Regulations
Impacting Electric Power Generators

Presented to Holland BPW

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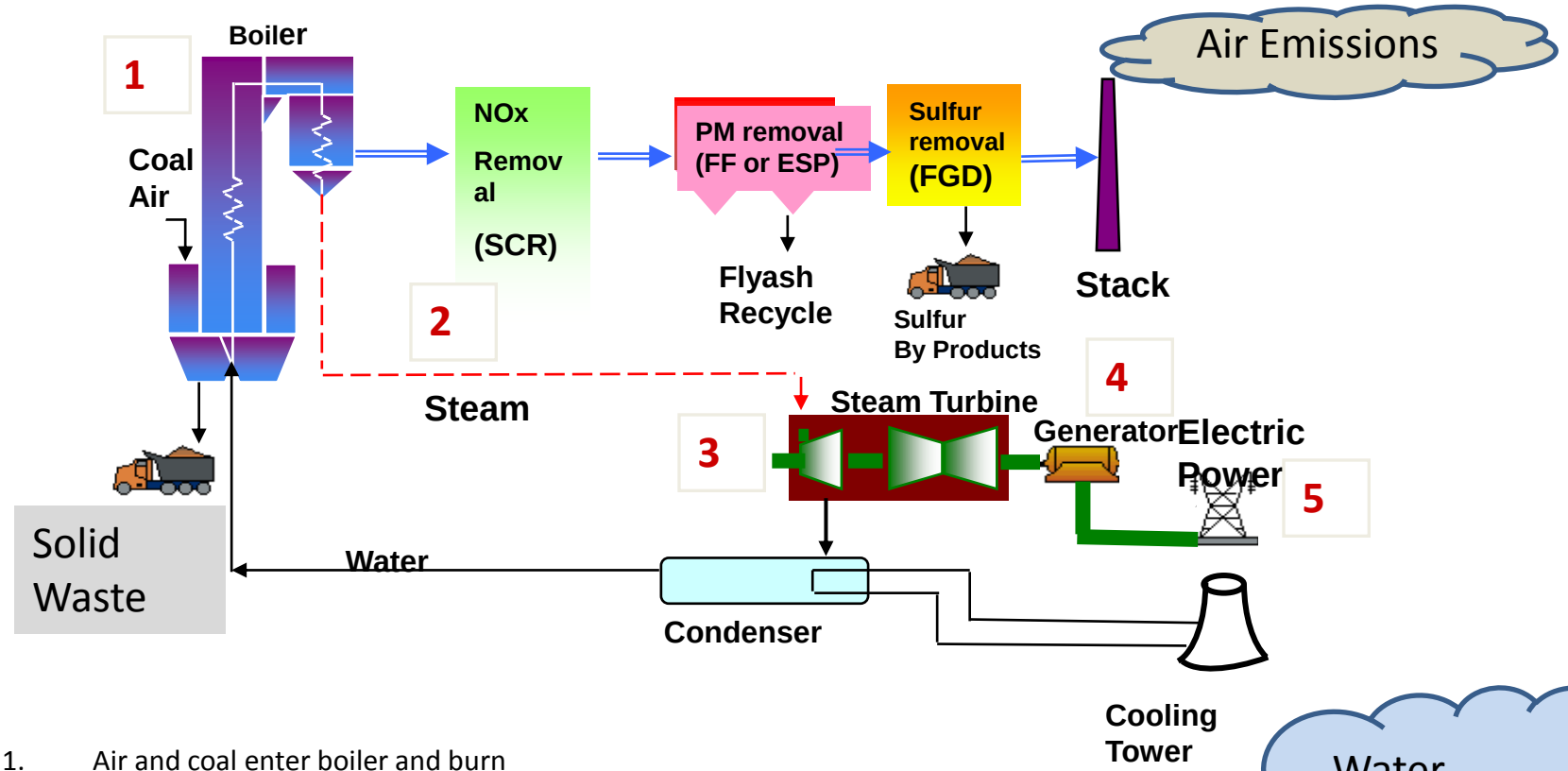
Doug Carter

Overview

- Focus is on Environmental Rules, rather than economic regulation.
- Organized by Media: Air, Water, Solid Wastes, Climate, "Issues"
- Attempt to reflect key differences by type of generation (coal, natural gas, wind)
- Approach – describe the general structure of rules, but allow time for conversation on your particular interests.
- Relevant websites identified at end.

Everything leaving a power plant is regulated



1. Air and coal enter boiler and burn
2. Heat converts water to steam
3. Steam turns blades of a turbine
4. Turbine shaft turns generator
5. Generator makes electricity

Types of Regulation

- Air (probably the most challenging for new sources)
  - New Source Review: BACT, Air Quality modeling, HAPs
  - Cross State Air Pollution Rule (CAIR)
  - NSPS: Current limits and proposed limits
  - Acid rain program
  - Proposed revisions to U-MACT (hazardous emissions)
- Water
  - Withdrawal: Cooling water intake structures
  - Emissions: Effluent guidelines
- Solid waste
  - Landfill regulations (state, proposed Federal)
- Climate: BACT, pending CO2 NSPS
- Other: Wind, the CFB permit.

