

Boiler MACT Overview

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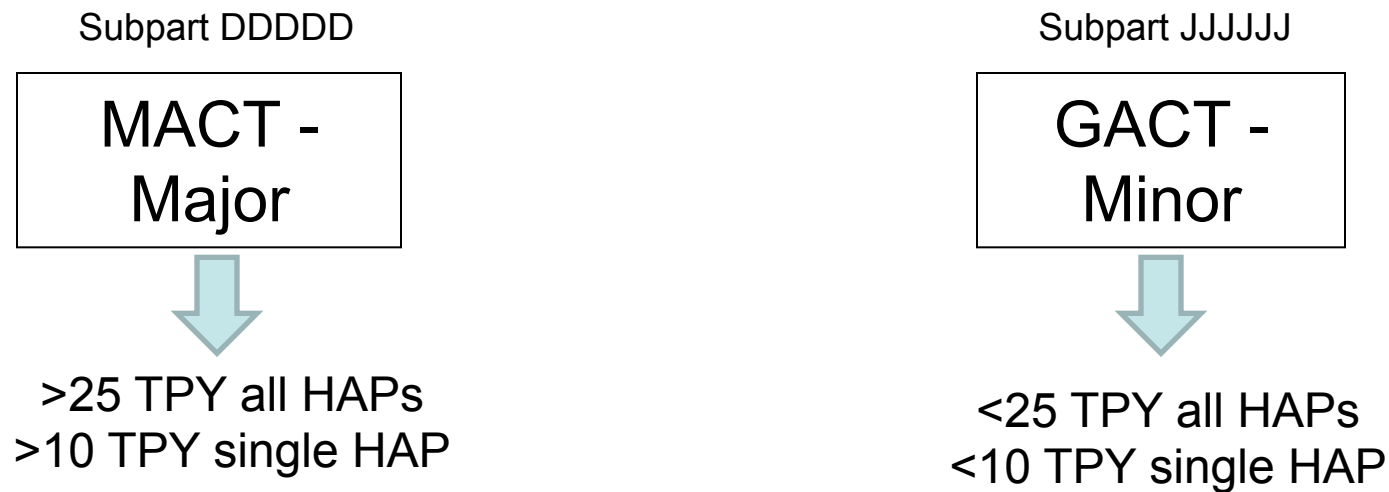
Boiler MACT 101

National Emission Standards for Hazardous Air Pollutants

are found in 40 CFR parts 61 and 63

Boiler MACT 101

- Industrial/ Commercial/ Institutional Boilers and Process Heaters, a.k.a. “Boiler MACT”
- One of 136 Federal NESHAPs
- Published in Federal Register January 2013 - after 9 years of debate, legal challenges, etc.



Maximum Achievable Control Technology

Generally Available Control Technology

Boiler MACT 101

- Four Rules to consider
 - **Maximum Achievable Control Technology** – major sources
 - Applies if a major **Hazardous Air Pollutant** source (>25 TPY all HAPs; >10 TPY any single HAP)
 - Applies to virtually any solid, liquid, or gas- fired boiler or process heater >5 MMBtu/hr

- Four Rules to consider
 - Generally Available Control Technologies – area sources
 - Minor sources
 - Synthetic area sources: major sources with existing boilers and process heaters that become area sources prior to January 31, 2016

Boiler MACT 101

- Four Rules to consider
 - Commercial / Industrial Solid Waste
Incinerators
 - Incinerators that burn solid wastes, not normally defined as “fuel”

Boiler MACT 101

- Four Rules to consider
 - Non-Hazardous Secondary Material
 - What is a waste vs a fuel

Boiler MACT 101

- Boiler MACT should not be confused with Utility MACT
 - Utility MACT targets large, coal-fired boilers used in electrical/power generation

Boiler MACT 101

- Boiler MACT targets the balance of industries other than electric generating units:

NAICS Code	Regulated Entity
211	Extractors of crude petroleum and natural gas
221	Electric, gas, and sanitary services
316, 326, 339	Manufacturers of rubber and plastic products
321	Manufacturers of lumber and wood products
322	Pulp & paper mills
324	Petroleum refineries and manufacturers of coal products
325	Chemical manufacturers
331	Steel works & blast furnaces
332	Electroplating, plating, polishing, annealing, and anodizing
336	Manufacturers of motor vehicle parts & accessories
611	Educational services
622	Health services

Definitions

- **Boiler:** *“An enclosed combustion device using controlled flame combustion and having the primary purpose of recovering thermal energy in the form of steam or hot water”*
- **Process Heater:** *“A combustion device in which combustion fuels do not directly contact the process material or gas in the combustion chamber (e.g. indirect fired)”*
 - Exemptions include: Boilers used for R&D; testing of military vessel propulsion systems; certain sized water heaters; *“temporary”* boilers/process heaters; where used as a *“control device”* that complies with another NESHAP; units complying with another NESHAP; etc.

