmed to length, only at the probe end (see Item 2 below). The line can be cut every 3 feet at a heat trace junction point. Cemtek Environmental will perform the sample line trimming.
2. \_\_\_\_\_ Make sure the end of the sample line containing the Type J thermocouple wire is installed at the CEMS cabinet/shelter end.
3. \_\_\_\_\_ Install the sample line into the probe, such that the heat trace extends inside the probe box, up to and as close as possible to the Swagelock fittings on the probe filter assembly. Exposed lengths of tubing must be avoided. Additional heat trace and/or insulation may be required for exposed sample tubing.
4. \_\_\_\_\_ The power and signal wires that are run inside of the sample line must be run into the analyzer cabinets' "SAMPLE LINE PWR" cabinet entry point with all extra left for internal routing. For a shelter, run the sample line through the bulkhead plate and down to the top of the sample conditioner impingers. The insulation should extend all the way to the top of the impingers.

**Cemtek Environmental:** (On-site during installation)

1. \_\_\_\_\_ The 3/8" Teflon sample tubing and the 1/4" Teflon calibration gas tubing are terminated at the probe. Project specific requirements may use Stainless steel or Silico-steel in lieu of Teflon. The blowback (purge) air line is High density polyethylene (HDPE). The blowback line is connected to instrument air at the CEMS cabinet end and to the accumulator tank at the probe end.
2. \_\_\_\_\_ The probe heater wires are terminated inside the probe box, on the terminal block supplied. These two (2) wires are both black and are for supplying 110 VAC power for heating the primary filter heater, which wraps around the probe housing.
3. \_\_\_\_\_ The 3/8" Teflon sample tubing and the 1/4" Teflon calibration gas tubing are terminated at the analyzer cabinet.
4. \_\_\_\_\_ The wire bundle from the sample line is terminated inside of the analyzer cabinet/shelter.
5. \_\_\_\_\_ All of the above items are checked.

#### D. ANALYZER EXHAUST AND DRAIN PIPE INSTALLATION

**CLIENT:** (Prior to Cemtek Environmental's arrival)

1. \_\_\_\_\_ PVC pipes must be installed from the analyzer cabinet/shelter wall to the outside for the sample exhaust and drain. A minimum of 1" I.D. PVC is recommended for both drain line and sample line exhaust. Small diameter tubing can cause back pressure on the CEM system and can have negative effects. Drain and exhaust should be run separately to prevent blockage.

**Cemtek Environmental:** (On-site during installation)

1. \_\_\_\_\_ All of the above items are checked.

#### E. OPACITY MONITOR INSTALLATION AND TERMINATION (If Opacity is supplied)

**CLIENT:** (Prior to Cemtek Environmental's arrival)

1. \_\_\_\_\_ Two 3 1/2", 150 lb., 8 hole mating flanges (put one flange hole at top position or 12 o'clock) must be mounted to the duct/stack opposite each other. The flange to flange distance must be within 1% of the specified flange to flange distance. (See drawings for complete mounting instructions.)
2. \_\_\_\_\_ The transmissometers optical head and retroreflector, combined with a blower unit for each, must be mounted to the flanges ( see drawings.)
3. \_\_\_\_\_ Power must be connected as described in the Cemtek Environmental supplied drawings.
4. \_\_\_\_\_ Signal wires must be run, in conduit, between the analyzer cabinet and the transmissometer. Leave excess wire at both ends for local routing and termination (10').
5. \_\_\_\_\_ Provide safe access to both the optical head and retroreflector locations. Cemtek Environmental will not work on the opacity monitor without safe platforms, walkways, and ladders which are essential for installation, maintenance, and certification testing personnel. These should be OSHA approved.
6. \_\_\_\_\_ Mount blowers at both the optical head and retroreflector sites on the stack. (See drawings for power requirements and mounting instructions.)

**Cemtek Environmental:** (On-site during installation)

1. \_\_\_\_\_ The blower hoses will be cut and installed.
2. \_\_\_\_\_ All signal wires will be terminated at the opacity monitor and at the analyzer cabinet. Power wires for blowers and opacity transmissometer should be connected by the client.
3. \_\_\_\_\_ Opacity monitor will be calibrated and aligned.
4. \_\_\_\_\_ All of the above items are checked.

#### F. GAS BOTTLE INSTALLATION AND TERMINATION

**CLIENT:** (Prior to Cemtek Environmental's arrival)

1. \_\_\_\_\_ The calibration and operational gas bottles must be supplied prior to start-up of the CEMS. The correct gases for your system are specified in the QA/QC document supplied by Cemtek Environmental. There is normally a 4-6 week delivery period.

