



Maintaining Continuous Emissions Monitoring Systems To Achieve High Reliability

*a technical solution to
meet every need...*

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Continuous Emission Monitoring

**Gas Fired, Coal Fired, Waste to Energy
& Process Applications
Fully Extractive or Dilution Extractive**



KNOW YOUR SYSTEM!!!

- **What regulations does your facility fall under?**
- **Who is the local regulatory agency responsible for your facility?**
- **What type of CEM System do you have? Fully extractive or dilution?**
- **Who are the manufacturer's of the major parts of the CEMS System? Probe, cooler, analyzers, DAHS.**



CEMS TYPES

FULLY EXTRACTIVE (DRY BASIS)

DILUTION EXTRACTIVE (WET BASIS)

OTHERS:

FULLY EXTRACTIVE (HOT/ WET)

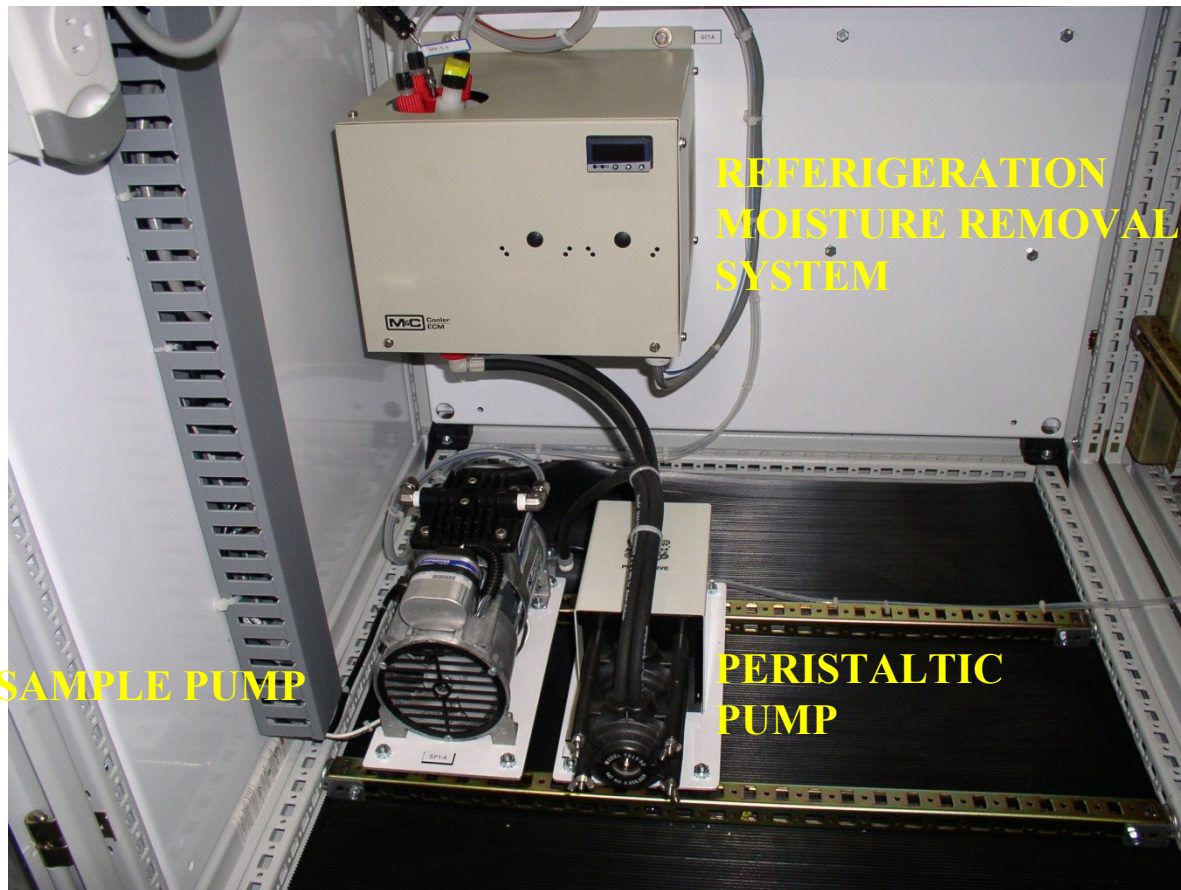
IN-SITU (CROSS STACK or PROBE)