Boilers and Process Heaters

- New: construction commenced after June 4, 2010
- Reconstructed: meet the reconstruction criteria and reconstruction commenced after June 4, 2010
- A boiler or process heater is existing if it is not new or reconstructed

Nineteen Subcategories

- Based on design type:
 - Solid fuel
 - Pulverized coal units
 - Coal-fired stokers
 - Coal-fired fluidized bed combustion units
 - Coal-fired fluidized bed combustion units with fluidized bed heat exchanger
 - Biomass-fired stokers burning kiln-dried biomass
 - Biomass-fired stokers burning wet biomass
 - Biomass-fired fluidized bed combustion units
 - Biomass-fired Dutch Ovens
 - Biomass-fired Suspension burners
 - Biomass-fired fuel cells
 - Biomass-fired hybrid suspension/grate units
 - Heavy Liquid fuel-fired units
 - Light Liquid fuel-fired units
 - Liquid fuel-fired units located in non-continental States and territories
 - Gas 1 (Natural gas/refinery gas)
 - Gas 2 (other gases)
 - Metal processing furnaces (natural gas-fired)
 - Limited-Use

Fuels Regulated

- Coal
- Biomass
- Liquid fuels
 - Heavy liquids
 - Light liquids
- Natural gas & refinery gas (Gas 1)
- Other gases (Gas 2 = coal gas, bio-gas, landfill gas)

Subcategories

- **Solid fuel subcategory** includes any boiler or process heater that burns at least 10% solid fuel on an annual heat input basis.
- **Coal subcategory** includes any boiler or process heater that burns at least 10% solid fossil fuel and no more than 10% biomass on annual heat input basis.
- **Biomass subcategory** includes any boiler or process heater that burns at least 10% biomass on annual heat input basis.
- **Liquid fuel subcategory** includes any boiler or process heater that burn any liquid fuel but less than 10% solid fossil fuel and less than 10% biomass on annual heat input basis.
 - Boilers and process heaters in the Gas 1 or Gas 2 subcategories that burn liquid fuel during periods of gas curtailment are not included in this subcategory.

Subcategories

- **Gas 1 subcategory** includes any boiler or process heater that burns only NG or refinery gas and burns liquid fuel only during periods of gas curtailment or gas supply emergencies or for periodic testing (testing - not to exceed 48 hours during any calendar year).
- **Gas 2 subcategory** includes any boiler or process heater not in Gas 1 subcategory and burns gaseous fuel and less than 10% solid fossil fuel and less than 10% biomass and no liquid fuel.
- **Limited-use boiler** means any boiler that has a federally enforceable average annual capacity factor of no more than 10 percent.

Pollutants Regulated

- Filterable PM
 - Alternate - Total Select Metals (Arsenic, Beryllium, Cadmium, Chromium, Lead, Manganese, Nickel, Selenium)
- HCl (Hydrogen Chloride)
- Hg (Mercury)
- CO (Carbon Monoxide)

Major Source Emission Standards - Existing

Subcategory	PM (lbs/MMBTU)	TSM* (lbs/mmBTU)	HCL (lbs/mmBTU)	Hg (lbs/mmBTU)	CO ppm @ 3% O ₂	Alt. CO* ppm @ 3% O ₂
Coal Stoker	0.040	5.3E-05	0.022	5.7E-06	160	340
Coal - FB	0.040	5.3E-05	0.022	5.7E-06	130	230
Coal – FB HX	0.040	5.3E-05	0.022	5.7E-06	140	150
Coal - PC	0.040	5.3E-05	0.022	5.7E-06	130	320
Wet Biomass Stoker	0.037	2.4E-04	0.022	5.7E-06	1,500	720
Dry Biomass Stoker	0.320	4.0E-03	0.022	5.7E-06	460	-
Biomass - FB	0.110	1.2E-03	0.022	5.7E-06	470	310
Biomass - Suspension	0.051	6.5E-03	0.022	5.7E-06	2,400	2,000
Biomass Dutch	0.280	2.0E-03	0.022	5.7E-06	770	520
Biomass – FC	0.020	5.8E-03	0.022	5.7E-06	1,100	-
Biomass - HY	0.440	4.5E-04	0.022	5.7E-06	2,800	900