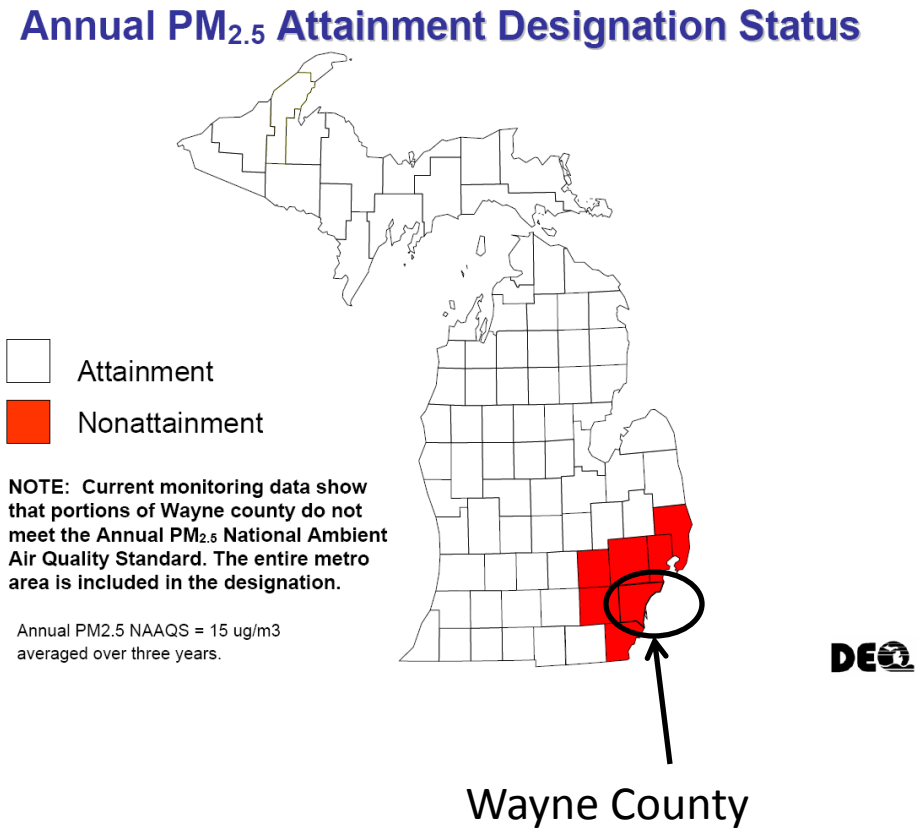
AIR: National Ambient Air Quality Standards

	Primary Standards (protect health)	
Pollutant	**Level**	**Averaging Time**
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour
	35 ppm (40 mg/m^3)	1-hour
Lead	0.15 $\mu g/m^3$	
Nitrogen Dioxide	53 ppb	
	100 ppb	
Particulate Matter (PM_{10})	150 $\mu g/m^3$	
Particulate Matter ($PM_{2.5}$)	15.0 $\mu g/m^3$	
	35 $\mu g/m^3$	
Ozone	0.075 ppm (2008 std)	
	0.08 ppm (1997 std)	8-hour
	0.12 ppm	1-hour
Sulfur Dioxide	0.03 ppm (1971 std)	Annual (Arithmetic Avg)
	0.14 ppm (1971 std)	24-hour
	75 ppb	1-hour

States submitted plans to EPA in 1971 showing how they would achieve these Standards by regulating sources of air pollution (SIPs).

