Umatilla Chemical Agent Disposal Facility

ATTACHMENT 11

CALIBRATION PROCEDURES AND IN SITU CONTINUOUS EMISSIONS MONITORING SYSTEMS

ATTACHMENT 11

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CALIBRATION PROCEDURES

[40 CFR 270.31; OAR 340-100-0002]

1. Oxygen, Carbon Monoxide, and Mercury (Hg) Analyzer Calibration Procedures

Attached calibration procedure and analyzer performance specification are as follows:

1.1 Initial Certification

After installation and prior to surrogate trial burns, the Continuous Emissions Monitoring System (CEMS) underwent initial certification in accordance with the UMCDF CEMS Certification Test Plan. The UMCDF CEMS Certification Test Plan is derived from the UMCDF Hazardous Waste Permit, UMCD Air Contaminant Discharge Permit, and UMCD Title V Permit and is in accordance with 40 CFR 60 (Standards of performance for new stationary sources) and 63 Appendix to Subpart EEE (Quality Assurance Procedures for Continuous Emissions Monitors Used for Hazardous Waste Combustors).

After installation and prior to the start of HD trial burn, the mercury (Hg) monitoring system CEMS underwent initial certification in accordance with the UMCDF CEMS Certification Test Plan, EPA Performance Specification 12A, and 40 CFR Part 75, Appendix K.

Initial performance test certification included calibration drift (CD), response time (RT), absolute calibration audit (ACA)/calibration error (CE)/cylinder gas audit (CGA), and relative accuracy (RA), as applicable. All four tests must occur within a 168-hour (7-day) period when the furnace system is operating at or above 50% thermal load.

1.2 Subsequent/Continuing Calibration

The CEMS must meet the calibration and QC requirements set forth in the UMCDF Hazardous Waste Permit and UMCD Air Contaminant Discharge Permit and Title V Permit.

The CEMS must be calibrated daily using certified (or higher quality) gases. The daily calibration drift check is a two point check (zero and span gas). For the CO CEMS, a zero and span gas check must be conducted for the low level range (0 – 200 ppm) and the high level range (0 – 3,000 ppm).

Prior to the daily calibration of the monitors, preoperational setup checks must be performed. These checks include, but are not limited to: gas line connections, strip chart and recorder, flow control panel, and verification of electrical power to the monitors. The calibration is performed in accordance with UM-0000-M-608, "Non-Agent *[sic]* Monitoring," that is based upon the Code of Federal Regulations (CFR), Title 40, Part 63, Appendix to Subpart EEE, and manufacturer's manuals.

The Hg CEMS and calibration requirements are identified in Permit Attachment 7.

1.3 <u>Quarterly Performance Audit</u>

1.3.1 Every quarter the CEMS must undergo a performance audit in accordance with federal regulations. Three of the quarterly audits are performed as follows:

1.3.1.1 The CO and O2 must consist of an absolute calibration audit (ACA)/calibration error (CE) tests in accordance with 40 CFR 60 Appendix B, Performance Specification 4B.

1.3.1.2 The Hg must consist of a system integrity test with three reference gas values of elemental and oxidized Hg in accordance with 40 CFR 60 Appendix B, Performance Specification 12A.

1.3.1.3 Quarterly audits must be conducted using EPA Protocol 1 or higher quality gases.

1.3.2 The fourth quarterly audit must be performed as follows:

1.3.2.1 An independent contractor must perform one annual audit in each calendar year.

1.3.2.2 The CO and O_2 CEMS annual audit must consist of a relative accuracy test audit (RATA) in accordance with 40 CFR 60 Appendix B, Performance Specification PS 4B.

1.3.2.3 The Hg CEMS annual audit must consist of a relative accuracy test audit (RATA) in accordance with 40 CFR 60 Appendix B, Performance Specification PS 12A using Method 29 or Method 30B.