CEMTEK ENVIRONMENTAL, INC.  
CLIENT PRE-INSTALLATION GUIDE AND CHECKLIST FOR CEMS

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2. \_\_\_\_\_ Regulators for the gas bottles must be supplied prior to the start-up of the CEMS. The secondary two stage regulator must be capable of supplying 0-60 psi and have two gauges. One is to show the cylinder pressure and the other is to show the cylinder discharge pressure.
3. \_\_\_\_\_ 1/4" Teflon or 316 Stainless Steel tubing (provided by Others) must be installed between each gas regulator and the analyzer cabinet/shelter. For shelters, run the tubing from the bottle regulators to the bulkhead plate on the shelter wall. NOTE: Make sure to blow out with compressed air all lines, especially stainless steel lines to remove all foreign matter and oils before connecting to the CEMS.
4. \_\_\_\_\_ All of the gas bottles must be mounted to the outside of the shelter wall or a wall near the analyzer cabinet. If mounted outdoors, the gas bottles must be covered or fully enclosed for protection from the elements. For shelters, a rain hood is provided which mounts to the shelter wall above the bottles.
5. \_\_\_\_\_ Spare gas bottles should be on-site before installation. This is very important in order for Cemtek Environmental to start-up the CEMS correctly. Some clients keep several spares on-site ready to use to allow for continuous operation. (BEWARE: Some calibration gases have a short shelf life (6 months to 1-1/2 years) ! Check with your local gas company rep. for calibration gas shelf life.) Spare bottles are for backup due to accidental leak and normal bottle usage.

NOTE: If initial supply of gas bottles are supplied by Cemtek Environmental, a demurrage agreement is required to be signed by the customer, to transfer ownership of the bottles to the client.

**Cemtek Environmental:** (On-site during installation)

1. \_\_\_\_\_ The 1/4" Teflon tubing will be installed into each regulator fitting and the fittings in the analyzer cabinet. The discharge pressure will be set at the appropriate level for adequate operation/calibration of the CEM system. Lines blown out to remove foreign material. System checked for leaks.
2. \_\_\_\_\_ All analyzers will be calibrated using the calibration gases.
3. \_\_\_\_\_ All of the above items are checked.

**G. DATA COMMUNICATIONS WIRING/COMPUTER/MODEM**

**CLIENT:** (Prior to Cemtek Environmental's arrival)

1. \_\_\_\_\_ Three twisted pair cable must be run from the computer to the analyzer cabinet. Leave excess wire at each end for local routing and termination (10'). Make sure not to run near any electrical (AC) wiring. Use 18-24 AWG copper, shielded with drain in conduit (Belden 8777 or equal). For runs in excess of 1500 feet, fiber optic cable is recommended. Shield for the communication line should be connected at only one end of the run, PLC end preferably.
2. \_\_\_\_\_ A desk or table **must** be set up or available for the DAHS computer and modem. Power requirements are at least 15 amps 110 VAC. UPS power and surge suppression is highly recommended. A 5 plug power strip is required.
3. \_\_\_\_\_ A VPN connection or a direct dial, analog, dedicated, separate modem phone line, with the correct number known, must be installed at Cemtek Environmental's DAHS computer location.



4. \_\_\_\_\_ A data/voice quality phone, located in the shelter or near the CEMS computer, is very helpful for process related work as well as trouble shooting.

**Cemtek Environmental:** (On-site during installation)

1. \_\_\_\_\_ All wires are terminated inside the analyzer cabinet and at the computer. Ground shields are checked.
2. \_\_\_\_\_ The DAHS computer equipment and modem are set up.
3. \_\_\_\_\_ All of the above items are checked out during the installation.

**H. BLOWBACK**

**CLIENT:** (Prior to Cemtek Environmental's arrival)

1. \_\_\_\_\_ A clean dry source of compressed air is required to blow back the sample line and probe. Instrument air is preferred. The air source should be regulated to 60-100 psi, and fed into the analyzer cabinet/CEMS shelter via a 3/8" tube bulkhead fitting. The flow is controlled by a solenoid valve and is dependent on the pressure and frequency of use. Initially, the solenoid valve will be opened to allow flow in short bursts for 3-10 sec/day. Maximum, peak usage would be 3-5 scfm of air for short bursts. If instrument air is not available, call Cemtek Environmental to determine what is the best substitute for your system.