Air Quality Nonattainment in Michigan

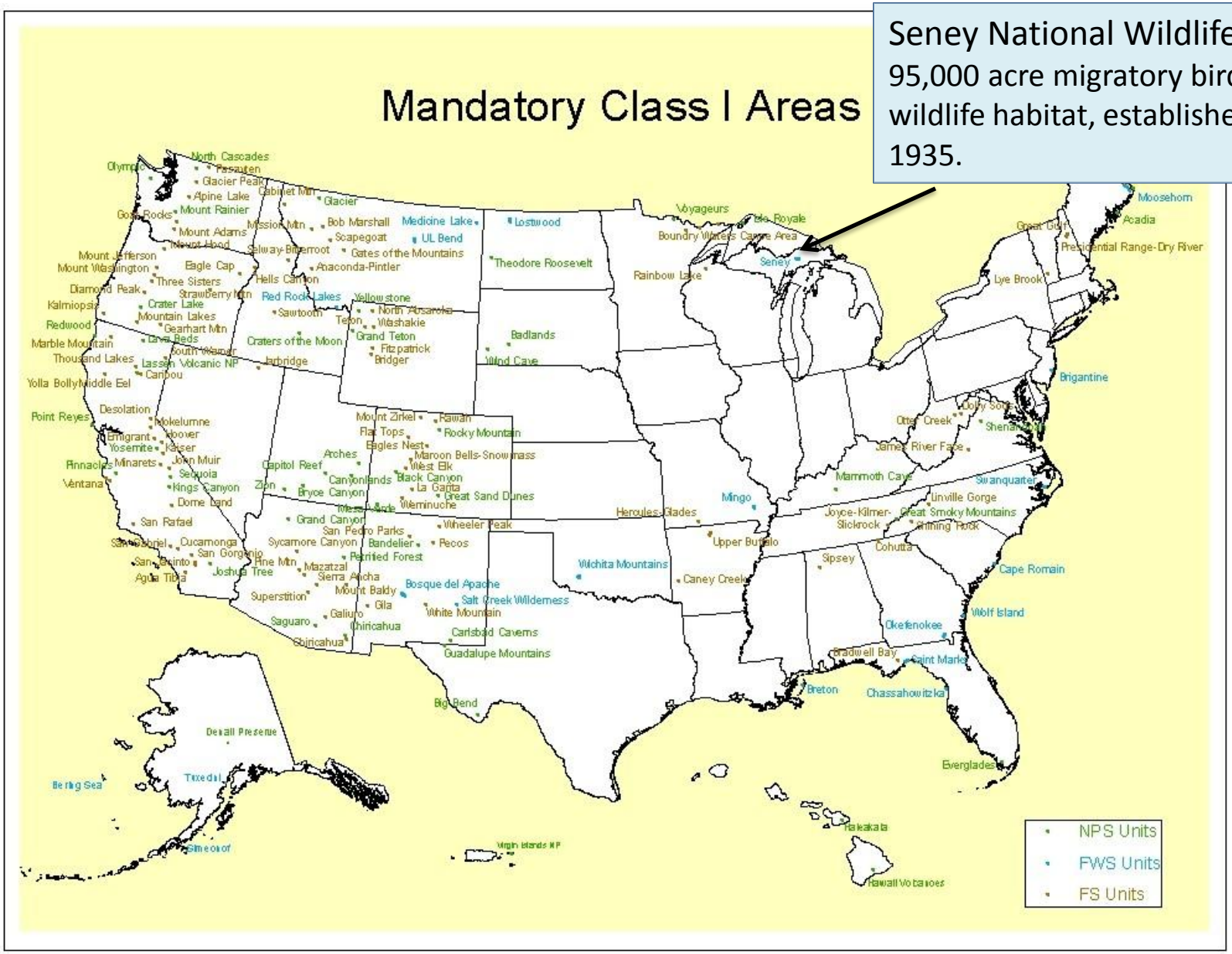
- SO2, NOx, Ozone, CO, Lead, PM2.5 24hr are all in attainment
- PM2.5 annual is in nonattainment in Detroit – Ann Arbor area
- Map shows entire metro area, but high readings are in a portion of Wayne County.



New Source Review

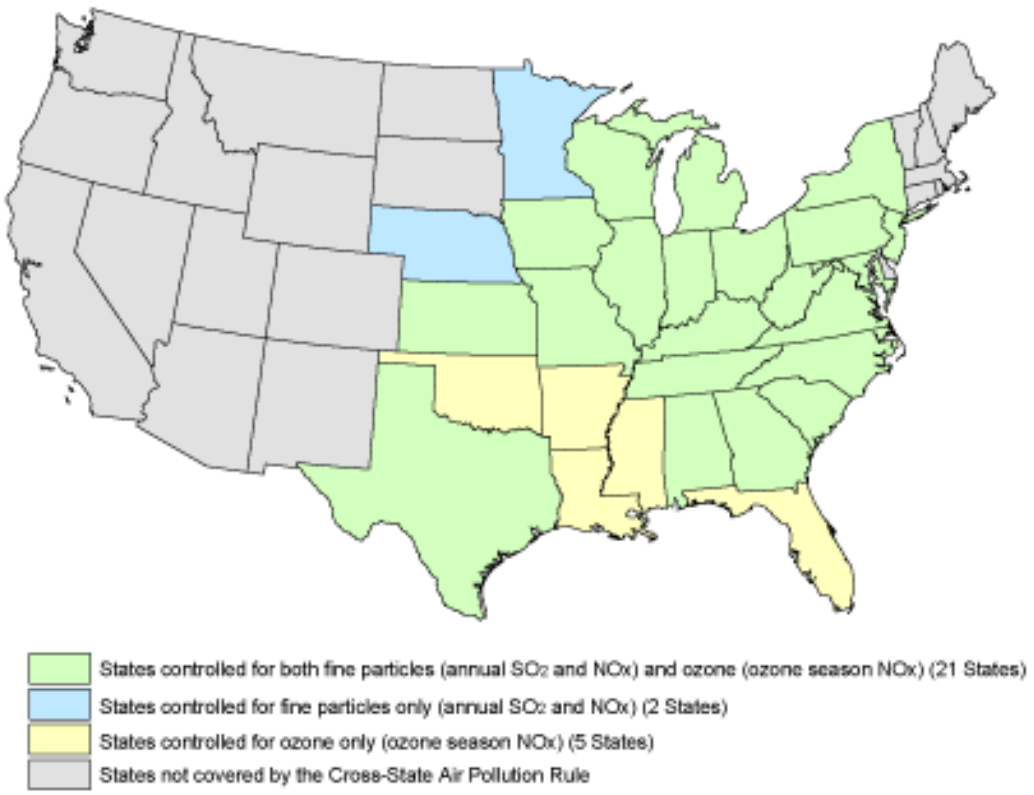
- Must obtain permit prior to construction
- Key areas of requirements
  - Best Available Control Technology for a list of regulated (nonhazardous) pollutants. Case-by-case determination by permitting authority.
  - Demonstration using complex computer models that allowed emissions will not exceed NAAQS, or exceed “PSD Increments”, which tend to be a fraction of NAAQS. Separate Increments for “Class I” areas such as National Parks.
  - General assessment of impacts on other values such as soils and vegetation
  - Public process, typically involving hearings and formal comments on proposed permit limits.

