REINHOLD ENVIRONMENTAL Ltd.

2010 APC Round Table
& Expo Presentation

July 18-20, 2010, in Concord, NC / Hosted by Duke Energy

Proposed Boiler MACT, Boiler GACT, CISWI & European Multi-Pollutant Removal Experience

Agenda

- Proposed Boiler MACT, Boiler GACT, CISWI
- Issues and Concerns with Proposed Language
- Pollutant Types & Control Methods
- Achieved Performance & Existing EU Regulations
- Recommendations

Regulatory Terms

- Maximum Achievable Control Technology (MACT)
- Generally Available Control Technology (GACT)
- Commercial and Industrial Solid Waste Incinerators (CISWI)
- Clean Air Interstate Rule (CAIR)
- Clean Air Mercury Rule (CAMR)

Maximum Achievable Control Technology (MACT)

Affected Source:

- The collection of all existing industrial, commercial, or institutional boilers or process heaters within a subcategory located at a major source facility that do not combust solid waste or:
- Each new or reconstructed industrial, commercial, or institutional boiler or process heater located at a major source facility that do not combust solid waste, as that term is defined under RCRA.
- The affected source does not include boilers and process heaters that are subject to another standard under 40 CFR 63 or a standard established under CAA section 129.

Maximum Achievable Control Technology (MACT)

Exemptions:

- An electric utility steam generating unit (note that non-fossil fuel fired utility boilers and utility boilers <25 MW are covered).
- A recovery boiler or furnace covered by 40 CFR 63, subpart MM.
- A boiler or process heater that is used specifically for research and development. This does not include units that provide heat or steam to a process at a research and development facility.
- A hot water heater (≤120 gal, <160 psig pressure, <210°F).
- A refining kettle covered by 40 CFR 63, subpart X.
- An ethylene cracking furnace covered by 40 CFR 63, subpart YY.
- Blast furnace stoves.
- Any boiler or process heater specifically listed as an affected source in another standard(s) under 40 CFR part 63.
- Temporary boilers (onsite less than 180 consecutive days).
- Blast furnace gas fuel-fired boilers and process heaters.

Maximum Achievable Control Technology (MACT)

Subcategories:

- If your new or existing boiler or process heater burns at least 10 percent coal on an annual average heat input basis, the unit is in one of the coal subcategories.
- If your new or existing boiler or process heater burns at least 10 percent biomass, on an annual average heat input basis, and less than 10 percent coal, on an annual average heat input basis, the unit is in one of the biomass subcategories.
- If your new or existing boiler or process heater burns at least 10 percent liquid fuel (such as distillate oil, residual oil), and less than 10 percent solid fuel, on an annual heat input basis, the unit is in the liquid subcategory.
- If your new or existing boiler or process heater burns gaseous fuel and less than 10 percent, on an annual average heat input basis, of liquid or solid fuel, the unit is in one of the gas subcategories.

Maximum Achievable Control Technology (MACT)

Emissions Limits and Work Practices:

- Emission limits were developed for new and existing sources for eleven subcategories, which EPA developed based on unit design.
- Fuel based emission limits for PM, HCl, Hg. Fuel and boiler design based limits for CO, dioxin/furan
- Limits for existing sources are based on top 12% of units for which EPA has data in subcategories with population greater than or equal to 30 units.
- Or top 5 units in subcategories with population less than 30 units.
- Limits for new sources are based on top performing unit in each subcategory.
- Variability was taken into account using a 99 percent upper prediction level and a fuel content variability adjustment for mercury and chloride (except biomass HCl limit).

Maximum Achievable Control Technology (MACT)

Continuous Compliance/Monitoring Requirements:

- Continuously monitor control device parameters for which operating limits have been developed, [3-hour or 12-hour?] block averages.
- If burning multiple fuels, maintain fuel mixture Hg and Cl content at or below the maximum fuel input levels established during initial performance test.
- For boilers >100 MMBtu/hr, must install a CO CEMS, 30-day averaging period.
- For boilers >250 MMBtu/hr burning coal, biomass, or residual oil, must install a PM CEMS, daily averaging period.
- Follow applicable plans, including QA requirements for monitoring systems.

Maximum Achievable Control Technology (MACT)

Notifications:

- Initial notification within 180 days of publication for existing sources, within 15 days of startup for new sources;
- Notification of intent to conduct performance test at least 30 days prior;
- Notification of compliance status within 60 days of completion of initial compliance demonstration;
- For natural gas fired units that intend to fire an alternative fuel during a curtailment period or supply interruption, a Notification of alternative fuel use within 48 hours of the declaration of a period of natural gas curtailment of supply interruption.

Maximum Achievable Control Technology (MACT)

Recordkeeping Requirements:

- Records demonstrating compliance with above requirements.
- Records documenting deviations.
- Monthly fuel use records.
- Documentation that you are not burning solid waste.

Color Code

Green = Value is achievable and has been proven.
Yellow = Value may be achievable but has not been proven.
Red = Value is not achievable or too low for reliable measurements.
Gray = Value is not addressed.