EX-SITU (CLOSE COUPLED EXTRACTIVE)

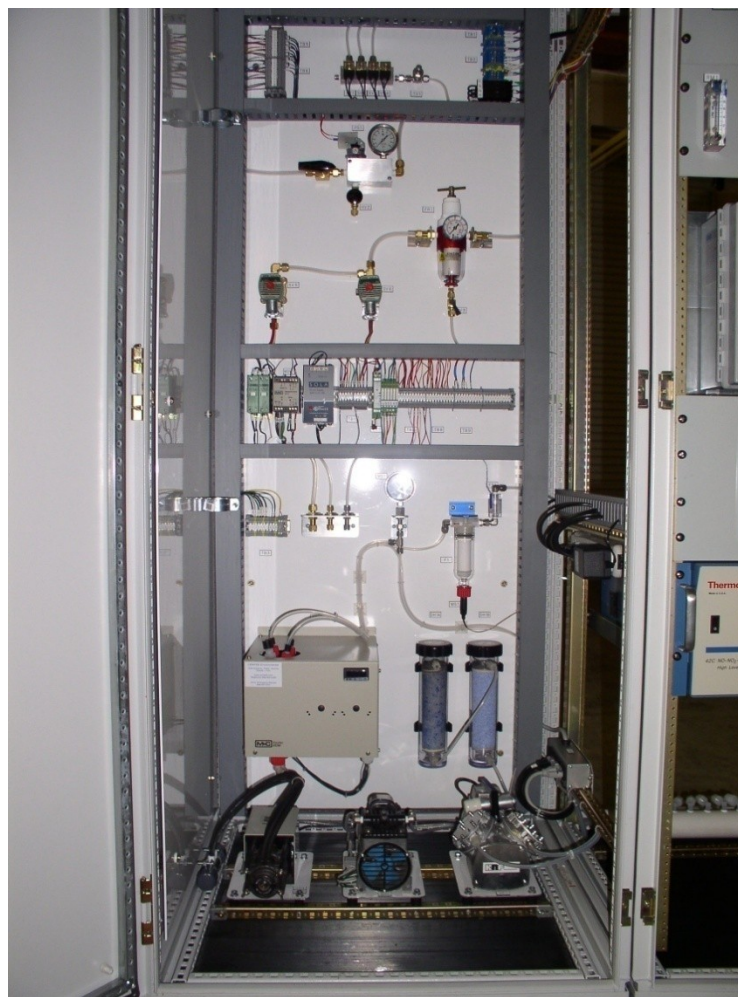


FULLY EXTRACTIVE – Dry Basis

- Sample Gas Dried To A Dew-point Of +2 Deg C
- Excellent Performance In Low Concentrations
- Good Performance In High Concentrations
- Requires Preventative Maintenance
- MEASUREMENT TYPES: Chemiluminescence, NDIR, UV Absorption, UV Fluorescence, Paramagnetic, Zirconia, FTIR, DOAS, IR-GFC
- Heated Probe Filter And Heated Sample Line
- Moisture Volume Needs to be Determined – Constant or Measured