Seney National Wildlife Refuge
95,000 acre migratory bird and wildlife habitat, established in 1935.



Cross State Air Pollution Rule

- Published August 8, 2011
- Limits SO2 and NOx from power plants
- Applies to 27 eastern states
- Initial compliance period is 2012, second in 2014
- 2% of allowances are “set aside” for new sources in each state
- Greatest impact is on coal-fired systems
- For MI:
  - SO2 – 243kTPY (2010) to 144kTPY (2014)
  - NOx – 81kTPY (2010) to 58ktpy (2014)

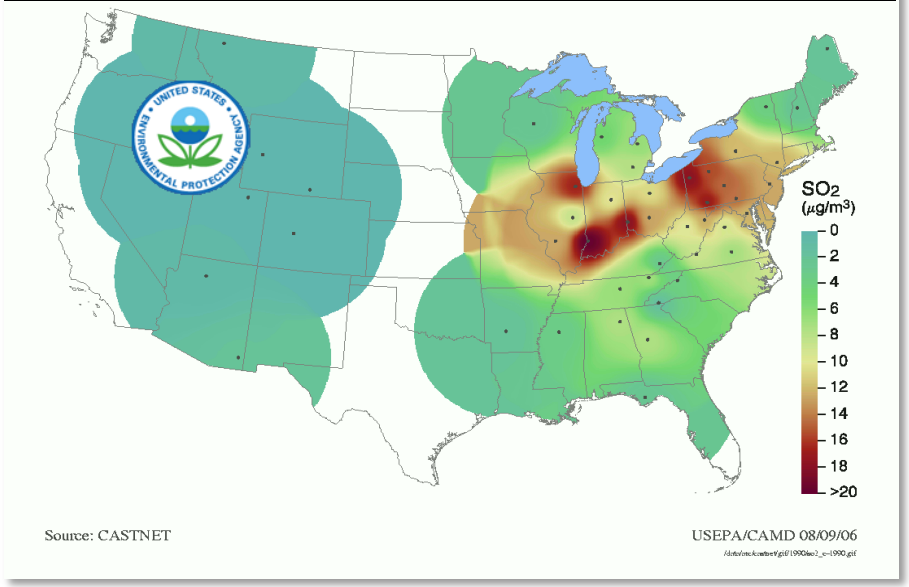


EPA Acid Rain Program

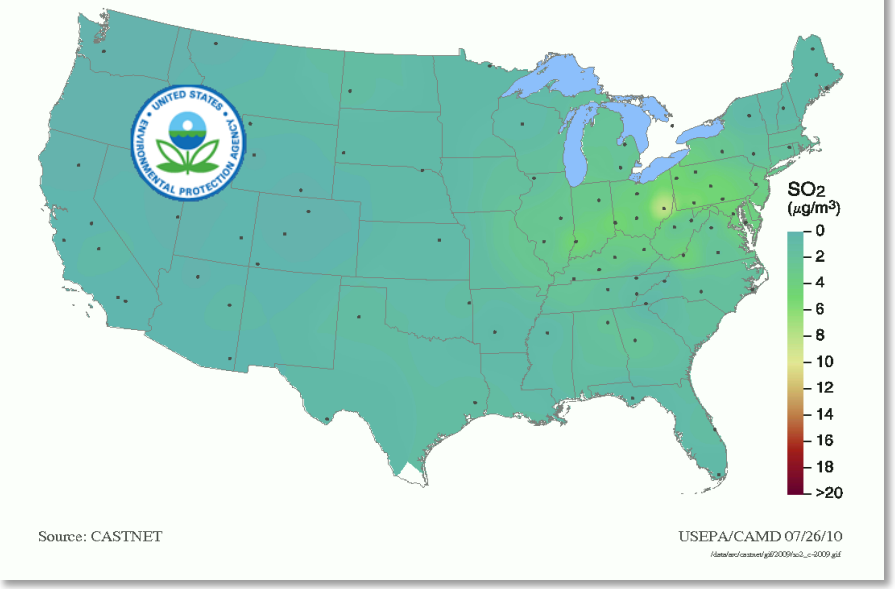
- Developed under CAA Title IV, added in 1990 amendments.
- Affected 2000 existing electric generating units >25 MW, and all new units, in 21 eastern states. Limited emissions of SO2 and NOx.
- Two phases: 1995/1996 & 2000.
- Targeted 10 million TPY reduction in SO2 and 2 million TPY reduction in NOx by 2000 (v. 1980).
- SO2 allowances based on an emission rate (2.5 or 1.2 #SO2/mmBtu) x heat input. A small auction set-aside assured allowances for new units (no free allocation).
- Region-wide trading program: EPA tracks transactions, but does not buy or sell allowances, except via annual auction.