**Cemtek Environmental:** (On-site during installation)

1. \_\_\_\_\_ All above items are checked.

**SAMPLE**

**Continuous Emissions Monitoring System – Standard  
Specification  
For  
Gas Turbine/Boiler Applications**

**Specification No.**

Prepared by:

Prepared for:

**Date:**

			Reviewer					
REV	Date	Preparer					Sheets	Status
0								

## 1.0 GENERAL

Customer issues this Specification to solicit offers to provide a Continuous Emission Monitoring System (CEMS) for the Project Name and Location. The CEMS will be required to monitor emissions from a type facility which will consist of X describe equipment combustion turbine generators or boilers; equipped with describe design of any catalyst and /or Pollution control equipment.

## 2.0 SCOPE

### 2.1 GENERAL

- 2.1.1 This Specification defines the technical and performance requirements for the design, manufacture, delivery, and start-up and certification of a fully assembled, tested, and operational CEMS. The CEMS shall include all related accessories necessary to meet the requirements of the USEPA 40CFR60 and San Joaquin APCD Permit No. \_\_\_\_\_ and this Specification.
- 2.1.2 The equipment to be furnished under this Specification shall be engineered, designed, fabricated, tested, and delivered in complete accordance with the requirements stated herein. Any exceptions must be clearly acknowledged and explained in the Bidder's response. In case of a conflict between specific requirements of this Specification, the more stringent requirement takes precedence.
- 2.1.3 The Seller shall make all tests necessary to ensure that material, equipment, and workmanship are of the required degree specified herein.

### 2.2 DOCUMENTATION

Refer to Table 2-1 for the document submittal schedule. All analyzer systems shall be furnished with the following documents:

- a. Complete spare parts list for analyzers and other repairable items – Broken down into four categories: Level A (Consumable/Startup spares) to Level D (seldom used parts)
- b. Recommended spare parts list with prices for analyzers and other repairable items
- c. Erection and Installation Drawings
- d. System piping schematic
- e. CEMS internal signal, control, & Power wiring diagrams
- f. Dimension outline, General arrangement, and elevation view drawings
- g. Rack & Panel Layouts
- h. Customer Interconnection Diagrams. Location and size of all conduit connections
- i. Signal Input/Output List
- j. Calibration Gas specifications
- k. QA/QC Plan
- l. 3rd Party Certification Test Protocol

- m. Factory Acceptance Test (FAT) Test Procedure/Results
- n. Local Regulatory submittals (describe if applicable)
- o. System operating manuals (as applicable) to be prepared by Supplier

2.3 UTILITIES, EQUIPMENT, AND SERVICES TO BE FURNISHED BY THE BUYER OR OWNER

- 2.3.1 Electrical power will be available at the shelter via interface junction boxes supplied by the Seller and installed on the outside wall of each analyzer shelter as:
  - a. 120 VAC, 60 Hz, single phase UPS for DAHS, analyzers & PLC or system controller, seller to supply. UPS power rated at 3.1 kva. Optional UPS can be included in CEMS design.
  - b. 480 VAC, 60 Hz, 3 phase, if transformer and disconnect switch is purchased. Otherwise, 208 VAC, 60 Hz, three phase – 150 Amp.
- 2.3.2 For each DAHS computer: A dedicated, direct dial, analog, data-quality telephone line capable of minimum baud rates of 28800 will be available for modem communication with the DAHS or internet connection.
- 2.3.3 Ethernet communication between the PLC and DAHS if DAHS is remote from the CEM/PLC shelter. Ethernet cable should be minimum 100 Mbps with RJ-45 connectors. Please be aware for lengths greater than 100 meters – Fiber optic cabling will be required. Customer is responsible for all hubs, repeaters, fiber modems, and converters as well as cabling and installation.
- 2.3.4 Serial communication or miscellaneous 4-20 mA dc analog and digital process signals from the plant DCS will be interface through the Seller's supplied signal junction box installed on the outside wall of each analyzer shelter.
- 2.3.5 Miscellaneous discrete alarm signals from the PLC in each analyzer shelter will interface through the Seller's supplied signal box installed on the outside wall of each analyzer shelter.
- 2.3.6 The Buyer will provide the following equipment/services:
  - a. Foundation and condensate drain for CEMS shelter.
  - b. Location of sample port for CEMS probe for reduce flow stratification and compliance with EPA requirements.
  - c. Exhaust stack sample ports necessary for mounting the sample extraction probe and test ports. Mating flanges and adapter flanges as necessary to interface the Seller provided probe.
  - d. Installation and mounting hardware of CEMS heated sample line (HSL) and other as required to connect HSL with CEMS cabinet.
  - e. Field conduit and wiring beyond the junction boxes on the outside wall of each analyzer shelter.