Boiler MACT (Major Source) – Proposed April 29, 2010

NESHAP 40 CFR 63 Subpart DDDDD

New & Existing Biomass Boilers

Compound	Vacated MACT Existing	Proposed Rule Existing	Vacated MACT New	Proposed Rule - New	Units
PM	0.07	**0.02**	0.025	**0.008**	lb/MMBtu
HCl	0.09	**0.006**	0.02	**0.004**	lb/MMBtu
Hg	9E-06	**9E-07**	3E-06	**2E-07**	lb/MMBtu
Dioxin (TEQ basis) (no limit under original MACT)	Susp burner / Dutch oven	**0.03**	Susp burner/Dutch oven	**0.03**	TEQ ng/dscm @ 7% O_2
	Fluidized Bed	**0.02**	Fluidized Bed	**0.007**	TEQ ng/dscm @ 7% O_2
	Fuel Cell	**0.02**	Fuel Cell	**5E-04**	TEQ ng/dscm @ 7% O_2
	Stoker/grate/other	**0.004**	Stoker/grate/other	**5E-05**	ppm @ 3% O_2
Carbon Monoxide (no limit under original MACT for existing)	Susp burner/Dutch oven	**1010**	Susp burner/Dutch oven	**1010**	ppm @ 3% O_2
	Fluidized Bed	**250**	Fluidized Bed	**40**	ppm @ 3% O_2
	Fuel Cell	**270**	Fuel Cell	**270**	lb/MMBtu
	Stoker/grate/other	**560**	Stoker/grate/other	**560**	lb/MMBtu

Boiler MACT (Major Source) – Proposed April 29, 2010

NESHAP 40 CFR 63 Subpart DDDDD

New & Existing Coal Boilers

Compound	Vacated MACT Existing	Proposed Rule Existing	Vacated MACT New	Proposed Rule New	Units
PM	0.07	**0.02**	0.025	**0.001**	lb/MMBtu
HCl	0.09	**0.02**	0.02	**6E-05**	lb/MMBtu
Hg	9E-06	**3E-06**	3E-06	**2E-06**	lb/MMBtu
Dioxin (TEQ basis) (no limit under original MACT)	Stoker/grate/other	**0.003**	Stoker/grate/other	**0.003**	TEQ ng/dscm @ 7% O_2
	Pulverized Coal	**0.004**	Pulverized Coal	**0.002**	TEQ ng/dscm @ 7% O_2
	Fluidized Bed	**0.002**	Fluidized Bed	**3E-05**	TEQ ng/dscm @ 7% O_2
	Stoker/grate/other	**50**	Stoker/grate/other	**7**	ppm @ 3% O_2
Carbon Monoxide (no limit under original MACT for existing)	Pulverized Coal	**90**	Pulverized Coal	**90**	ppm @ 3% O_2
	Fluidized Bed	**30**	Fluidized Bed	**30**	ppm @ 3% O_2
	0.07	**0.02**	0.025	**0.001**	lb/MMBtu
	0.09	**0.02**	0.02	**6E-05**	lb/MMBtu

Table 2 Summary of MACT Floor Results for the Fuel-Related HAP for Existing Subcategories

Subcategory	Parameter	PM	Mercury	HCl
Units designed for Biomass firing	No. of sources in subcategory	420	420	420
	No. of sources with data	192	91	92
	No. in MACT floor	24	11	12
	Avg. of top 12%, lb/MMBtu.	6.06E-03	3.46E-07	4.34E-03
	99% UPL of top 12% (test runs), lb/MMBtu	0.0162	7.52E-07	6.00E-03
	99% UPL with fuel variability of top 12%, lb/MMBTU		8.88E-07	

Table 3— Summary of MACT Floor Results For The Organic HAP Subcategories

Subcategory	Parameter	Dioxin/Furan (TEQ)
Stoker—Biomass	No. of sources in subcategory	**320**
	No. of sources with data	**16**
	No. in MACT floor	**2**
	Avg. of top 12%.	**0.000819 ng/dscm @ 7% O2.**
	99% UPL of top % (test runs).	**0.00339 ng/dscm @ 7% O2.**
Fluidized Bed— Biomass ...	No. of sources in subcategory	**12**
	No. of sources with data	**6**
	No. in MACT floor	**5**
	Avg. of top 12%	**0.00507 ng/dscm @ 7% O2.**
	99% UPL of top % (test runs)	**0.0127 ng/dscm @ 7% O_2.**

Table 2 Summary of MACT Floor Results for the Fuel-Related HAP for Existing Subcategories

Subcategory	Parameter	PM	Mercury	HCl
Units designed for Coal firing	No. of sources in subcategory	578	578	578
	No. of sources with data	366	285	318
	No. in MACT floor	44	35	39
	Avg. of top 12%, lb/MMBtu.	7.24E-03	5.95E-07	4.23E-03
	99% UPL of top 12% (test runs), lb/MMBtu	0.0179	1.64E-06	7.38E-03
	99% UPL with fuel variability of top 12%, lb/MMBTU		2.88E-06	1.11E-02

Table 3— Summary of MACT Floor Results For The Organic HAP Subcategories

Subcategory	Parameter	Dioxin/Furan (TEQ)
Stoker—Coal	No. of sources in subcategory	361
	No. of sources with data	14
	No. in MACT floor	**2**
	Avg of top 12%	0.00182 ng/dscm @ 7% O2.
	99% UPL of top % (test runs).	0.00274 ng/dscm @ 7% O2.
Fluidized Bed—Coal	No. of sources in subcategory	31
	No. of sources with data.	12
	No. in MACT floor.	**2**
	Avg of top 12%	0.000471 ng/dscm @ 7% O2.
	99% UPL of top % (test runs)	0.00168 ng/dscm @ 7% O2.
PC—Coal	No. of sources in subcategory	186
	No. of sources with data	10
	No. in MACT floor	**2**
	Avg of top 12%	0.00158 ng/dscm @ 7% O2.
	99% UPL of top % (test runs). .	0.00307 ng/dscm @ 7% O2.

Generally Available Control Technology (GACT)

Affected Source:

- Subpart applies to each new or existing affected industrial, commercial, or institutional boiler located at an area source of HAP.
- Existing Source: Industrial, commercial or institutional boilers for which construction or reconstruction began on or before – date of publication of proposed rule in Federal Register.
- New Source: Industrial, commercial or institutional boilers for which construction or reconstruction began after – date of publication of proposed rule in Federal Register.
- New Affected Source: Industrial, commercial or institutional boilers for which fuel switching from natural gas to coal, biomass, or oil commenced after – date of publication of proposed rule in Federal Register.
- Any industrial, commercial, or institutional boiler that was a major source on which a control device was installed after November 15, 1990, resulting in the unit becoming an area source is required to obtain a permit under 40 CFR 70 or 40 CFR 71.