**SAMPLE
CONDITIONING BAY**





**SYSTEM CONTROL
PANEL**

**SAMPLE FLOW
CONTROL PANEL**





DILUTION EXTRACTIVE – Wet Basis

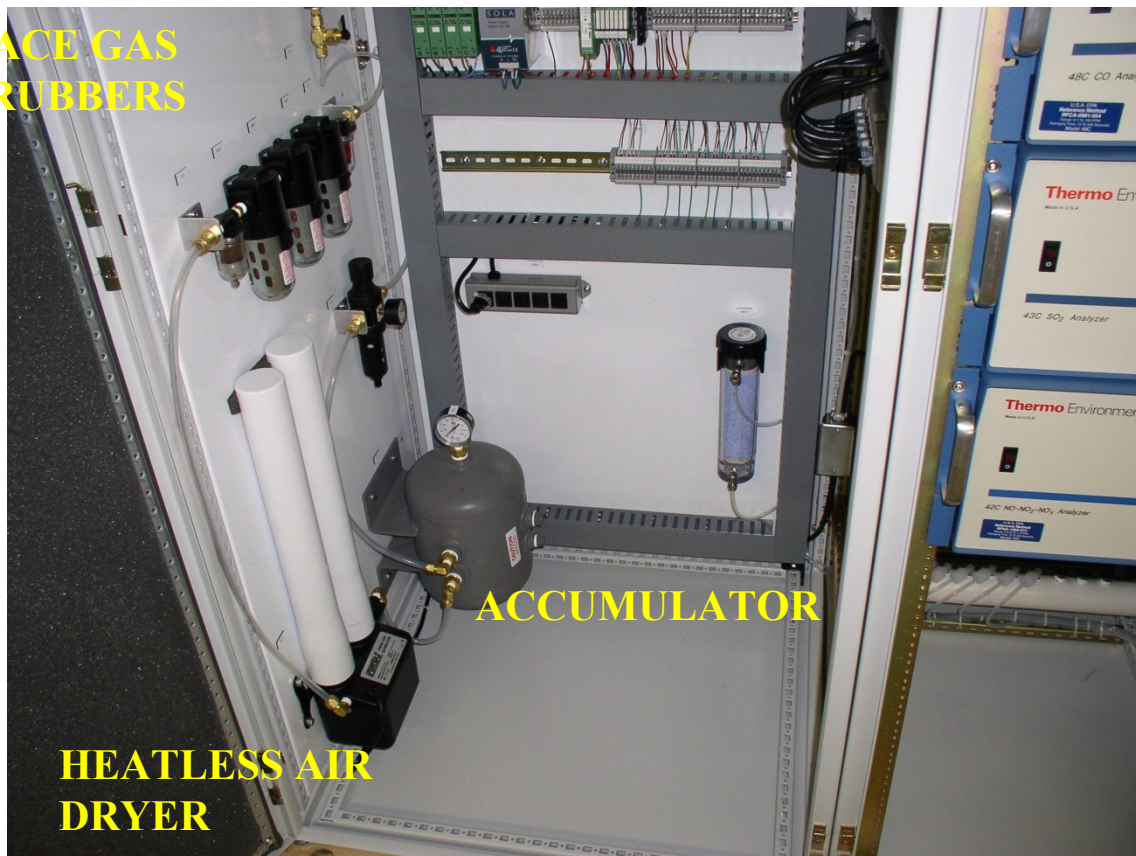
- DILUTES SAMPLE WITH CLEAN DRY AIR
- MINIMIZES MAINTENANCE
- USES HIGHLY SENSITIVE GAS ANALYZERS
- LOWER COST SAMPLE LINE – FREEZE PROTECTED
- SIMPLE TO OPERATE
- MEASUREMENT TYPES: Chemiluminescence (NO_x), UV Fluorescence (SO₂), GFC-IR (CO), NDIR (CO₂ diluent)



DILUTION CONTROL PANEL

**GAS
ANALYZERS**

**TRACE GAS
SCRUBBERS**



ACCUMULATOR

**HEATLESS AIR
DRYER**



Choose the Right System!!!

Application Choices – Dilution or Extractive

- Pollutant Concentrations
 - Lowest constituent dictates
 - May preclude dilution due to analyzer limitations
- Mass Emissions Requirement
 - Dilution is a wet basis measurement
 - Requires flow measurement



Application Choices – Dilution or Extractive

	Advantages	Disadvantages
Dilution Extractive	<ul style="list-style-type: none"> Low maintenance More reliable Coal fired Some oil fired 	<ul style="list-style-type: none"> Low concentrations (Ratios above 100:1)
Fully Extractive	<ul style="list-style-type: none"> Low concentrations Gas fired Some oil fired Fuel flow meter 	<ul style="list-style-type: none"> Higher maintenance Lower availability



My CEM System is Installed, Now What?