- f. Interconnecting cable via ethernet between the DAHS and system controllers per specifications.

Installation at the plant site shall be provided by the Buyer. Two days installation supervision is provided by Supplier. Start-up assistance to support engineering construction is required.

- 2.3.8 Buyer will be responsible for performing all tasks associated with construction labor. These tasks shall include:
  - a. Unloading and storage of all CEMS equipment.
  - b. Placement and mounting of each CEMS cabinet on a concrete pad or platform.
  - c. Installing conduit, signal cables, probe, and sample line umbilical beyond Seller's termination points at each shelter.
  - d. Installing hardware in the form of scaffolding, ladders, platforms, and all structural components necessary to install and service the CEMS equipment.
  - e. Installing other associated support equipment as necessary for permanent support and operation of the CEMS.

**3.0 SITE CONDITIONS**

- 3.1 The Plant site is located in the City of \_\_\_\_\_, name of state, (give detailed location of job site).

Plant grade elevation is \_\_\_\_\_ above sea level; barometric pressure = \_\_\_\_\_ psia.

The following annual average climatic conditions may be expected at the site:

Ambient Temperature Extremes :	(Typical)
Summer	Dry —bulb 90 °F
	Wet —bulb 75 °F
Winter	Dry —bulb 14 °F
Precipitation, Wind, and Earthquake:	
Average annual rainfall	XX inches
Basic Wind Speed	Per ASCE7, 90 mph, Exposure 'c' Imp. Factor 1.15 @ 33 Ft. above ground
Seismic Factor	A~ .Aa = 0.09, Seismic Hazard Exposure Group 2, Performance Category B
Frost Penetration	6 inches
Roof Live Load	Per ABC 20 psf

- 3.2 EXHAUST GAS CHARACTERISTICS

3.2.1 Normal ambient conditions at the CEMS measurement location within the stack are as follows:

- a. Temperature: Min./Max./Normal: \_\_\_\_\_ °F
- b. Pressure: \_\_\_\_\_ H<sub>2</sub>O
- c. Flow Rate: \_\_\_\_\_ lbs/hr
- d. Stack Height above sea level: \_\_\_\_\_ ft.
- e. Base of stack elevation above sea level: \_\_\_\_\_ ft.
- f. Stack Velocity: Min/Max/Normal: \_\_\_\_\_ ft/sec.
- g. Stack Internal diameter: \_\_\_\_\_ ft.
- h. Stack wall thickness: \_\_\_\_\_ inch

3.2.2 Expected exhaust gas constituent:

**Fuel = Natural Gas**

	Normal	Min.	Max.
a. NO <sub>x</sub> - Normal *	1-3ppm	1ppm	15 ppm
b. NO <sub>x</sub> – startup			
c. NO <sub>x</sub> – Controls Off			
d. CO	5-10ppm	2ppm	20ppm
e. SO <sub>2</sub>	0-2ppm	0 ppm	5ppm
f. VOC	1-5ppm	1ppm	5ppm
g. H <sub>2</sub> SO <sub>4</sub>	.5-3ppm	.5ppm	3ppm
h. PM <sub>10</sub>	11 lb/hr		
i. Opacity	5 % (EPA Method 9)		

\*For NO<sub>x</sub> – Specify emissions levels for normal operation, startup and NO<sub>x</sub> control device out of service

#### 4.0 DESIGN REQUIREMENTS

##### 4.1 SAMPLE EXTRACTION PROBE for stack CEMS

- 4.1.1 The CEMS shall make its measurements using fully extractive sampling technology.
- 4.1.2 All probe parts exposed to the flue gas shall be constructed of materials that are corrosion-resistant and chemically inert with respect to the process gases being sampled and temperature condition. CEM must calibrate through the probe per EPA specifications.