1.3.2.4 The annual audit will fulfill the quarterly audit for the quarter during which it is performed.

All federal Title 40 CFR citations are citations to the Title 40 CFR adopted as Oregon rule by OAR 340-100-0002 and as altered by OAR Chapter 340, Divisions 100-106, 109, 111, 113, 120, 124, and 142. See the preface introduction for further explanation.

2. Process Instrument Calibration

2.1 General

This section describes the calibration of instruments controlled by the UMCDF Permit. The following provides supplemental information regarding some of the most common types of instruments at this facility. Because calibration and testing processes are often governed by manufacturer recommendations, other codes and standards, these discussion are general in nature.

2.1.1 Each instrument must be calibrated in accordance with manufacturer's recommendations and/or as specified in appropriate UMCDF preventive maintenance instrument (PMI) procedures. All instrument calibrations must be accomplished using measurement & test equipment (M&TE) with accuracy traceable to the National Institute of Standards and Technology (NIST) or other accepted national or international standards.

2.1.2 Calibration results must be documented on appropriate calibration records. Upon completion of a successful instrument calibration, the documentation must be entered into the operating record indicating the instrument calibration date, and calibration due date (interval between required calibration).

2.1.3 The calibration frequency, required instrument calibrated range, expected operating range or setpoint and instrument loop accuracy must be as specified in Tables 5-4 (Module V) for BRA instrumentation, Table 5-9 (Module V) for BDS instrumentation, Table 7-1a (Module VII) for LIC1 instrumentation, Table 7-1b (Module VII) for LIC2 instrumentation, Table 7-3 (Module VII) for MPF instrumentation, and Table 7-5 (Module VII) for DFS instrumentation, as applicable.

2.2 Definitions

Calibration - To ascertain outputs of a device corresponding to a series of values of a quantity, that the device is to measure, receive, or transmit. Accomplished by comparison measurements of unknown accuracy to standards of known accuracy in order to detect, correlate, report, or eliminate by adjustment variation in accuracy of the instrument being compared.

Accuracy - The degree of conformity of an indicated value to a recognized standard value, ideal value.

Loop Accuracy – Accuracy of a series of individual components within a measurement or control loop, expressed as = $(a_1{}^2 + a_2{}^2 + \ldots a_n{}^2)^{0.5}$, where a_1 through a_n represents the accuracies of the loop components expressed as a percent.

Loop Test – A test whereby a known process signal is applied to simulate an output from a field sensing device and the resulting process signal is observed at the end point (final readout device) and verified to be within acceptable limits.

Calibrated Instrument Range – The region between the calibrated limits of a measurement device, expressed by stating the lower and upper measurement values of the device.

Span – The calibrated arithmetic difference between upper and lower range values.

Setpoint (Digital) – The setpoint is the measured or process value at which an electrical/electronic switch or other on/off device actuates or changes state.

Setpoint (Analog) – The control point of an analog control system or instrument that represents the desired value of the controlled variable.

AWFCO - Automatic waste feed cut-off

2.3 Pressure Instruments

Pressure instruments must be calibrated and checked, as a minimum, at 0, 50, and 100% of calibrated span, as governed by the specific application. Pressure switches must be calibrated at the specific point(s), as governed by the specific application. Differential pressure instruments must have appropriate differential pressure applied using suitable M&TE.

2.4 Flow and Differential Pressure Instruments (Used for Flow Measurement)

2.4.1 Flow and differential pressure instruments (used for flow measurement) must be calibrated and checked at 0, 50, and 100% of calibrated span or at specific point, as governed by its application. Differential pressure instruments (used for flow measurement) must have appropriate differential pressure applied using suitable M&TE.

2.4.2 For primary flow elements the manufacturer’s certified data must be used for determining device accuracy, flow versus differential pressure values (orifices, venturies, and annubars) and meter and calibration factor values (electromagnetic, coriolis, and turbine-type flowmeters). Electromagnetic, coriolis, and turbine-type flowmeters must be calibrated or programmed in accordance with manufacturer's recommendations, utilizing the manufacturer's standard substitution/calibrator device and/or appropriate M&TE.