Major Source Emission Standards - Existing

Subcategory	PM (lbs/MMBTU)	TSM* (lbs/mmBTU)	HCL (lbs/mmBTU)	Hg (lbs/mmBTU)	CO ppm @ 3% O ₂	Alt. CO* ppm @ 3% O ₂
Heavy liquids	0.062	2.0E-04	0.0011	2.0E-06	130	-
Light liquids	0.0079	6.2E-05	0.0011	2.0E-06	130	-
Non-Continental liquids	0.270	8.6E-04	0.0011	2.0E-06	130	-
Gas 1	-	-	-	-	-	-
Gas 2	0.0067	2.1E-04	0.0017	7.9E-06	130	-

* TSM as surrogate for PM; Alt CO: for use with CO CEMS

Heavy liquids = residual oils (#4, #5 & #6 oil)

Light liquids = distillate oils (#1, #2 oil, bio-diesel, vegetable oils)

Non-Continental = Hawaii, Puerto Rico, U.S. Island Territories

Gas 1 = natural gas and refinery gas

Gas 2 = Other process gases (coal gas, landfill gas, hydrogen, bio-gas)

Major Source Emission Standards - New

Subcategory	PM (lbs/ MMBTU)	TSM* (lbs/mmBTU)	HCL (lbs/mmBTU)	Hg (lbs/mmBTU)	CO ppm @ 3% O ₂	Alt. CO* ppm @ 3% O ₂
Coal Stoker	0.0011	2.3E-05	0.022	8.0E-06	160	340
Coal - FB	0.0011	2.3E-05	0.022	8.0E-06	130	230
Coal – FB HX	0.0011	2.3E-05	0.022	8.0E-06	140	150
Coal - PC	0.0011	2.3E-05	0.022	8.0E-06	130	320
Wet Biomass Stoker	0.030	2.6E-05	0.022	8.0E-06	620	390
Dry Biomass Stoker	0.030	4.0E-03	0.022	8.0E-06	460	-
Biomass - FB	0.0098	8.3E-05	0.022	8.0E-06	230	310
Biomass - Suspension	0.030	6.5E-03	0.022	8.0E-06	2,400	2,000
Biomass Dutch	0.0032	3.9E-05	0.022	8.0E-06	910	520
Biomass – FC	0.020	2.9E-05	0.022	8.0E-06	1,100	-
Biomass - HY	0.026	4.4E-04	0.022	8.0E-06	330	900

Major Source Emission Standards - New

Subcategory	PM (lbs/MMBTU)	TSM* (lbs/mmBTU)	HCL (lbs/mmBTU)	Hg (lbs/mmBTU)	CO ppm @ 3% O ₂	Alt. CO* ppm @ 3% O ₂
Heavy liquids	0.013	7.5E-05	4.4E-04	4.8E-07	130	-
Light liquids	0.0011	2.9E-05	4.4E-04	4.8E-07	130	-
Non-Continental liquids	0.023	8.6E-04	4.4E-04	4.8E-07	130	-
Gas 1	-	-	-	-	-	-
Gas 2	0.0067	2.1E-04	0.0017	4.8E-07	130	-

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Control Technologies

- Complying with MACT PM, HCl, and Hg limits:
 - Technology options for existing units:
 - PM (TSM) --- Dry ESPs, Wet ESPs, Fabric Filters, Catalyst Filters/Bag houses
 - HCl --- FGD, Wet Scrubbers, Wet ESPs, Catalyst Filters
 - Hg --- Combinations of ESPs with FFs.....or ESPs + Sorbent Injection + FFs.....
 - New technologies continuing to emerge for Hg control