- Time to learn about your CEMS.
 - Training: Most integrators can provide training that covers equipment from many different manufacturers.
 - Inventory: Set up a spare parts inventory with consumable and critical spare parts.
- Get your hands dirty.
 - Perform maintenance checks according to the Quality Assurance/ Quality Control Plan.
 - Have your CEMS vendor's phone number on speed dial.



Quality Assurance/Quality Control Plan

- Why do I need to follow the QA/QC Plan?
 - It's the LAW!!!
 - A record of CEMS maintenance proves to the regulatory agency that the data is quality assured.
 - The QA/ QC plan is a guideline to develop your own maintenance schedule.



Daily Preventative Maintenance

Sample System Checks – Daily

	Item	Tag	Set Point	Record Daily Value or Status
Pressures	Instrument air	PG1	>90 psig	
	Sample pressure	PG2	>2 psig	
	Probe vacuum	VG1	<10 inch Hg	
	Sample probe purge air	FR1	>80 psig	
Flows	Total sample flow	RM1	4-5 lpm	
	NO _x analyzer flow	RM2	~1.5 lpm	
	CO analyzer flow	RM3	~1.5 lpm	
	O ₂ analyzer flow	RM4	~1.5 lpm	
	Gas sample total flow	RM5	4-5 lpm	
Visual checks	Room/enclosure temperature	HVAC	75°F, ±5°F	
	Moisture sensor/filter	MS1	Clean and dry	
	Cooler temp	GC1	Green light = okay	
	Drain pump	DP1 and DP2	Turning approx. 6 rpm	
	Sample line temp control	TC1	250°F, ±10°F	



Weekly Preventative Maintenance

Sample System Checks – Weekly

Item	Value or Status (Completed, OK, Replaced)
Perform all daily checks.	
Perform manual calibration check.	
Check moisture sensor (MS1) and tubing downstream of sample conditioner for moisture. Remove and dry as necessary. Check sample conditioner (GC1) for proper operation.	
Verify sample line heater operation by checking current with amp meter.	

DAHS Checks – Weekly

Item	Value or Status (Completed, OK, Replaced)
Check/change backup media (CD disk, tape, etc).	
If enabled, verify that automatic backups have occurred for the week.	
Verify there is sufficient disk for another week of data.	



Monthly Preventative Maintenance

Sample System Checks – Monthly

Item	Value or Status (Completed, OK, Replaced)
Perform all daily and weekly checks.	
Check sample pump (SP1); replace diaphragms and disks as needed, usually every 4 months.	
Check peristaltic pump tubing (DP1 and DP2), replace as necessary.	
Change desiccant media (DH1 and DH2).	
If equipped with an air compressor:	
1. Check/change oil as needed.	
Check filter on shelter HVAC system. Clean or replace as needed, usually every 2-3 months.	
Check CGA/linearity cal gas bottle pressures > 500 psig. Order new gas bottles as needed keeping in mind the lead time may be several weeks.	

**CGA/Linearity Gas Cylinders



Quarterly Preventative Maintenance

Sample System Checks – Quarterly

Item	Value or Status (Completed, OK, Replaced)
Perform all daily, weekly, and monthly checks. Note that all routine maintenance is to be performed prior to the required quarterly audit test.	
<p>If sample gas pressure (PG2) shows a decline, perform probe maintenance. Replace the filter element and clean the filter chamber as necessary. Replace O-rings. Verify probe box heater is operating.</p> <p>If flow is low, check sample pump (SP1).</p>	
Verify and calibrate all CEMS alarm switches.	
The rear motor on the drain pumps (DP1/DP2) should be given two drops of #20 non-detergent oil. Do not over oil. Clean off any dust or dirt.	
Perform CEMS sample system leak check and flow balance procedure.	
Check ammonia scrubber (AS1). When deposits are visible 75% of the way up the length of the scrubber, scrubbing media needs to be replaced. Depending on concentration of NH ₃ and flowrate, media life may last 30,000 hrs.	
Perform general housekeeping duties inside shelter/cabinet. Dust/clean all equipment surfaces.	



Quarterly Preventative Maintenance Cont.