2.5 Temperature Instruments

2.5.1 Temperature instruments must be calibrated and checked, as a minimum, at 0, 50, and 100% of calibrated span or at specific point, as governed by its application.

2.5.2 Temperature instruments with thermocouple or RTD sensors must be tested by injecting a simulated temperature signal (millivolts or resistance, as applicable) at the sensor head (where practical) and reading the resultant temperature value at the receiving instrument. Appropriate NIST reference tables or certified manufacturer's equivalency tables shall apply to thermocouples and RTDs. The manufacturer's certification for materials and accuracy shall be acceptable.

2.5.3 Capillary filled-type temperature sensing system must be calibrated by immersing the temperature sensing element in a controlled temperature bath, or dry block calibrator utilizing appropriate M&TE to monitor the bath/calibrator temperature and resulting device output and switch actuation points.

2.6 Level Instruments

2.6.1 Level instruments must be calibrated and checked at a minimum of 0, 50, and 100% of calibrated span or at specific points, as governed by its application.

2.6.2 Differential pressure instruments used for level measurement, must have appropriate differential pressures applied, using suitable M&TE (equivalent to the required level range, including corrections for specific gravity, fill fluid density, and head corrections, as necessary).

2.6.3 Ultrasonic level transmitters must be calibrated (or programmed) to accommodate the range, span, and/or setpoint requirements of the Permit. The manufacturer's instructions must be utilized for these calibrations. These instruments must be functionally checked to ensure proper operation by varying the measured variable level, where practical.

2.6.4 Point contact sonic level switches must be calibrated (or programmed) to accommodate the setpoint requirements of the application. The manufacturer's instructions must be utilized for these calibrations. These instruments must be functionally checked to ensure proper operation by removing the switch sensor and immersing it in liquid or by varying the measured variable level.

2.7 Analyzers

Analyzer instruments must be calibrated and checked at 0, 50, and 100% of calibrated span, where practical. For analyzers requiring a certified sample gas or sample solution for the calibration standard, a one- or two-point check is acceptable (e.g., pH buffer solution at 4.0 and 10.0 pH).

Moisture/humidity instruments must be calibrated (or programmed) to accommodate the range, span, and/or setpoint requirements of the application. The manufacturer's instructions must be utilized for these calibrations.

2.8 Switches

2.8.1 Flame Supervision Sensors - must be checked for proper operation in accordance with the vendor's recommended checkout procedures. This must include checking the programmer module output contacts for proper operation.

2.8.2 Position and Speed Switches - Position switches must be checked by stroking valves or actuating equipment and confirming that switch actuation occurs at the proper position. Speed switches must be checked by operating the equipment in such a manner as to verify the proper operation of the switch or by using the vendor's recommended calibration procedure.

2.8.3 Motor Operation Switches - Auxiliary motor starter contacts must be checked for proper operation by manually starting and stopping the corresponding motor and confirming relay and contact actuation.

2.8.4 Electronic Switches (with Analog Sensing Element) - Transmitters must be calibrated by introducing a variable signal from a calibration unit and verifying that the corresponding output is correct. Electronic switches are then calibrated by simulating either the transmitter process input variable or corresponding transmitter output signal of the required set point and verifying that the switch actuates properly. Electronic temperature switches are checked by introducing a multivolt signal at the thermocouple head that corresponds to the required set point and by verifying proper switch actuation.

2.9 Weight Measuring Systems

2.9.1 Load cell-type weight measurement instruments must be configured and calibrated (or programmed) for the specific weight measurement requirements, as governed by its specific application. The manufacturer's instructions must be used for initial setup. After initial setup, the weight measuring system accuracy must be verified, by dead load weight comparison. Certified weights of known quantity shall be added incrementally to the scale/vessel and compared to the final readout values.