The Acid Rain Program has improved air quality

1990 SO_2 Concentrations



2009 SO_2 Concentrations



New Source Performance Standards (air)

- Issued under CAA Sec. 111 authority
- Rules apply to SO2, NOx, PM. (Mercury NSPS limits displaced by Sec.112 “MACT” limits)
- Rules are revised over time. They apply depending on when a source commenced construction (let contracts, 40CFR60.2)
- NSPS is “best demonstrated” technology, and considers cost.
- Serve as a base for NSR “BACT” limits.

Example NSPS limits

Pollutant	**CURRENT Regulations (CC 3/1/2005-5/4/2011)**	**PROPOSED Regulations (CC > 5/4/2011)**	**KKKK (combustion turbines & NGCC)**
Filterable PM (60.42Da)	0.14 #/MWh, or 0.015 #/mmBtu; or 0.030 #/mmBtu & 99.9% redn (NG-only is generally exempt)		
Total PM		0.055 #/MWh (NG-only is exempt)	
SO2 (60.43Da & 60.4330)	1.4 #/MWh, or 95% reduction	1.0 #/MWh, or 97% reduction	0.9 #SO2/MWh, any fuel: < 0.06 #/mmBtu heat input
NOx (60.44Da & 60.4320)	1.0 #/MWh	0.7 #/MWh	For Natural Gas: 50-850 mmBtu/hr heat input: 25ppm (1.2 #/MWh). >850 mmBtu/hr: 15ppm (0.43 #/MWh)
Hg (60.45Da)	CC > 1/30/2004: Bit: 0.02 #/GWh Sub: 0.066 #/GWh (w) 0.097 #/GWh (d) Lig: 0.175 #/GWh IGCC: 0.020 #/GWh		

CC = Commenced constuction

Utility HAPs (mercury, etc.)

- Authority is Sec. 112 of Clean Air Act (NESHAPS)
- EPA regulates listed HAPs by industrial sectors
- Electric generating unit standards were adopted in 2005 (using NSPS authority instead of NESHAPS). Reviewing court vacated the rule.
- Since then, permitting authority must establish HAP limits (Maximum Achievable Control Technology) on a case-by-case basis.
- EPA proposed a new set of MACT limits in May 3, 2011 Federal Register. Final rule required by November 16, per consent decree. Focus is on coal-fired EGUs.
  - EPA proposes "surrogates" for groups of HAPs. E.g., Total PM represents non-mercury metal HAPs.
  - Limits are very stringent. Bituminous coal mercury emission limit is 1% of limit adopted by EPA in 2005 (0.0002 #/GWh v 0.02 #/GWh)
  - *New source* means any affected source the construction or reconstruction of which is commenced after the Administrator first proposes a relevant emission standard under this part establishing an emission standard applicable to such source. (40CFR63.2)

Proposed Utility HAP limits

New/Existing	Fuel	Pollutant	Limit*	Units of Standard
New	Any coal	Total PM	0.0056 #TPM/mmBtu	0.05 #/MWh
		HCl	0.000033 #HCl/mmBtu	0.3 #/GWh
		SO2	0.044 #SO2/mmBtu	0.4 #/MWh
	Bit or Sub	Hg	0.018 #Hg/TBtu (revised)**	0.00001 #/GWh (orig); 0.0002 #/GWh (rev'd)
	Lig	Hg	3.6 #Hg/TBtu	0.040 #/GWh
Existing	Any coal	Total PM	0.03 #TPM/mmBtu	
		HCl	0.0020 #HCl/mmBtu	
		SO2	0.20 #SO2/mmBtu	
	Bit or Sub	Hg	1.2 #Hg/TBtu (revised)*	
	Lig	Hg	4.0 #Hg/TBtu	

* Note: Unit conversions for new units are based on Heat Rate of 9 millionBtu/MWh.
** EPA revised certain mercury limits after the proposed rule was published, due to a math error.

In General –
New source limits are 1/5th to 1/60th the comparable limits for existing sources.