- 4.1.3 Heated Filter shall remove particulate down to 2 micron. Heated Filter is made of ceramic material, plus accessible for ease of maintenance and replacement. Heater designed to maintain sample temperatures up to 400°F.
- 4.1.4 Probe body constructed of 316 Stainless Steel or Hastelloy (if needed for SCR inlet temperature).
- 4.1.5 NEMA enclosure and sample line mating boot.
- 4.1.6 Probe stinger tube – ½” schedule 40 pipe stainless steel designed for stack temperatures up to 1000 Deg. F.
- 4.1.7 3 or 4 inch, 150 lb. Raised faced mounting flange with bolts and flange gasket. Adapter flanges, associated hardware, and cooling flanges (required for stack temps. > 550 Deg. F) provide by Others.
- 4.1.8 All control, signal, and power wires for the probe, included in the sample line.

#### 4.2 HEATED SAMPLE LINE (UMBILICAL)

The Seller shall provide pre-insulated and heat-traced sample line bundles connecting the sample extraction probe to the sample conditioning system. The sample line shall contain all necessary tubes and wires to support the probe requirements for power, control and alarm monitoring. Sample line material to be 316 stainless steel for sample transport and calibration and purge lines. Sample line must maintain a temperature above the sample dew point (240 degrees F minimum) at the minimum site ambient with a constant power density heater. A thermocouple is included, located approx. 50 ft. from the power end of the line, used for sample line temperature control and alarming.

The sample line bundle consists of the following:

- 1– 3/8” Heated Sample tubes – 316 stainless steel
- 1 – ¼” unheated calibration tube – 316 stainless steel
- Type K thermocouple located 50 ft. from power end
- Constant power density heat trace – 208 VAC
- Signal and power wires for probe heater and alarms
- FRP black vinyl outer jacket or equivalent

A temperature controller shall be included in the CEMS enclosure designed to control the sample line temperature. A high/low temperature alarm shall be provided to the DAHS PLC for the sample line.

Installation of the sample line is by others.

#### 4.3 SAMPLE CONDITIONING SYSTEM for stack CEMS

The sample conditioning system shall include all necessary tubing, valves, pumps, coolers, drains, filters, etc., required to efficiently condition the raw sample to a state suitable for introduction into the gas analyzers per applicable federal and state regulations. Instrumentation and accessories must be provided to appropriately adjust or control the sample gases for the following:

##### 4.3.1 SAMPLE CONDITIONER/DRYER

An electronic refrigerant or thermoelectric type sample cooler shall be included with

peristaltic pumps to dry sample to below 4°C. The sample shall be dried to a dewpoint below the interference level. Glass impingers shall be provided. Sample residence time with condensate shall be minimized to prevent absorption of the gases to be measured.

A high temperature alarm contact shall be provided, wired back to the [CEMS controller for output to the CEM DAHS or plant DCS](#). For sites located in SCAQMD, or as a [maintenance option](#) – An exit gas thermocouple shall be provided with the conditioner and wired back to the DAHS PLC for continuous monitoring and recording of exit gas temperature.

#### 4.3.2 SAMPLE FILTRATION & MOISTURE ALARM

An integral moisture sensor alarm and secondary filter shall be provided downstream of the sample conditioner. The secondary filter shall remove 99.9% of the particles down to 2 microns. Filter material shall not absorb gases of interest. Moisture sensor alarm shall be wired back to the CEMS controller for alarming absorb gases of interest. Moisture sensor alarm shall be wired back to the DAHS PLC for alarming. An automatic relay shall be provided that will shut down the sample vacuum pump in the event of a moisture alarm.

#### 4.3.3 SAMPLE TRANSPORT & ASSOCIATED INSTRUMENTATION

The sample transport system shall be made of chemically inert materials, such as stainless steel, Teflon, glass, etc., that will not corrode, contaminate, or chemically react with the expected sample constituents. All fittings shall be 316 stainless steel Swagelok type. All tubing shall be either PFA Teflon or 316 stainless steel.

The sample transport system shall control pressure and volumetric flow rate of the sample and distribute it to the individual analyzers. Pressure regulators with gauges and flow meters with control valves shall be provided so that flow rates to individual analyzers can be controlled and monitored from the front panel.

#### 4.3.4 SAMPLE PUMP(S)

Diaphragm type vacuum pump(s) shall be provided to draw the sample from the probe down to the analyzers. All wetted surfaces of the pump shall be Teflon lined or stainless steel.

#### 4.3.5 DRAIN & EXHAUST

A 1-1/4" PVC drain and exhaust vent shall be provided to the exterior of the shelter. All condensate shall be sloped to drain outside the shelter. If ambient conditions require, a power outlet shall be provided near the condensate drain for heat tracing to be provided by Others. Piping to site sanitary drain is by Others. Exhaust vent shall include a bug screen.