OA Audits – Quarterly

Perform quarterly CGA/linearity test and check DAHS results.	Completed On:
Perform quarterly opacity calibration error test and check DAHS reports.	Completed On:
For Part 75 reporting systems: Perform quarterly stack flow-to-load analysis (done through the DAHS at end of reporting quarter).	Completed On:



Annual Preventative Maintenance Cont.

Sample System Checks – Annual

Item	Value or Status (Completed, OK, Replaced)
Perform all daily, weekly, monthly, quarterly, and semiannual checks. Note that all routine maintenance is to be performed prior to the required annual RATA.	
Replace sample pump (SP1) diaphragms.	
Inspect and clean thermoelectric cooler fan (GC1).	
Inspect and replace as needed Fluororubber, polypropylene, PVC, toalone, and Teflon joints.	

QA Audits – Annual

Perform any required annual RATA.	All testing completed on:
Check results for the RATA Bias Adjustment Factor and enter the BAF into the DAHS record field.	
For Appendix D reporting units: Perform annual fuel flowmeter accuracy check before close of the quarter in which due.	Analysis completed on:



What happens if I have a failure?

- **Diagnose the problem**
 - Check with your CEMS technician or CEMS vendor. Experience with the system can help answer questions.

- **Repair the problem**
 - CEMS require a minimum of 95% availability. Downtime can lead to data substitution or even worse, FINES!!

- **Know the next step**
 - Are recertification or diagnostic tests required?



40CFR Part 75 Diagnostic Tests & Recertification Events

Recertification and Diagnostic Test Policy for Dry-Extractive CEMS¹

Description of Event	Event Status	RATA	7 Day Error	Cycle Time Test	Linearity Check	Calibration Error Test	Submit RT556	Comments
Permanently replace NO _x , SO ₂ , O ₂ or CO ₂ analyzer with like-kind analyzer as defined in Acid Rain Program Policy Manual Question 7.22.	R	X	X		X	X	X	Permanent replacement of an analyzer is a recertification event. EPA does not require the cycle time test in this case, since the analyzer is like-kind and the rest of the system is the same. Modify RTs 510 and 530 in monitoring plan as necessary.
Permanently replace NO _x , SO ₂ , O ₂ or CO ₂ analyzer with new analyzer that does not qualify as a like-kind analyzer.	R	X	X	X	X	X	X	Modify RTs 510 and 530 in monitoring plan as necessary.



Recertification and Diagnostic Test Policy for Dry-Extractive CEMS¹

Description of Event	Event Status	RATA	7 Day Error	Cycle Time Test	Linearity Check	Calibration Error Test	Submit RT556	Comments
Replace or repair any of the following components:								
Photomultiplier	D				5	X	A	EPA will conditionally allow the abbreviated linearity check and the alternative response check (footnotes 5 and 6). For repair or replacement of other major components not listed (e.g., major components of new monitoring technology not addressed), contact the EPA for a case-by-case ruling.
Lamp	D				5	X	A	
Internal analyzer particulate filter	D			6		X	A	
Analyzer vacuum pump	D			6	5	X	A	
Capillary tube	D			6	5	X	A	
Ozone generator	D				5	X	A	
Reaction chamber	D				5	X	A	
NOX Converter	D				5	X	A	
Ozonator dryer	D				5	X	A	
Sample cell	D				5	X	A	
Optical filters	D				5	X	A	
Replace or repair circuit board	D				5	X	A	EPA will conditionally allow the abbreviated linearity check.



What does all this “boil” down to?

- **CEMS reliability begins in the Engineering and Design phase.**
- **Perform regular Preventative Maintenance**
- **It’s All About Relationships**
 - **Develop a Relationship with your CEMS Vendor**
 - **Spare Parts Supplier**
 - **Service Contracts**
 - **Develop a Relationship with your Regulatory Agency**
 - **Develop a Relationship with your CEMS**



A Technical Solution To Meet Every Need

Thank You!



- CEMS
- Process Monitors
 - SCR / SNCR
 - Scrubber monitors
 - Coal mill monitors
- System upgrades
- Testing
 - Quarterly Audits
 - RATA
- Data Acquisition Systems
 - Part 60
 - Part 75
 - State/ Local reports
- Training
- QA/ QC Plans
- Monitoring Plans