Water Regulations

- Steam-electric power plants (Coal, nuclear, NGCC) use large amounts of river/lake water to condense steam to liquid water (withdrawal).
- Several processes within a power plant can contribute water pollutants to a receiving stream or river (discharges).
- Withdrawals are regulated under Sec. 316(b) of the Clean Water Act, by placing requirements on the "cooling water intake structure". Most new steam-electric units are required to employ cooling towers to reduce the heat load on aquatic biota. Many existing power plants use "once-through" cooling water systems.
- Discharges are regulated by Effluent Guidelines (which are actually regulations) set by EPA and usually enforced by states via operating permits.
- EPA regulations are at 40CFR423.

Table 3-8. Current Effluent Guidelines and Standards for the Steam Electric Power Generating Point Source Category

Waste Stream	BPT [a]	BAT [a]	NSPS [a]	PSES and PSNS [a]
All Waste Streams	pH: 6-9 S.U. [b] PCBs: Zero discharge	PCBs: Zero discharge	pH: 6-9 S.U. [b] PCBs: Zero discharge	PCBs: Zero discharge
Low-Volume Wastes	TSS: 100 mg/L; 30 mg/L Oil & Grease: 20 mg/L; 15 mg/L		TSS: 100 mg/L; 30 mg/L Oil & Grease: 20 mg/L; 15 mg/L	
Fly Ash Transport	TSS: 100 mg/L; 30 mg/L Oil & Grease: 20 mg/L; 15 mg/L		Zero discharge	Zero discharge (PSNS only) No limitation for PSES
Bottom Ash Transport	TSS: 100 mg/L; 30 mg/L Oil & Grease: 20 mg/L; 15 mg/L		TSS: 100 mg/L; 30 mg/L Oil & Grease: 20 mg/L; 15 mg/L	
Once-Through Cooling	Free Available Chlorine: 0.5 mg/L; 0.2 mg/L	Total Residual Chlorine: If ≥ 25 MW: 0.20 mg/L instantaneous maximum; If < 25 MW, equal to BPT	Total Residual Chlorine: If ≥ 25 MW: 0.20 mg/L instantaneous maximum; If < 25 MW, equal to BPT	
Cooling Tower Blowdown	Free Available Chlorine: 0.5 mg/L; 0.2 mg/L	Free Available Chlorine: 0.5 mg/L; 0.2 mg/L 126 Priority Pollutants: Zero discharge, except: Chromium: 0.2 mg/L; 0.2 mg/L Zinc: 1.0 mg/L; 1.0 mg/L	Free Available Chlorine: 0.5 mg/L; /0.2 mg/L 126 Priority Pollutants: Zero discharge, except: Chromium: 0.2 mg/L; 0.2 mg/L Zinc: 1.0 mg/L; 1.0 mg/L	126 Priority Pollutants: Zero discharge, except: Chromium: 0.2 mg/L; 0.2 mg/L Zinc: 1.0 mg/L; 1.0 mg/L
Coal Pile Runoff	TSS*: 50 mg/L instantaneous maximum		TSS*: 50 mg/L instantaneous maximum	

Best Practicable Control Techy Best Available C T New Source Performance Std Pretreatment Stds, new/exist

Source: Steam Electric Power Generating Point Source Category: Final Detailed Study Report, USEPA, 821-R-09-008, Oct 2009.

Waste Stream	BPT [a]	BAT [a]	NSPS [a]	PSES and PSNS [a]
Metal Cleaning Wastes	TSS: 100 mg/L; 30 mg/L Oil & Grease: 20 mg/L; 15 mg/L Copper: 1.0 mg/L; 1.0 mg/L Iron: 1.0 mg/L; 1.0 mg/L	See *Chemical Metal Cleaning Wastes* below	See *Chemical Metal Cleaning Wastes* below	See *Chemical Metal Cleaning Wastes* below
Chemical	See *Metal Cleaning Wastes* above	Copper: 1.0 mg/L; 1.0 mg/L Iron: 1.0 mg/L; 1.0 mg/L	TSS: 100 mg/L; 30 mg/L Oil & Grease: 20 mg/L; 15 mg/L Copper: 1.0 mg/L; 1.0 mg/L Iron: 1.0 mg/L; 1.0 mg/L	Copper: 1.0 mg/L (daily maximum)
Non-chemical	See *Metal Cleaning Wastes* above	Reserved	Reserved	Reserved

Source: [40 CFR Part 423].

a – The limitations for TSS, oil & grease, copper, iron, chromium, and zinc are presented as daily maximum (mg/L); 30-day average (mg/L). For all effluent guidelines, where two or more waste streams are combined, the total pollutant discharge quantity may not exceed the sum of allowable pollutant quantities for each individual waste stream. BPT, BAT, and NSPS allow either mass- or concentration-based limitations.

b – The pH limitation is not applicable to once-through cooling water.

Free Available Chlorine: 0.5 mg/L; 0.2 mg/L - 0.5 mg/L instantaneous maximum, 0.2 mg/L average during chlorine release period. Discharge is limited to 2 hrs/day/unit. Simultaneous discharge of chlorine from multiple units is prohibited. Limitations are applicable at the discharge from an individual unit prior to combination with the discharge from another unit.