Generally Available Control Technology (GACT)

Work Practice Requirements:

Source	Subcategory	Requirement
Existing Source (units with heat input capacity of less than 10 MMBtu per hour)	Coal, Biomass or Oil	Conduct a tune-up of the boiler biennially as specified in §63.11222.
Existing Source (units with heat input capacity of 10 MMBtu per hour or greater)	Coal, Biomass or Oil	Have a one-time energy assessment performed by qualified personnel on the boiler and the facility to identify cost-effective energy conservation measures. Assessment must include all components listed in 40CFR63 Subpart JJJJJJ Table 2.

Generally Available Control Technology (GACT)

Exempted Sources:

- Any boiler specifically listed as an affected source in another standard(s) under 40 CFR 63.
- Any boiler specifically listed as an affected source in another standard(s) established under section 129 of the Clean Air Act.
- Any boiler required to have a permit under section 3005 of the Solid Waste Disposal Act or covered by 40 CFR 63 Subpart EEE.
- Any boiler used specifically for research and development. Does not include boilers that only provide steam to a process or for heating at a research and development facility.
- Any gas-fired boiler.

Generally Available Control Technology (GACT)

Continuous Compliance Requirements:
Monitoring, Installation, Operation, and Maintenance Requirements

- For boilers ≥100 MMBtu/hr, must install a CO CEMS, daily averaging period.
- For boilers with an applicable opacity operating limit, must install and operate a COMS in accordance with §63.11223(d).
- Develop site-specific monitoring plan for any applicable emission limit for which you demonstrate compliance through stack testing. The site-specific monitoring plan must address §63.11223(b)(1-4)
- Monitor and collect data according to the site-specific monitoring plan
- Monitor continuously or collected data at all required intervals during the time that the affected source is operation except for during monitor malfunctions, associated requires and required quality assurance or control activities (i.e., calibration checks, zero and span adjustments).

Generally Available Control Technology (GACT)

Recordkeeping Requirements:

- Do not include data recorded during monitoring malfunctions, associated repairs, or required quality assurance or control activities in data averages and calculations used to report emission or operating levels.
- All data collected during all other periods must be used in assessing the operation of the control device and associated control system.
- Records demonstrating compliance with above requirements.
- Records documenting deviations.
- Monthly fuel type and use records.

Boiler GACT (Area Source) – Proposed April 29, 2010
NESHAP 40 CFR 63 Subpart JJJJJ

**Emissions limits apply at all times,
including periods of start-up, shutdown, and malfunction.**

Source	Subcategory	Particulate Matter (PM)	Mercury	Carbon Monoxide (CO)
New Source	Coal	0.03 lb per MMBtu of heat input	3E-06 lb per MMBtu of heat input	310 ppm by volume on a dry basis corrected to 7% oxygen (daily average)
	Biomass	0.03 lb per MMBtu of heat input	NA	100 ppm by volume on a dry basis corrected to 7% oxygen (daily average)
	Oil	0.03 lb per MMBtu of heat input	NA	1 ppm by volume on a dry basis corrected to 3% oxygen (daily average)
Existing Source with heat input capacity of 10 MMBtu per hour or greater	Coal	NA	3E-06 lb per MMBtu of heat input	310 ppm by volume on a dry basis corrected to 7% oxygen (daily average)
	Biomass	NA	NA	160 ppm by volume on a dry basis corrected to 7% oxygen (daily average)
	Oil	NA	NA	2 ppm by volume on a dry basis corrected to 3% oxygen (daily average)

Commercial and Industrial Solid Waste Incinerators (CISWI)

Affected Source:

- Solid waste incineration units at commercial and industrial facilities would be subject to the proposed CISWI standards.
- CISWI units burning agricultural materials that meet the definition of solid waste would be part of the appropriate standards under this proposed rule.
- If the unit recovers energy (e.g., boiler or process heater burning solid waste), it would be subject to the CISWI energy recovery unit subcategory.
- If the unit does not recover energy, it would be included in either the incinerators subcategory or the small, remote incinerators subcategory.
- Cyclonic burn barrels, which may be used to combust agricultural materials, would be included in either the incinerators subcategory or the small remote incinerators subcategory.

Commercial and Industrial Solid Waste Incinerators (CISWI)

Exemptions:

- Qualifying small power producers, qualifying cogeneration units and metals recovery units are expressly exempt from coverage pursuant to CAA exclusions from the definition of "solid waste incineration unit" set forth in Section 129(g)(1).
- Units that are required to have a permit under section 3005 or the Solid Waste Disposal Act (i.e., hazardous waste combustion units) are exempt from Section 129 rules per CAA Section 129(g)(1).
- Air curtain incinerators at commercial or industrial facilities combusting "clean wood" waste are also excluded from the definition of solid waste incineration unit set forth in CAA Section 129(g)(1), but that section provides that such units must comply with opacity limits.

Commercial and Industrial Solid Waste Incinerators (CISWI)

Exemptions:

- Solid waste incineration units that are included within the scope of other CAA Section 129 categories include municipal waste combustors, pathological waste incinerators (EPA intends to regulate these units under other solid waste incineration (OSWI) standards), sewage sludge incinerators (EPA currently intends to issue a regulation setting emission standards for these units by December 16, 2010), and hospital/medical/infectious waste incinerators, and these solid waste incineration units will remain exempt from the CISWI standards.

Commercial and Industrial Solid Waste Incinerators (CISWI)

Work Practice Requirements:

Source	Subcategory	Requirement
Existing Source (units with heat input capacity of less than 10 MMBtu per hour)	Coal, Biomass or Oil	Conduct a tune-up of the boiler biennially as specified in §63.11222.
Existing Source (units with heat input capacity of 10 MMBtu per hour or greater)	Coal, Biomass or Oil	Have a one-time energy assessment performed by qualified personnel on the boiler and the facility to identify cost-effective energy conservation measures. Assessment must include all components listed in 40CFR63 Subpart JJJJJJ Table 2.