Control Technologies

- Existing Solid Fuel Units – PM Controls
 - Coal units with Dry or Wet ESPs
 - Can always optimize coal units with OFA and ESP upgrades
 - Biomass units
 - Dry and Wet ESPs
 - Wet scrubbers.....not ok; will need other add-on controls

Control Technologies

- State of the art advancements in ESP technology
 - Plasma enhanced
 - Lentoid electrode
 - Tubular electrode
 - Membrane electrode
 - Five-Field
 - High frequency – high voltage rectifier
- Also ceramic bag house and catalytic ceramic bag house technology taking hold

Control Technologies

- Mercury control technologies
 - Sorbent injection
 - Activated carbon systems
 - Activated carbon/halogen systems
 - Titanium dioxide w/ UV radiation systems
 - Nano-sorbent systems

Applicable “Work Practice Standards”

- Tune-ups
 - Applicable to all affected boilers and process heaters.
- Energy Assessment
 - Applicable only to existing affected boilers and process heaters.
- Start-up & Shutdown provisions
 - ?Affirmative defense portion of “malfunctions”?

Tune-ups

- Initial tune-up
 - By compliance timetable
- On-going tune-ups
 - > 10 mmBTU/Hr = Annual
 - > 5 mmBTU/Hr but < 10 mmBTU/Hr = Biennial
 - > 5 mmBTU/Hr w/ O₂ Trim = 5 years
- A tune-up includes:
 - Inspecting burner, burner housing
 - Adjustment/cleaning of burner and fuel nozzles
 - Adjusting air:fuel ratio for to optimal levels
 - Before and after CO stack gas measurement
 - Review of fuel records

Tune-ups

- **As applicable**, inspect the burner, and clean or replace any components as necessary.
- Inspect the flame pattern, as applicable, and adjust the burner as necessary to optimize the flame pattern.
- Inspect the system controlling the air-to-fuel ratio, as applicable, and ensure that it is correctly calibrated and functioning properly.
- Optimize emissions of CO consistent with manufacturer's specifications, and with any NOx requirement to which the unit is subject.

Tune-ups

- Measure CO and oxygen before and after the adjustments are made.
 - May use a portable CO/O₂ analyzer.
- Maintain on-site and submit, if requested, a report containing:
 - The CO and oxygen measured at high fire or typical operating load before and after the adjustments;
 - Description of any corrective actions taken; and
 - Type and amount of fuel used over the prior 12 months.
- Note: Must conduct tune-up while burning fuel that provided majority of heat input over previous 12 months.

Energy Assessments

- If heat input capacity < 0.3 TBtu/yr
 - 8 hours on-site
- If heat input capacity > 0.3 TBtu & < 1.0 TBtu/yr
 - 24 hours on-site
- If heat input capacity > 1.0 TBtu/yr
 - 24 hours on-site + 8 hours for additional 1.0 TBtu of capacity

Facilities with ISO or DOE approved “energy management systems” are exempt

Energy Assessments

- Is intended to cover the operation, optimization, and efficiency of:
 - Burners
 - Feed water pumps
 - Boiler insulation and cladding
 - Super heaters
 - Air Pre-Heater
 - Economizer
 - FD Fan (and OFA Fan if applicable)
 - PRVs
 - Steam piping & insulation
 - Steam traps and condensate recovery
 - Steam end user consumption
 - Air pollution control equipment
 - ID fan and stack
- An EA is all about “reasonably” maximizing the combustion and thermal efficiency of the system

Energy Assessments

The energy assessment must include the following 7 items:

1. A visual inspection of the boiler or heater system (cracks, corrosion, leaks, insulation)
2. An evaluation of the operating affected boiler systems, specifications of energy use systems, and operating and maintenance procedures
3. An inventory of major energy consuming systems and equipment
4. A review of architectural and engineering plans, system operating logs and procedures, and fuel usage records
5. A list of major energy conservation measures that are within the facility's control
6. A list of the energy savings opportunities derived from the on-site system analysis
7. A comprehensive report detailing ways to improve efficiency, the cost of those potential energy improvements, and the timeframe for recouping investment