Total Residual Chlorine: 0.20 mg/L instantaneous maximum. Total residual chlorine (TRC) = free available chlorine (FAC) + combined residual chlorine (CRC). TRC discharge is limited to 2 hrs/day/unit. TRC is applicable to plants ≥25 MW, and FAC is applicable to plants <25 MW. The TRC limitation is applicable at the discharge point to surface waters of the United States and may be subsequent to combination with the discharge from another unit.

126 Priority Pollutants: zero discharge - 126 priority pollutants from added maintenance chemicals (refer to App. A to 40 CFR 423). At the permitting authority's discretion, compliance with the zero-discharge limitations for the 126 priority pollutants may be determined by engineering calculations, which demonstrate that the regulated pollutants are not detectable in the final discharge by the analytical methods in 40 CFR part 136.

TSS*: 50 mg/L instantaneous maximum on coal pile runoff streams. No limitation on TSS for coal pile runoff flows ≥10-year, 24-hour rainfall event.

In general, current technology is adequate to meet EGs

- Major waste water streams are from conveying ash, cooling tower blowdown, metal cleaning processes, and coal pile runoff.
- Treatment processes include various techniques to remove suspended and dissolved solids in the waste water.
  - Settling ponds allow suspended solids to sink to the pond bottom by gravity.
  - Addition of lime, iron-chloride compounds, and sulfur compound cause conversion of dissolved solids to suspended particles, and encourage agglomeration to larger particles which can be removed by filters
  - Some power plants use biological treatment similar to sewage treatment plants. Others use evaporative basins.

New Effluent Guidelines are planned

- Current EGs were last updated in 1992.
- In 2009, EPA announced a decision to develop new limits.
- A proposed rule is expected in July 2012.
- EPA is currently focused on FGD wastewater, and surface impoundments (wet storage of ash).

Solid Wastes from power plants are regulated by State

- Two major waste streams are byproducts of controlling air pollutants:
  - Calcium sulfate (gypsum) from FGD control of SO2 at coal-fired units.
  - Ash from the mineral content of coal or wood.
- Michigan Department of Environmental Quality, Waste & Hazardous Materials Division, regulates solid waste disposal.
- EPA has proposed "Coal Combustion Residuals Rule" to regulate power plant solid wastes under RCRA (power plants are currently exempt from RCRA).
  - EPA offered 2 approaches. One would be federally implemented, the other would provide guidelines to states.

Michigan regulation of power plant solid wastes

- Solid Waste Management Act Administrative rules, 2005
- Coal ash & wood ash is “low-hazard industrial waste”
- Regulated as “Type III” landfill
  - Rules control location, design, and operation
  - In general, must use a membrane liner, “compacted soil liner” (3 feet thick), or pass a hydrogeologic site evaluation
  - Groundwater monitoring conducted throughout active life and for 30 years after closure.
  - Fee/ton paid to “Perpetual Care Fund” (trust/escrow account) to ensure monitoring & remediation for 30 years after closure.

A Large Portion of Solid Wastes are Recycled

- ACAA survey found 44% of power plant solid wastes are currently recycled - typically as wallboard, or as input to cement manufacture, or road aggregate.
- Ash can be “contaminated” by other collection systems, like ACI for mercury control, or by cofiring biomass.
- It is very likely that new units will either recycle, or use dry landfills for power plant solid waste disposal.
- Pulverized coal and FBC wastes differ, but both are amenable to recycle.
- Good information available from American Coal Ash Association, http://www.acaa-usa.org/associations/8003/files/2009_Production_and_Use_Survey_Revised_100511.pdf

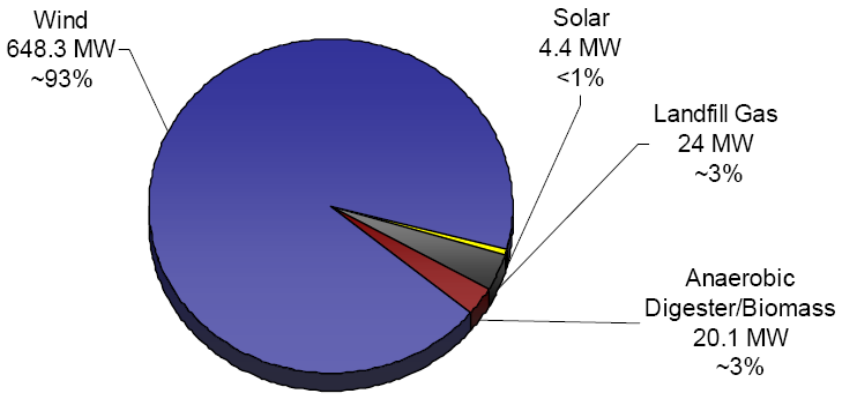
Climate Change regulation

- New fossil fuel-fired power plants must evaluate CO2 BACT as part of their air permit NOW.
  - Requirement applies to PSD permits issued after January 2, 2011.
  - If potential emission > 75,000 TPY CO2 (about 9 MWe of capacity if firing coal; about 20 MWe if gas-fired).
  - Final guidance (94 pages) issued by EPA March 2011.
- EPA was scheduled to propose NSPS limits for power plants on September 30, but has delayed the rule. A final rule is still scheduled for May 2012, per a settlement agreement. Those rules would cover both existing and new power plants.