#### 4.3.6 AMMONIA SCRUBBER (OPTIONAL)

For turbines utilizing ammonia injection for SCR, NOx control systems - NH3 scrubbers must be used before NOx analyzer to prevent ammonia bisulfate salts from accumulating in the analyzer. For applications which have ammonia slip present in the sample ammonia scrubber dessicant shall be provided downstream of the sample conditioner. The ammonia scrubber will remove ammonia slip from the sample gases so as to not contaminate downstream analyzer equipment. The scrubber will be 99% effective for ammonia slip levels up to 20 ppm, without absorbing gases of interest. A moisture drain



shall be provided, plumbed to the shelter drain.

#### 4.3.7 CALIBRATION SYSTEM

An automatic and manual system shall be provided to inject calibration gases at the instruments directly (local cal.) or through the probe (stack cal.). Calibration control and monitoring functions shall be performed by the DAHS PLC. Electronic solenoid valves shall be provided for each separate calibration gas cylinder (daily gases).

Two stage stainless steel calibration gas bottle regulators shall be provided for all daily calibrations. Brackets shall be mounted to the exterior of the shelter for securing the calibration gas cylinders in accordance with OSHA regulations. Calibration gas cylinders shall be located so as to be accessible to plant personnel for replacement. [A rain protective hood shall be included above the gas cylinders \(optional\).](#)

#### 4.4 GAS ANALYZERS

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 and performance. The analyzers shall meet the following specific requirements:

##### 4.4.1 NO<sub>x</sub> ANALYZER

- a. Compliant with 40 CFR 60/75, Appendix B, Performance Specification 2.
- b. Chemiluminescent method of sample analysis
- c. Microprocessor based instrument capable of serial and/or Ethernet communication for diagnostics
- d. Stainless steel NO<sub>2</sub> converter capable of > 100,000 ppm-hours life
- e. Dual range/dual span with separate, dedicated analog outputs for each range
- f. Capable of 20:1 minimum turn down ratio
- g. 7 day drift NTE 2.5%, RATA NTE 10%
- h. Suitable manufacturers: Thermo Model 42i-LS or TAPI 200 EM/EH
- i. Single range for inlet NO<sub>x</sub> and dual range for stack NO<sub>x</sub>.

##### 4.4.2 CO ANALYZER

- a. Compliant with 40 CFR 60/75, Appendix B, Performance Specification 4
- b. Microprocessor based instrument capable of serial and/or Ethernet communication for diagnostics
- c. Gas filter correlation method of sample analysis
- d. Dual range/dual span with separate, dedicated analog outputs for each range
- e. Capable of 100:1 minimum turn down ratio
- f. 7 day drift NTE 2.5%, RATA NTE 10%

- g. Suitable manufacturers: Thermo Model 48i or TAPI 300EM

#### 4.4.3 O2 ANALYZER

- a. Compliant with 40 CFR 60/75, Appendix B, Performance Specification 3
- b. Paramagnetic or zirconium oxide method of sample analysis
- c. Single range: 0-25%
- d. 7 day drift NTE 0.5% O2, RATA NTE 10%
- e. Suitable manufacturers: Cemtek model 1010 zirconium oxide, Servomex Model 1440 paramagnetic stand alone or as part of TAPI NOx bench or Ametek

#### 4.5 INSTRUMENT RACK & SAMPLE CONDITIONING MOUNTING

All analyzers shall be housed in a open 19” rack design carbon steel frame, suitably bolted to the floor. Rack shall be open on the front and sides to aid in air flow and cooling as well as allow access for maintenance of the equipment. Analyzers shall be mounted on slide rails to facilitate easy removal for maintenance purposes.

Sample conditioning components will be mounted on a wall mounted plate (open panel design) located adjacent to the analyzer cabinet. Mounting of these components will be such to facilitate ease of maintenance and viewing of flowmeters, pressure gauges, and other indicating instruments.

An ambient temperature monitor is included and wired back to the CEMS controller for monitoring & alarming of low & high temperature conditions in the CEMS rack.

#### 4.6 SYSTEM CONTROLLER

- 4.6.1 The system controller shall be a Allen Bradley Compact Logix, Programmable Logic Controller (PLC) with ethernet communication link, from the PLC to the DAHS computer is required. A minimum of 30 days of local data storage shall be included.

The system controller for each unit will be rack mounted in the CEMS shelter and shall perform the following minimum functions: Housekeeping, Data Collection, monitoring of alarms, control, and Preliminary Calculations.