The dead weight calibration procedure is a four-point calibration curve. This calibration procedure tests the function and accuracy of the entire weight system including load cells and transmitters. The weights measured during the calibration shall be indicated in the Control Room and recorded in PDARS to verify the loop accuracy. The calibration is performed in the following manner:

- The weight system to the empty BDS conveyor is zeroed.
- An empty flat tray of known weight is added to the conveyor and the calibration of the system is adjusted to match.
- An approximately 2,500-lb weight is added and the calibration of the system is adjusted to match.
- An additional approximately 2,500-lb weight is added for a total of 6,216 lbs, and the calibration of the system is adjusted to match.
- Measurements are taken at each of the four calibration points and the ±24-lb accuracy of the scale system is verified. A repeatability of ±0.64% must be achieved.

3. Waste Feed Cut-Off Testing

In order to demonstrate and maintain the effectiveness of the automatic waste feed cut-off (AWFCO) system, tests to simulate malfunction and methods of calibration have been devised. In addition, the operating staff are trained to work in concert with the automatic waste feed cut-off system in response to malfunctions. The scope of the AWFCO system and testing of the waste feed cut-off system is included in site procedures and are described as follows:

3.1 Scope and implementation of Automatic Waste-Feed Cut-Off System

3.1.1 The automatic waste feed cut-off system consists of devices that stop the flow of waste-feed into or out of a process area along with all instruments and control systems that automatically actuate these shut-off devices in the event of an upset of malfunction that could lead to incomplete destruction or excess emissions.

3.1.2 Process areas considered include LIC1, LIC2, DFS, MPF, and the BRA.

3.1.3 AWFCOs include all items for the incinerators and the BRA.

3.1.4 Control systems are designed to be "fail-safe." In the event of an instrument, interlock, or power failure, the controls involved will go to or stay at the safest position for them to maintain when control is lost. For example, waste-feed cut-off valves will close when any of the instruments or interlocks within the control circuits fails.

3.1.5 The majority of the AWFCOs listed in the Permit have prealarms. Some AWFCO parameters do not have prealarms such as loss of flame, low pressure in the agent feed line, the slag discharge gate not closed, the PFS carbon filter bypass valve not closed. Information on the prealarms for each incinerator or BRA AWFCO are provided in the alarm and interlock matrices for each incinerator and BRA. Operators monitor operating conditions and watch for trends that could indicate a pending upset condition. The operators must try to correct an upset condition observed or indicated by a pre-alarm. They must continue to monitor abnormal operating conditions to verify that any automatic corrective actions are completed and to watch for the possibility of worsening conditions that would indicate a pending shutdown condition. An automatic shutdown will occur if an upset condition has not been corrected. Upon observing a shutdown alarm, the operators monitor the operating system involved to verify that all automatic operations are completed properly (i.e., waste-feed cut-off valves have closed, burners shutdown, etc., as appropriate to the shutdown action required).

3.2 Initial Calibration and Functional Check-Out of AWFCO Instruments and Control Systems

3.2.1 All instruments and devices for the entire facility must be initially calibrated per Section 2 of this attachment in accordance with manufacturer's recommended procedures and/or preventive maintenance instrument (PMI) procedures.

3.2.2 All wiring and connections must be checked for continuity. All loops are checked for polarity and voltage level.

3.2.3 All control loops and interlocks must be checked for proper operation by simulating a process variable for each field sensing instrument and confirming that the final control device functions properly.

3.2.4 Each waste feed cut-off device (valve, gate, door, pump shutdown, etc.) must be checked for proper operation. Each device must properly respond to open/close or start/stop signals. Full closure of cut-off devices must be confirmed by verifying that the appropriate interlocks are activated.