Commercial and Industrial Solid Waste Incinerators (CISWI)

Continuous Compliance Requirements:
Monitoring, Installation, Operation, and Maintenance Requirements

- If using a **fabric filter** to comply, you must install and operate a bag leak detection system with an alarm such that the bag leak detection system alarm **does not sound more than 5%** of the operating time during a 6-month period. Each bag leak detection system must be installed, operated, calibrated, and maintained in a manner consistent with the manufacturer's specifications and recommendations and specifications of §60.2165(b).
- If using a **wet scrubber** to comply, continuously monitor the following operating parameters if not using CEMS: pressure drop across the wet scrubber (or amperage), scrubber liquid flow rate, and pH.
- If using an **ESP** to comply, continuously monitor the following operating parameters: voltage and secondary current (or total power input).

Commercial and Industrial Solid Waste Incinerators (CISWI)

Continuous Compliance Requirements:
Monitoring, Installation, Operation, and Maintenance Requirements

- If using an **SNCR** to comply, continuously monitor the following operating parameters: reagent injection rate (e.g., ammonia or urea) and secondary chamber temperature (if applicable to the unit).
- If using **carbon injection or dry sorbent injection** to comply, continuously monitor the following operating parameters: sorbent injection rate.
- If you use an air pollution control device **other than a wet scrubber, activated carbon injection, selective noncatalytic reduction, or an electrostatic precipitator or limit emissions in some other manner** to comply with the emission limitations under §60.2670, you must petition the Administrator for specific operating limits to be established during the initial performance test and continuously monitored thereafter. (For more details on the required components of the petition see §60.2115).

Commercial and Industrial Solid Waste Incinerators (CISWI)

Continuous Compliance Requirements:
Monitoring, Installation, Operation, and Maintenance Requirements

- Annual inspections of scrubbers, fabric filters and other air pollution control devices that may be used to meet the emission limits.
- Facilities using a CEMS to demonstrate continuous compliance with any of the emission limits of this subpart must complete the following:
  - Demonstrate compliance with the appropriate emission limit(s) using a 24-hour block average, calculated following the procedures in EPA Method 19 of appendix A-7 of this part.
  - Operate all continuous emissions monitoring systems in accordance with the applicable procedures under appendices B and F of part 60.

Commercial and Industrial Solid Waste Incinerators (CISWI)

Continuous Compliance Requirements:
Monitoring, Installation, Operation, and Maintenance Requirements

- Monitoring of bypass stack use if installed at an affected unit. Use of a bypass stack at any time is an emissions standards deviation for particulate matter, HCl, Pb, Cd, and Hg.
- Conduct annual performance tests (where appropriate) for PM and HCl emissions, fugitives from ash handling, and opacity. (If demonstrate that the unit is less than 75% of the limit for 3 consecutive years, performance testing frequency reduces to every 3 years.)
- Annual visual emissions observation (Method 22) for ash handling operations (for all subcategories except waste-burning kilns).

Commercial and Industrial Solid Waste Incinerators (CISWI)

Recordkeeping Requirements:

- Maintain for **5 years** records of the initial performance tests and all subsequent performance tests, operating parameters, quality and type of waste burned, any maintenance, the siting analysis, and operator training and qualification. (See §60.2175 for specific details)

Report	Due date	Contents
Startup notification for new units	Prior to initial startup	•Type of waste to be burned Max design waste burning capacity Anticipated maximum charge rate
Initial test report	No later than 60 days following the initial performance test	•Complete test report for the initial performance test •The values for the site-specific operating limits •Installation of bag leak detection system for fabric filter

Commercial and Industrial Solid Waste Incinerators (CISWI)

Report	Due date	Contents
Annual report	No later than 12 months following the submission of the initial test report. Subsequent reports are to be submitted no more than 12 months following the previous report	•Name and address •Statement and signature by responsible official •Date of report •Values for the operating limits •Highest recorded 3- hour average and the lowest 3-hour average, as applicable, for each operating parameter recorded for the calendar year being reported •If a performance test was conducted during the reporting period, the results of the test •If a performance test was not conducted during the reporting period, a statement that the requirements of §60.2155(a) or (b) were met •Documentation of periods when all qualified CISWI unit operators were unavailable for more than 8 hours but less than 2 weeks
Emission limitation or operating limit deviation report	By August 1 of that year for data collected during the first half of the calendar year. By February 1 of the following year for data collected during the second half of the calendar year	•Dates and times of deviations •Averaged and recorded data for those dates •Duration and causes of each deviation and the corrective actions taken •Copy of operating limit monitoring data and any test reports •Dates, times, and causes for monitor downtime incidents

Commercial and Industrial Solid Waste Incinerators (CISWI) NSPS

Proposed April 29, 2010

Emission Limits (Existing CISWI Units – NSPS 40 CFR 60 Subpart DDDD)

Compound	Incinerators (2000 CISWI limit)	Proposed CISWI Subcategories				
		Incinerators	Energy Recovery Units	Waste-burning Kilns	Burn-off Ovens	Small, Remote Incinerators
HCl (ppmv)	62	29	1.5	1.5	130	150
CO (ppmv)	157	2.2	150	710	80	78
Pb (mg/dscm)	0.04	0.0026	0.002	0.0027	0.041	1.4
Cd (mg/dscm)	0.004	0.0013	0.00041	0.0003	0.0045	0.26
Hg (mg/dscm)	0.47	0.0028	0.00096	0.024	0.014	0.0029
PM,filterable (mg/dscm)	70	13	9.2	60	33	240
Dioxin/furans, total (ng/dscm)	(no limit)	0.031	0.75	2.1	310	1600
Dioxin/furans, TEQ(ng/dscm)	0.41	0.0025	0.059	0.17	25	130
NOx (ppmv)	388	34	130	1100	120	210
SO_2 (ppmv)	20	2.5	4.1	410	11	44
Opacity (%)	10	1	1	4	2	13