##### 4.6.1.1 Alarms shall be generated to indicate the following as a minimum:

- a. Failure of probe heater.
- b. Failure of sample line heater.
- c. Sample conditioning system malfunction (excessive moisture in sample).
- d. Sample cooler exit temperature too high.
- e. Communications failure between the system controller and DAHS.
- g. Calibration results outside of tolerance (analyzer out-of-control or calibration failure).

- h. System in maintenance condition.
- h. Emissions in excess of plant permit limit.

A common trouble alarm and high emissions alarm relay output (dry contact) will be available from the PLC.

- 4.6.2 The system controller shall incorporate an operator interface panel (OIT) mounted in the instrument rack if the DAHS is not located in the CEM cabinet. The OIT shall allow control of calibrations and entry of bottle targets, as well as data display of CEMS data and alarms. This will be a minimum 4 line, 40 character per line LCD display with keypad. Direct serial or ethernet communication to the PLC shall be provided to allow uninterrupted access to the PLC data when the DAHS is not in operation.
- 4.6.3 The system controller for each analyzer shelter shall accept isolated, 4-20 mA analog input signals from the DCS via a hard-wired connection to an exterior shelter wall mounted NEMA 4X junction box. In addition, the PLC will provide dry contact status alarms and accept 24 VDC digital input statuses from the DCS via this junction box. Refer to the attached list for a typical I/O list to/from the DCS. As an option, the PLC will provide an Ethernet or serial interface using Modbus RTU protocol to communicate these signals digitally to the DCS.

#### 4.7 DATA ACQUISITION SYSTEM

- 4.7.1 The Supplier shall integrate a hardware and software product of the DAHS to perform monitoring system control, data acquisition, data storage, and regulatory reporting functions. The DAHS system shall be designed so that in the event of a computer failure, data is backed up in the PLC controller for over 30 days. The Supplier shall configure the PLC and the DAHS recording and reporting functions in accordance with site specific conditions and local regulatory requirements. During installation and start-up of the CEMS, the Supplier shall verify proper operation of the DAHS including real time communication of each PLC to the DAHS.

The data acquisition unit is designed around a central processing unit, which is an IBM compatible, desktop PC computer. The PC computer consists of the following components:

- Pentium IV Processor
- Speed: 2.8 GHz minimum
- RAM: 256 MB RDRAM, 64K cache
- Floppy: 1.44 Meg 3.5 inch floppy disk
- Hard disk: Raid One configuration
- Monitor: 17 inch SVGA color monitor
- Operating System: Windows 2000
- Modem: 56kbps
- Backup Drive: External Hard Drive

- 4.7.2 The DAHS shall use a Windows 2000, NT, or XP Operating System and perform the following at a minimum:

- a. Read and record the full range of gas concentrations in each stack, from zero through full scale.

- b. Produce an instantaneous readout of all required emissions and process data.
- c. Generate regulatory compliance reports from a menu driven format per 40 CFR 60 and 40 CFR 75 v2.1 guidelines.& local SCAQMD regulations.
- d. Generate graphical displays, trends, etc., for current and historical data as well as displaying CEMS status.
- e. Compute and record monitor calibration error and calibration drift.
- f. Automatically check measured values to determine if they are within allowable limits of normal operation, and flag questionable and/or out-of-tolerance data for operator recognition.
- g. Generate alarms.
- h. Allow system alarms to be viewed and acknowledged by operators.
- i. Allow for automatic or manual entry of all required process data and information, including fuel analysis data like heating values and fuel bound sulfur.
- j. Be capable of distinguishing periods when the turbines are off-line for reporting purposes.
- k. NH3 slip calculation using inlet NOx and stack NOx analyzers and NHe injection rate per EPA guidelines.

#### 4.8 REPORTS

Seller shall provide all software and modifications to fulfill reporting requirements of the EPA, and local regulator agency.