3.3 Periodic Testing of UMCDF Automatic Waste-Feed Cut-Off Systems

The following narrative explains how each part of the AWFCO system contributes to preventing hazards to health and the human environment. Refer to the definitions in the previous section for terms used in this discussion.

- An instrument senses a change in the process.
- The input loop brings the instrument data to the control system.
- The control system evaluates the instrument data. If the data requires an AWFCO action, a software interlock is activated to change the signal to an output loop.
- The output loop signals a change in the state of a device in the field
- The device changes state to stop waste feed.

Requirements for the weekly testing of AWFCO systems at UMCDF are as follows.

3.3.1 Instruments which activate the AWFCO systems are specified in the Hazardous Waste Permit Module V, Table 5-5 for the BRA; Module VI, Tables 6-3 for the LIC1 and LIC2, 6-5 and 6-7 for the MPF, and 6-11 for the DFS; and Module VII, Tables 7-2 for the LIC1 and LIC2, 7-4 and 7-4a for the MPF, and 7-6 for the DFS. These instruments must be calibrated in accordance with Section 2.0 of this attachment. The calibration of these instruments must include confirmation of the input loops to the control system.

3.3.2 Automatic waste feed cut-offs activated during the previous week while treating hazardous waste in the incinerator or BRA are deemed to have been tested and will be documented on the inspection check sheet. PDAR system data will be attached to the inspection check sheet documenting activation of the AWFCO system. Software interlocks, for the AWFCOs that did not activate in the previous week, must be tested weekly by an offline method that will not require the activation or deactivation of devices in the field.

3.3.3 In the offline method, input loop values shall be forced into states requiring activation of the AWFCO system and output loop values shall be confirmed (via activation of the appropriate interlock) to go to the state required for the AWFCO.

3.3.4 In the offline method, calculated values (e.g. the rolling one-hour average of an input loop value) shall be forced into states requiring activation of the AWFCO system and output loop values shall be confirmed (via activation of the appropriate interlock) to go to the state required for AWFCO.

3.3.5 In order to perform the offline AWFCO software interlock test, waste feed must be stopped to the treatment unit and the incinerators or BRA cleared of waste.

3.3.6 Weekly testing of AWFCO software interlocks shall not be required for any system which has not processed waste in the preceding week.

3.3.7 When a system is to resume feeding of waste, the weekly testing must be performed before feed is resumed and weekly testing must resume on the established day and time, e.g. Midnight on Saturday or noon on Sunday, etc.

3.3.8 Output loops and devices which perform AWFCO actions to start and stop waste feed shall not require scheduled testing. The normal operations of the UMCDF will start and stop waste feed several times each week during any period when waste is being treated.

User staff must confirm the proper operation of these output devices as a routine matter in performance of operating and maintenance procedures.

3.3.9 Documentation of the weekly testing of the AWFCO alarms (including the PDAR report indicating which AWFCO alarms activated during the previous week) will be maintained in the operating record.

"IN-SITU" CONTINUOUS EMISSIONS MONITORING SYSTEMS (CEMS)

The Continuous Emissions Monitor Systems (CEMS) are used for continuously monitoring the exhaust gas from the UMCDF furnace systems for carbon monoxide (CO), oxygen (O_2), carbon dioxide (CO_2), and mercury (Hg). The UMCDF Hazardous Waste Permit requires the exhaust gas from the furnace systems to be monitored for CO, O_2, and Hg. The CO_2 concentration in the Deactivation Furnace System (DFS) exhaust gas was required to be monitored to satisfy the Toxic Substances Control Act (TSCA) requirements for treating polychlorinated biphenyls (PCBs) in M55 rocket shipping and firing tubes.