Commercial and Industrial Solid Waste Incinerators (CISWI) NSPS

Proposed April 29, 2010

Emission Limits (New CISWI Units – NSPS 40 CFR 60 Subpart CCCC)

Compound	Original Limits for Incinerators (2000 CISWI limit)	Proposed CISWI Subcategories				
		Incinerators	Energy Recovery Units	Waste-burning Kilns	Burn-off Ovens	Small, Remote Incinerators
HCl (ppmv)	62	0.074	0.17	1.5	18	150
CO (ppmv)	157	1.4	3.0	36	74	4.0
Pb (mg/dscm)	0.04	0.0013	0.0012	0.00078	0.029	1.4
Cd (mg/dscm)	0.004	0.00066	0.00012	0.00030	0.0032	0.057
Hg (mg/dscm)	0.47	0.00013	0.00013	0.024	0.0033	0.0013
PM, filterable (mg/dscm)	70	0.0077	4.4	1.8	28	240
Dioxin/furans, total (ng/dscm)	(no limit)	0.0093	0.034	0.00035	0.011	1200
Dioxin/furans, TEQ (ng/dscm)	0.41	0.00073	0.0027	0.000028	0.00086	94
NOx (ppmv)	388	19	75	140	16	210
SO_2 (ppmv)	20	1.5	4.1	3.6	1.5	43
Opacity (%)	10	1	1	1	2	13

Note – new sources required to use CEMS and 24-hour block average for CO compliance.

Proposed: Boiler MACT -Boiler GACT

EPA acknowledges the following

- Regulatory requirement for fuel sampling if burning more than one type of fuel
- Fuel HAP content varies significantly
- Bi-products of combustion vary with different fuels
  - Primary organic HAP in coal is benzene formed in combustion
  - Primary organic HAP in biomass is formaldehyde formed in combustion

Proposed: Boiler MACT -Boiler GACT - CISWI NSPS
Major Regulatory Issues & Concerns

- Synthetic Minor permitting option is allowed (cap HAPs @ 10 single/25 combined tpy)
- Emission limits apply at all times, startup, shutdown
- Test with highest concentration of mercury and Cl
- Stack test defines minimum sorbent injection rate as 90% of performance test average
- Fuel sampling requirements
- Fuel type categorized by 10% minimum coal or biomass

Proposed: Boiler MACT -Boiler GACT

- Use of surrogates for regulation:
  - Pass PM filterable –HAP metals testing not required
  - Pass HCl – HAP acid gases testing not required
  - Pass CO – Non-dioxin organic HAP testing not required
- No surrogates allowed Dioxins and Furans

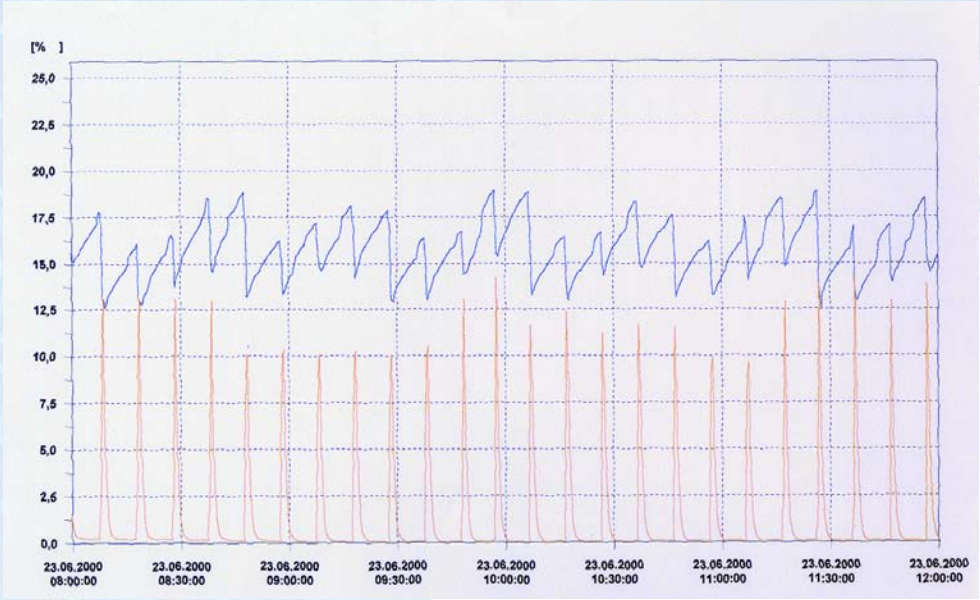
Boiler MACT (Major Source) –
Proposed April 29, 2010
NESHAP 40 CFR 63 Subpart DDDDD

Stack Testing

- All stack test runs must be at least 4 hours each
- PM - Method 5 or 17
- Hg - Method 29 or ASTM-D6784-02 (Ontario Hydro)
- HCl - Method 26A or 26 (if no entrained water droplets)
- Method 19 to convert concentration to lb/mmBTU
- CO - Method 10 or a CO CEMS
- Dioxin/Furan - Method 23

Influence of Cleaning Cycle on Particulate & Gaseous Emissions

- Primarily occur during cleaning cycle
- Reduced pressure drop minimizes cleaning cycles
- Reduced cleaning cycles reduces emissions



Influence of the cleaning cycle on the residual pollutant content in the clean gas