#### 4.9 CEMS Enclosure

- 4.9.1 Seller shall supply a separate CEMS enclosure to be located at the base of each stack. Each CEMS enclosure shall provide a lighted, climate-controlled indoor workspace to allow for protection and maintenance of the equipment, with a suitable exterior location allocated for gas cylinder storage.
- 4.9.2 The size of each shelter shall be 8' w x 10' l minimum with nominal inside height of 8' .
- 4.9.3 Shelter construction:
  - Interior and exterior prefinished aluminum skins. Heavy duty vinyl floor or aluminum treadplate floor, acrylic roof coating.
  - R-15 rigid polystyrene or polyurethane insulation for walls and roof or applicable local codes (especially So CA).
  - 4 lifting rings located at the base of the shelter near the corners for off-loading using crane.
  - Entrance door – 36"x90" fully gasketed with stainless steel exterior hardware. Crashbar lock and hydraulic door closure inside. 16" square safety glass on the door
  - Feed thru bulkhead plate – Aluminum. Located on the upper wall of the shelter for penetrations of cal. Gas piping, instrument air feed, sample line bundles, customer signals, and DAHS communications.
  - Calibration gas bottle mounting – Rain hood (16" deep) and Unistrut mounted to the

wall to accommodate up to 6 cal. Gas bottles. Bottle straps included.

4.9.4 Shelter paint – Aluminum skins prefinished in light tan (off-white) to reduce solar glare.

4.9.5 Electrical requirements for CEMS shelters are addressed in Section 4.11.

4.9.6 Supplier-provided HVAC shall be adequate to maintain the indoor temperature in a range consistent with the recommended operating range of the CEMS equipment given the site ambient conditions in Section 3.2 of this Specification. HVAC will be wall mounted unit including an integral resistance heating coil. Minimum HVAC size of 2 tons cooling, with 5 KW heater. Wall mounted thermostat for temperature control. [Redundant HVAC and controllers can be requested if customer desires.](#)

4.9.7 Smoke alarm wired to 120 VAC power with a dry contact alarm wired backed to the CEM controller and a wall mounted fire extinguisher

#### 4.11 SHELTER ELECTRICAL

The shelter shall be provided completely pre-wired and assembled with all necessary appurtenances in accordance with the NEC code. The following is included:

- 150 Amp, 208 VAC electrical service panel with all necessary breakers for equipment provided by Seller
- EMT conduit drops from trough run around the continuous perimeter of the shelter
- Copper ground pad mounted to the frame of the shelter for connection to Customer's ground grid
- Minimum 12 guage copper wire
- Duplex outlets located on each wall for customer use
- Quad receptacle for DAHS computer (if mounted in shelter)
- 4 foot, dual tube fluorescent light fixtures (minimum two per shelter) to provide adequate lighting for all equipment
- Exterior low pressure sodium light with photo sensor
- Light switch located near door

[Externally mounted \(by customer in the field\) 480 VAC, 45 KVA transformer with drip shield. Wall mounted \(to exterior of shelter\), 480 VAC disconnect switch for transformer \(wired in the field by Customer\).](#)

### 5.0 SERVICES (Include on-site labor, travel time and expenses additional)

#### 5.1 FACTORY ACCEPTANCE TEST

The Supplier shall provide facilities and technician support for the factory functional checkout of the system prior to shipment. This checkout shall be performed per a written procedure, which shall be developed by the Supplier and submitted to the Buyer for review 30 days prior to the test or earlier. The tests procedure shall include the hardware and software inspection and demonstration. A minimum of 1 day customer witness test at the end of the factory acceptance test.

#### 5.2 INSTALLATION AND START-UP SUPPORT

The Supplier shall furnish the services of a qualified field engineer for installation and start up the CEMS following the field installation of the equipment. Start-up support shall include the following, as a minimum 3 days per CEM:

- a. An installation checklist shall be reviewed and a walk-down performed to ensure that all equipment is ready for activation.
- b. Power up the system and perform a thorough test of all system functions per a site-specific checklist.
- c. Monitor on-line operation and calibration drift over a two-day period.
- d. Check DAHS software to ensure proper data reduction, calculations, display, and reporting functions.

### 5.3 TRAINING

The Supplier shall provide a minimum of three days training program for the Owner's operating, environmental and maintenance personnel that meets the following minimum requirements:

- a. The training program shall consist of classroom as well as hands-on sessions designed to train the Owner's personnel in proper operation and maintenance of all equipment furnished by the Seller, including equipment provided by sub-vendors.
- b. Two days on CEMS hardware and one day on general DAHS operator training.

### 5.4 SYSTEM CERTIFICATION

- 5.4.1 The CEMS shall be designed to pass all applicable initial certification tests [in 40 CFR Parts 60 and SCAQMD or San Joaquin APCD Regulations](#).
- 5.4.2 In the event that the system fails to attain certification, the Supplier shall bear the costs associated with modifying the system as necessary to meet certification requirements and to pay for additional testing.