The UMCDF Hazardous Waste Permit requires the CO and O_2 CEMS located downstream of the I.D. blowers for the DFS, Liquid Incinerators (LIC) and the Metal Parts Furnace (MPF) to be interlocked to activate the automatic waste feed cut-off (AWFCO) system. The CEMS monitoring the exhaust gas are configured with two sets of monitoring systems (primary and backup) that can be independently calibrated and maintained. Only one set (CO and O_2) of CEMS are designated as the "monitors of record" for compliance purposes. In the event that the online "monitors of record" require maintenance activities, the backup set of CEMS are placed online and are then designated the "monitors of record." Only the "monitors of record" will activate the AWFCO system when the operating ranges exceed permitted levels.

The UMCDF Hazardous Waste Permit requires Hg CEMS in the Pollution Abatement System Carbon Filter System (PFS). The remaining Hg adsorption capacity of the sulfur-impregnated carbon (SIC) is required to be monitored per Permit Attachment 7, and SIC change out and/or cessation of use of a PFS is based on the Hg levels measured by the CEMS.

The DFS exhaust gas CEMS consist of a primary and backup configuration that includes CO_2 in addition to CO and O_2. One analyzer is capable of both CO and CO_2 detection. Both analyzers are certified in accordance with the UMCDF CEMS Certification Plan. The UMCDF CEMS analyzers that are connected to the AWFCO will be audited quarterly to ensure a sound document trail for their accuracy from the time they are certified. All instruments are "in-situ" CEMS in compliance with specification requirements. The O_2 analyzers are based on zirconium oxide measurement technology. All other gas analyzers are based on gas filter correlation infrared measurement technology.

The method of analysis, analyzer type, and analytical range for the CEMS monitors are as follows:

- CO is continuously monitored (corrected to a dry basis) in the I.D. blower exhaust for the DFS, LICs, and MPF. The CO concentrations are measured by an "in-situ" nondispersive infrared analyzer (NDIR). The CO analyzer is a multirange instrument with a low range of 0-200 parts per million (ppm) and a high range of 0-3,000 ppm. The output of the monitor is displayed on the Control Room advisor screen both as a continuous reading corrected to 7% oxygen concentration and as a rolling average also corrected to 7% oxygen concentration. The data is archived by the Process Data Acquisition and Recording System (PDARS) and by chart recorders. The CO monitors will be certified using 40 CFR 60, Appendix B, Performance Specification 4B. The CO monitors will be calibrated in accordance with the Performance Specifications for Continuous Emission Monitoring Systems referenced by 40 CFR 63 Appendix to Subpart EEE.

- O_2 is continuously measured (corrected to a dry basis) in the I.D. blower exhaust for the DFS, LICs, and the MPF. O_2 is also continuously monitored downstream of the primary chamber exhaust for the DFS and the MPF, and downstream of the MPF afterburner. The O_2 concentrations are measured by "in-situ" zirconia oxide electrochemical monitors. The UMCDF will operate the O_2 analyzers in the 0-25% range. The output of the monitors is displayed on the Control Room advisor screen. The data is archived by the PDARS and by chart recorders. The O_2 monitors will be certified using 40 CFR 60, Appendix B, Performance Specification 4B. The O_2 monitors will be calibrated in accordance with the Performance Specifications for Continuous Emission Monitoring Systems referenced by 40 CFR 63 Appendix to Subpart EEE.

- The total vapor phase mass concentration of mercury (Hg) (elemental and oxidized forms) in the MPF exhaust gas is continuously sampled and monitored in the MPF pollution abatement system carbon filter system (PFS) by the mercury monitoring system (VEN-MERC-001). The mercury monitoring system CEMS are located after the MPF PFS and before the common stack. The mercury monitoring system CEMS units are listed in Permit Attachment 7, Table 1. The Hg monitors must be operated and calibrated in accordance with Permit Attachment 7.

The CEMS must be located in shelters constructed of composition panels that provide weather protection and insulation. Each shelter must be heated and cooled to provide the temperature control for the UMCDF CEMS. All the UMCDF CEMS equipment must be powered by commercial power and provided with uninteruptible power supply (UPS) backup.