Gaseous Pollutant Adsorption Potential

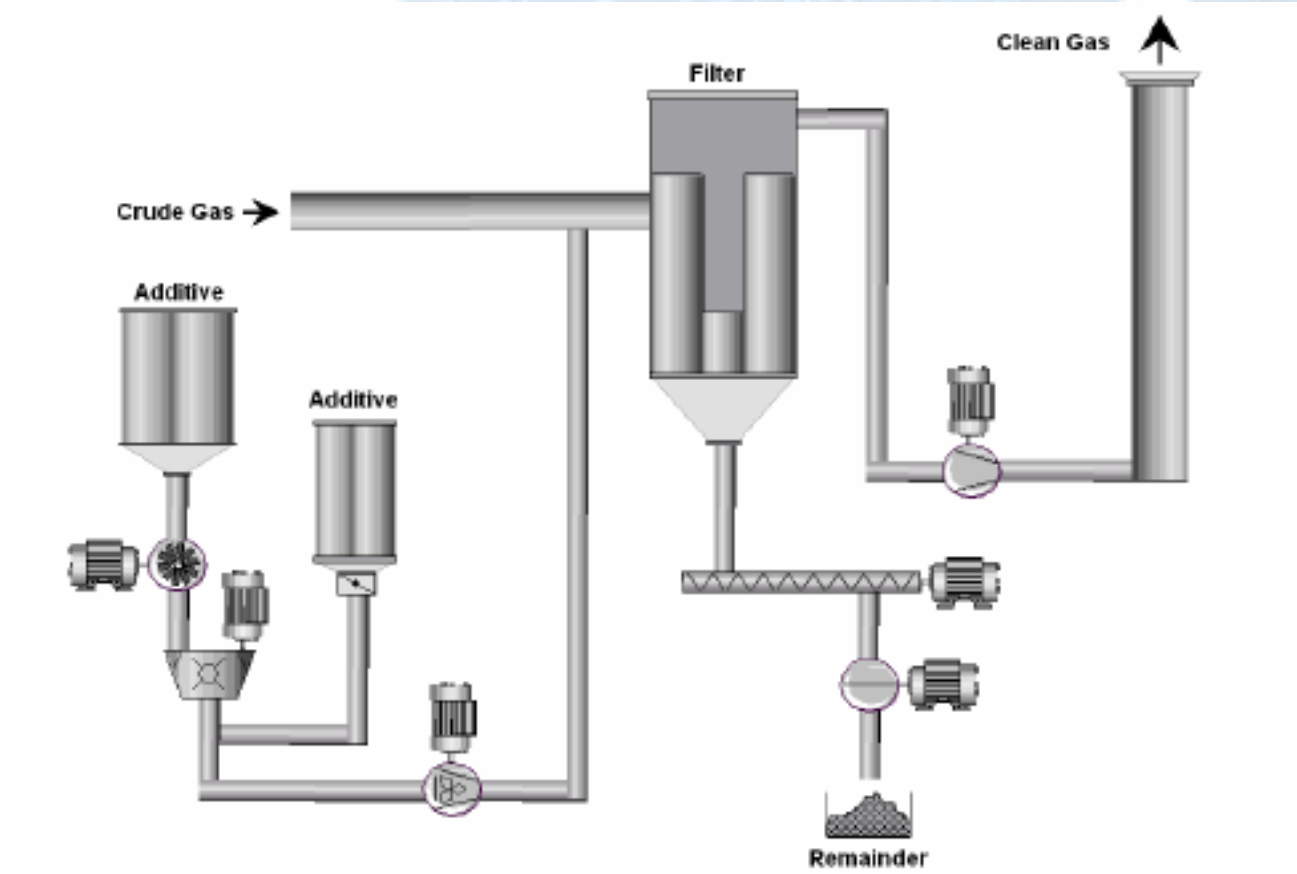
- Calcium oxide, lime (CaO)
- Calcium hydroxide, hydrated lime ($Ca(OH)_2$)
- Sodium bicarbonate ($NaHCO_3$)
- Soda ash (Na_2CO_3)
- Trona – Green River Formation ($Na_2CO_3 * NaHCO_3 * 2\ H_2O$)
- Activated carbon/open hearth furnace coke
- Metals stabilization compounds

$$\frac{\text{g pollutant}}{\text{kg adsorbent}}$$

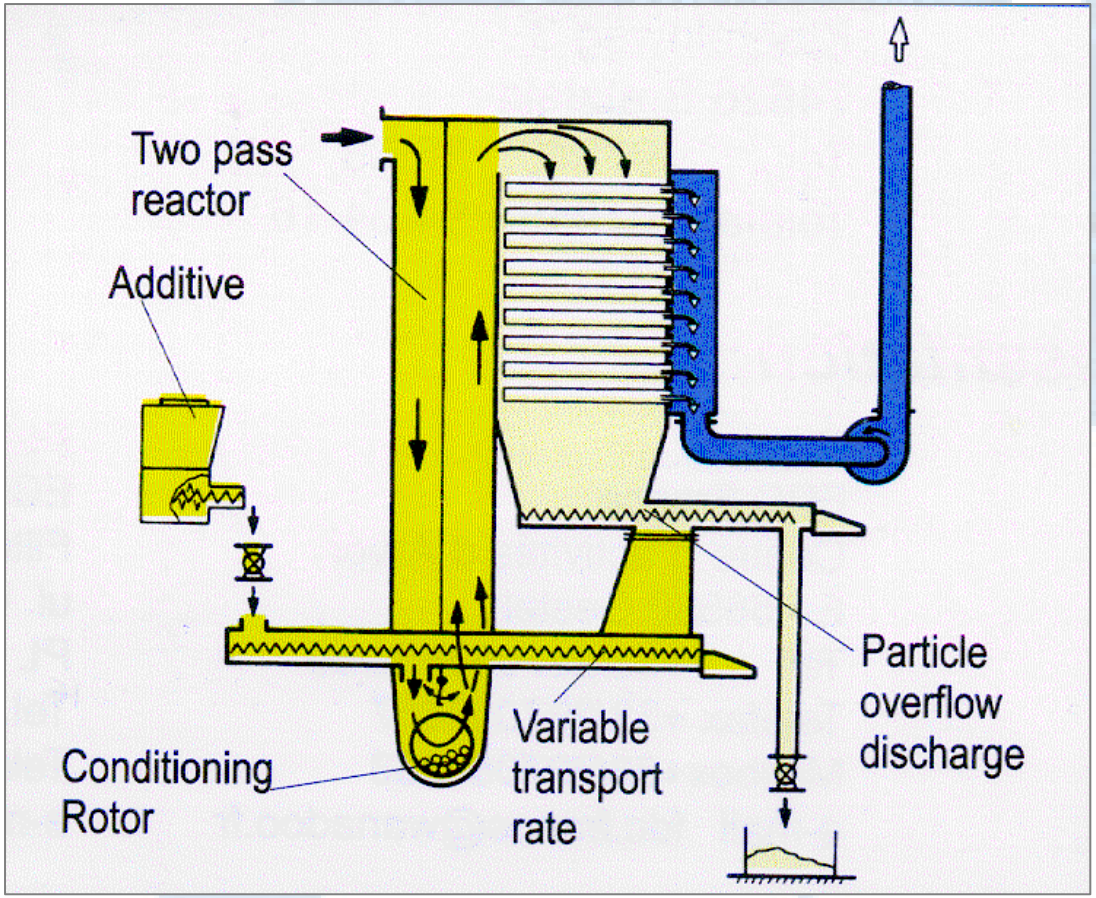
CaO	~ 64.4 g / kg
$Ca(OH)_2$	~ 24.2 g / kg
Trona	~ 85.2 g / kg
$NaHCO_3$	~ 113.5 g / kg