Qualified Energy Assessor

- EPA defines a QEA as:
 - Someone who has demonstrated capabilities to evaluate energy saving opportunities for steam generation and major energy using systems, including:
 - Boiler combustion management
 - Boiler thermal energy recovery systems
 - Feed water economizers
 - Air pre-heaters
 - Boiler blow down systems
 - Soot blowing systems
 - Primary energy resource selection
 - Fuels
 - Fuel switching
 - Applied thermal energy vs. electric alternatives
 - Insulation issues
 - Steam traps and steam leak management
 - Condensate recovery systems
 - Steam end use management and conservation

Qualified Energy Assessor

- As an individual(s) possessing the knowledge and capability including:
 - Background, experience, and recognized abilities to perform the assessment activities, data analysis, and report preparation
 - Familiarity with operational and maintenance practices for steam or process heating systems
 - Evaluating additional process heating opportunities including steam turbine operations and reducing/controlling steam demand
 - Evaluating other process heating system opportunities including utilization of waste heat recovery and proper process heating methods
 - Evaluating boiler-steam turbine cogeneration systems
 - Evaluating specific steam end-use systems
- *What this really all means is that...*
 - You are a Registered ME or ChemE with steam system experience; or
 - You are an “experienced” engineer, scientist, or technician with either:
 - Considerable steam system experience, or
 - Accredited by a University or other similar technical energy program

Start-up & Shutdown

- Requirements apply to all affected boilers and heaters
 - Start-up: *“the period between the start of first firing of fuel in the unit immediately after a shut down and until the unit first supplies steam”*
 - Shutdown: *“the period that begins when no more steam is supplied or the point where no fuel is being fired in the unit”*
- For units other than Gas 1 units, this means:
 - Control devices on and operable
 - CEMS/COMS on and operable
 - Recordkeeping
 - Start-up/shutdown procedure
 - No emissions standards apply during start-up or shutdown events

Performance Tests

- Worst case representative fuel firing
 - By pollutant
- Fuel type/mix monitoring requirements and constraints
- Operating constraints

Compliance Options

- May elect to comply with alternate TSM limit instead of PM limit.
- May elect to comply with alternate output-based limit instead of input-based limit.
- May elect to comply with alternate CO CEMS based limit instead of CO stack based limit.
- May elect to comply with mercury, HCl, or TSM limits by fuel analysis instead of by performance stack test.
 - Fuel Sampling Plans
- May elect to comply by emission averaging.
- Can earn efficiency credits from implementation of energy conservation measures to comply with output-based limits.

Compliance Timetable

- Existing units – January 31, 2016
- New units – upon startup
- Notice of Compliance Status includes:
 - Tune-up documentation
 - Energy assessment documentation
 - Fuel sampling plan (if applicable)
 - CEMS/CPMS installed and certified (where applicable)
 - CEMS – Continuous Emission Monitoring System
 - CPMS – Continuous Parameter Monitoring System
- 180 days from compliance date in which to demonstrate compliance with emission limits
 - Annual performance testing thereafter
 - Unless demonstration <75% of emission limit for 2 consecutive years, then may test triennially
- Semi-Annual and Annual reporting

Notifications

- Initial Notification of Applicability
 - Existing sources – No later than May 31, 2013
 - New sources – Within 120 days after source becomes subject
- New Sources
 - Notification to Construct
 - Notification of Actual Startup
 - within 15 days after startup

Notifications

- Notification of Performance Evaluation of Continuous Monitoring System
 - 60 days prior
- Notification of Compliance Status
 - No later than 120 days after applicable compliance date, unless conducting a performance test, then
 - Within 60 days following performance test
- Notification of fuel switch, physical change, or permit limitation resulting in applicability
 - Within 30 days of the switch/change

Notifications

- Notification of Performance Test
 - 60 days before
- Notification of intend to use another fuel during period of natural gas curtailment
 - Within 48 hours of declaration of curtailment
 - Only units in the Gas 1 subcategory
- Notification of Intent to Demonstrate Compliance by Emission Averaging
 - 180 days prior to date of testing, if requested
- Notification of Intent to commence combustion of solid waste
 - 30 days prior to date of solid waste combustion

Further Issues @ EPA

- Applicability and Legality of Upper Prediction Limit (UPL)
- Broader implications of the Sewage Sludge Incinerators (SSI) MACT ruling
- Affirmative Defense ruling
- NHSM rule
- Petitions for reconsideration of CPMS including consequences of exceeding operating parameters
- Revised CO limits
- Sierra Club and other NGOs file for broad remand

Questions?

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