Each CEMS has its own calibration system. This ensures the accuracy of each monitor. Calibrations can be done manually or automatically. The CEMS can be programmed to run automatic daily calibrations. The instruments will run the calibration cycle and will signal the plant distributed control system as to what calibration gas is flowing. The time of the automatic calibration runs is adjustable. The length of time each gas flows is programmable and will likely be changed to suit site conditions. The calibration system, with appropriate calibration gases, has the capability of verifying the zero and upscale response of each continuous gas analyzer. The gas is introduced into the UMCDF CEMS sampling system at the sample point through the analyzer. The gases are housed in the appropriate gas cylinder usage rack for each system. Daily calibration checks must be performed, and the readings must be recorded in two locations:

- The PDARS in the control room (CON) records all UMCDF CEMS readings including the data from daily calibrations. The PDARS software allows compilation of calibration data in several formats. One report is used to determine calibration drift (CD) for the Data Assessment Report (DAR) to be submitted with each quarterly audit report.

- The CEMS readings must be recorded on a chart recorder and the calibration data annotated on the strip chart.

<u>CO and CO_2Analyzers</u>

The model number for the CO and CO_2 analyzers are 210 LR manufactured by Procal Analytics, Ltd. Interference filters are placed in the path of a broadband infrared radiation (IR) source. Two filters are used per an analyte of interest. One selects a measuring wavelength while the other selects a reference wavelength. The filters are mounted on a rotating disc immediately in front of the IR source. This arrangement gives rise to an IR beam alternating rapidly between measuring wavelength and reference wavelength for each analyte. This alternating beam passes through the gas to be measured, eventually striking the IR detector in the form of pulses of radiation.

Filters have been selected so that if any of the gas to be measured is present, a significant amount of radiation will be absorbed at the measuring wavelength with very little or none at the reference wavelength. A logarithmic relationship exists between gas concentration and the ration of IR signal strengths at the measuring and reference wavelengths.

During calibration of the analyzer, the measured absorbance is recorded for known sample gas concentrations over the measuring range required for the specific application. Results of this exercise are recorded within the system's memory in the form of a look-up table. During operation, the system calculates concentration levels from absorbance levels by continual reference to the look-up table.

The analyzer ranges are:

CO: 0 – 200 ppm and 0 – 3000 ppm
CO_2: 0 – 12%

The analyzer features an optical head unit with IR source and rotating filter wheel. The sample gas component is identified by modulating a dual wavelength, nondispersive IR beam for the component through the sample gas chamber. Readings from the analyzer are adjusted to account for the moisture content of the matrix being sampled. The optical head unit includes a moisture analyzer. The analyzer control unit is located in a monitoring house and displays the analytical results and distributes an output signal to a strip chart recorder and to the PDARS.

Oxygen Analyzers

The model number for the O_2 analyzers is ZRM-ZTB manufactured by COSA Instrument Corporation. The O_2 analyzer uses a zirconium oxide (ZrO_2) ceramic sensing element to determine the concentration of O_2 in the exhaust gas. The analyzer is directly inserted into the furnace flue gas. Response is very fast due to the limited dead air space between the replaceable filter and the Zirconia sensor. The sensor measures the oxygen concentration by comparing the oxygen pressure of the sample side of the oxygen cell, to the pressure on the reference side of the cell. Standard atmospheric oxygen is the source for the reference side. The internal circuitry quantifies the signal generated by the oxygen cell and displays it as percent oxygen on the analyzer control unit.

The UMCDF analyzers must be operated in the 0 – 25% range.

The analyzer must be inserted directly into an alloy intake pipe that will deliver the sample to the analyzer. The sample is passed directly to the analyzer and the results are sent to the analyzer control unit where the outputs are directed to the strip chart recorder and to the PDARS.

Hg Monitors and Analysis

The Hg CEMS instrument and process parameters and sampling and analysis requirements are described in Permit Attachment 7.