From 2003 tests, "Brickyard Road"

Traditional In-Duct Additive Injection System



Additive Injection System with Recycle System



Dioxin and Furan Formation

1. Don’t form it (no chlorine in fuel)
2. Dioxin/Furan forms in cooling zone => Treat it

Technology Requirements for Activated Carbon, Dioxin & Acid Gas

- Retention time (condition)
- Good contact (react)
- Maximize efficiency of carbon (reuse)
- Highly efficient fabric filtration

Design Goal ➔
Lower reagent consumption & operational costs

Mercury Dioxin Furan Adsorption Using Activated Carbon

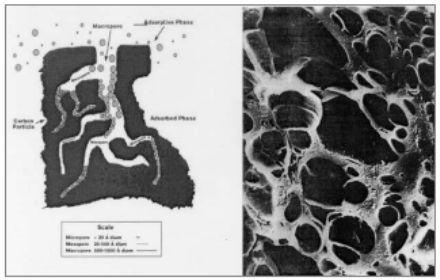
Example with Activated Coke:

Input values:
Dioxin/furan: 3 - 5 ng/Nm³ dry
Mercury: < 0.5 mg/Nm³ dry

Emission limits:
Dioxin/furan: 0.1 ng/Nm³ dry
Mercury: 30 µg/Nm³ dry

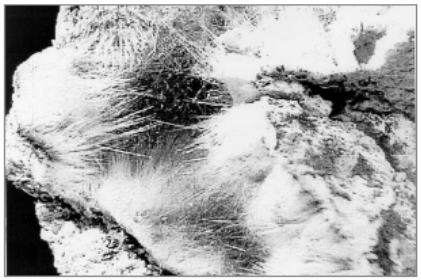
Specific injection quantity of activated coke / carbon
~ 70 mg/Nm³ dry

Carbon



Activated carbon

Zeolite



Mordenit

Additive powder quality	Open-hearth furnace coke	Activated carbon	Mordenit
Specific surface [m² / g]	~ 300	600 - 1500	~ 90
Combustible / danger of self-ignition	yes	yes	no
Danger of explosion	to be considered	to be considered	no
Costs [EUR / t] Silo vehicle ex works	~ 350 - 500	500 - 2500	~ 300 - 500

Additive powder qualities for dioxine separation — LÜHR FILTER

Norit "DARCO FGD" datasheet:
Bromophenol blue number ~ 85 minimum
Mesh size <325 mesh (45 µm) ~ 95% minimum
Bulk density ~ 32 lb/ft^3
Surface area ~ 600 m^2/g

Summary of Relevant Emission Limit Values accord. to EU Directive 2000/76/EG (Annex V)

	Daily Average (DAV)			Half Hour Average (HAV)		
	mg/m3	gr/scf	lb/mmBTU	mg/m3	gr/scf	lb/mmBTU
Overall Dust	10	0.004	0.006	30	0.012	0.018
Overall Carbon*	10	18		20	36	
HCl	10	6	0.006	60	36	0.035
HF	1	1	0.0005	4	4	0.0023
SO2	50	17	0.03	200	70	0.117
NOx *	200	97		400	194	
CO *	50	40		100	80	
Average Over Sampling Period	DAV		HAV			
Cd + Tl	0.05	mg/m3				
Hg + Hg Compounds	30	g/m³	50	g/m³		
∑ Heavy metal	0.5	mg/m3				
Dioxin + Furan	0.1	ng/m3				

WtE Plant – Wuppertal

Messkomponente	Last-Zustand	Einheit	Crude gas values: Mittelwert, Konzentration vor RGVR 31	Crude gas values: Maximum, Konzentration vor RGVR 31	Clean gas values: Mittelwert, Konzentration hinter RGVR 31	Clean gas values: Maximum, Konzentration hinter RGVR 31
Summe Cd/Tl	VL/ML	mg/m³	0,009	0,011	< 0,003	< 0,003
Hg(TMW)	VL/ML	mg/m³	0,083	0,089	< 0,001	< 0,001
Summe Sb-Sn	VL/ML	mg/m³	0,16	0,20	nn	nn
PCDD/PCDF als TE	VL/ML	ng TE/m³	2,15	2,3	< 0,001	< 0,001
Benzo(a)pyren	VL/ML	mg/m³	< 0,000002	< 0,000002	< 0,000002	< 0,000002
Summe As-Cr, BaP	VL/ML	mg/m³	0,010	0,012	nn	nn
HF	VL	mg/m³	2,9	3,1	< 0,032	0,054
Hg	VL	mg/m³	0,078	0,11	< 0,002	< 0,002
HCl	VL	mg/m³	918	947	7,7	8,9
SO2	VL	mg/m³	193	281	5	7
Gesamt-C	VL	mg/m³	-	-	0,8	1,5
HF	ML	mg/m³	3,9	4,0	< 0,020	< 0,020
HCl	ML	mg/m³	1.095	1.214	5,7	6,9
Hg	ML	mg/m³	0,088	0,10	< 0,002	< 0,002
SO2	ML	mg/m³	206	327	4	6
Gesamt-C	ML	mg/m³	-	-	0,4	0,9

VL = full load
ML = part load

Atlantic States Cast Iron Pipe

Phillipsburg, NJ

Air Flow: 55,110 dscfm
Upstream Temp: 280-290°F
6,020 flat bags ~ 59,772 ft^2
Air to cloth ratio:3.2:1 to 3.3:1
Dust recirc rate (KUV): up to 10:1
Sodium bicarbonate for SO_2 control
Enviroblend - heavy metals control
Activated Carbon for Hg control

Pre 2006 Installation		Guarantee	After Installation
Hg:	289 µg/Nm^3, total	15 µg/Nm^3	0.94 µg/Nm^3
P.M.:	3.6 gr/dscf	0.002 gr/dscf	0.0008 gr/dscf
SO_2:	50-75 ppm	N/A	8 ppm
CO:	N/A		85 ppm
NOx:	100-125 ppm		58 ppm

Recommendations

New & Existing Biomass Boilers

Compound	Vacated Existing MACT	Proposed Rule Existing	Vacated New MACT	Proposed Rule - New	Units
PM	0.07	0.02	0.025	0.008	lb/ MMBtu
HCl	0.09	0.006	0.02	0.004	lb/ MMBtu
Hg	9E-06	**9E-06**	3E-06	**2E-06**	lb/ MMBtu
Dioxin (TEQ basis) (no limit under original MACT)	Susp burner/Dutch oven	0.03	Susp burner / Dutch oven	0.03	TEQ ng/dscm @ 7% O_2
	Fluidized Bed	0.02	Fluidized Bed	0.007	TEQ ng/dscm @ 7% O_2
	Fuel Cell	0.02	Fuel Cell	5E-04	TEQ ng/dscm @ 7% O_2
	Stoker/grate/other	0.004	Stoker/grate/other	5E-05	ppm @ 3% O_2
Carbon Monoxide (no limit under original MACT for existing)	Susp burner/Dutch oven	1010	Susp burner/Dutch oven	1010	ppm @ 3% O_2
	Fluidized Bed	250	Fluidized Bed	40	ppm @ 3% O_2
	Fuel Cell	270	Fuel Cell	270	lb/MMBtu
	Stoker/grate/other	560	Stoker/grate/other	560	lb/MMBtu

Recommendations

New & Existing Coal Boilers

Compound	Vacated Existing MACT	Proposed Rule Existing	Vacated New MACT	Proposed Rule – New	Units
PM	0.07	0.02	0.025	**0.01**	lb/MMBtu
HCl	0.09	0.02	0.02	**.004**	lb/MMBtu
Hg	9E-06	3E-06	3E-06	2E-06	lb/MMBtu
Dioxin (TEQ basis) (no limit under original MACT)	Stoker/grate/other	0.003	Stoker/grate/other	0.003	TEQ ng/dscm @ 7% O_2
	Pulverized Coal	0.004	Pulverized Coal	0.002	TEQ ng/dscm @ 7% O_2
	Fluidized Bed	0.002	Fluidized Bed	**0.007**	TEQ ng/dscm @ 7% O_2
	Stoker/grate/other	50	Stoker/grate/other	7	ppm @ 3% O_2
Carbon Monoxide (no limit under original MACT for existing)	Pulverized Coal	90	Pulverized Coal	90	ppm @ 3% O_2
	Fluidized Bed	30	Fluidized Bed	30	ppm @ 3% O_2
	0.07	0.02	0.025	0.001	lb/MMBtu
	0.09	0.02	0.02	6E-05	lb/MMBtu

Recommendations

**Emissions limits apply at all times,
including periods of start-up, shutdown, and malfunction.**

Source	Subcategory	Particulate Matter (PM)	Mercury	Carbon Monoxide (CO)
New Source	Coal	0.03 lb per MMBtu of heat input	3E-06 lb per MMBtu of heat input	310 ppm by volume on a dry basis corrected to 7% oxygen (daily average)
	Biomass	0.03 lb per MMBtu of heat input	NA	100 ppm by volume on a dry basis corrected to 7% oxygen (daily average)
	Oil	0.03 lb per MMBtu of heat input	NA	1 ppm by volume on a dry basis corrected to 3% oxygen (daily average)
Existing Source with heat input capacity of 10 MMBtu per hour or greater	Coal	NA	3E-06 lb per MMBtu of heat input	310 ppm by volume on a dry basis corrected to 7% oxygen (daily average)
	Biomass	NA	NA	160 ppm by volume on a dry basis corrected to 7% oxygen (daily average)
	Oil	NA	NA	2 ppm by volume on a dry basis corrected to 3% oxygen (daily average)

Summary

- Particulate limits proposed are achievable
- Chloride limits are low but achievable
- Mercury levels have not been proven
- Dioxin formation depends on benzene and chloride in coal or fuel
- Dioxin levels are below reliable measurability
- Dioxin levels for coal are very low
- No comment on CO requirements

Proposed Boiler MACT, Boiler GACT, CISWI & Luehr Multi-Pollutant Removal Experience