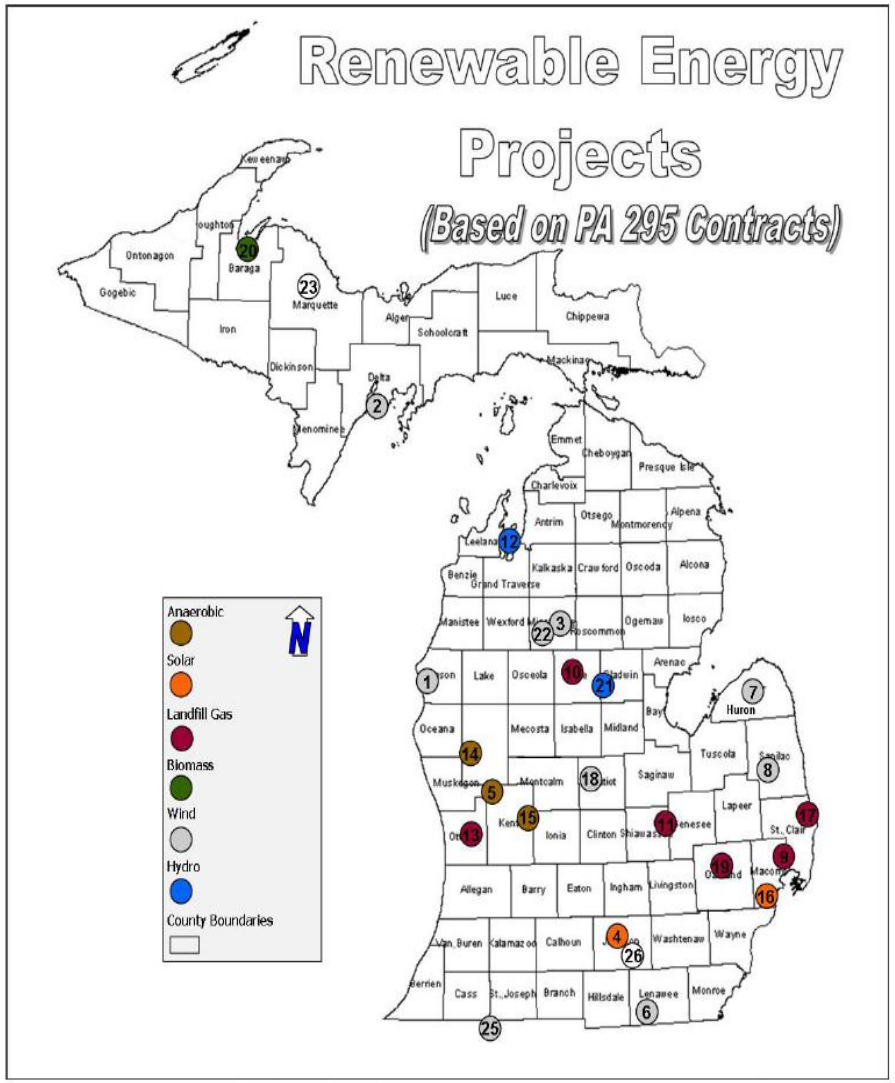
Michigan Renewable Energy Standard

- MI Public Act 295, 2008: Requires all MI utilities to supply 10% of generation from renewable energy by 2015; interim steps for 2012-2014.
- Up to 10% of the 10% (1%) can come from "advanced cleaner energy generation" (includes coal – but not gas – system w/85% CO2 capture)
- Additional requirements for very state's largest utilities.
- 2009 Average RE for State was 3.6%; HBPW was 1.9%
- All utilities have submitted plans to MI PSC showing path to meeting 10% target by 2015.
- Most common approach to date is wind generation.
- Surcharges collected in 2009 by 2 largest utilities: $60 million.

New Capacity (MW) by Technology



- Status of RE projects based on 295 contracts filed w/ MI PSC.
- Source: MI PSC Feb 2011 report.



MI Wind Energy Zone Board identified regions with greatest wind potential

- WEZB created by PSC under 2008 legislation.
- Issued its final report Oct 2009.
- Identified 4 regions with “Highest wind energy potential”.
- Two existing projects, in 2009, are at “thumb”.

Other Issues: Wind

- Wind farm regulation is different; all state-based.
- Issues include: Noise and set-back from residences, bird/bat kills, visual intrusion, radar & communications interference from EMF, low frequency vibration, shadow flicker.
- In Michigan, PSC issues a Certificate of Convenience and Necessity for the electricity, but not a state-level permit.
- MI Dept of Licensing & Regulatory Affairs provides zoning guidance to municipalities considering wind farms.
- See: http://www.glc.org/energy/wind/pdf/GLWC-LandBasedSiting-Jan2010.pdf

Other Issues: JDYoung CFB air permit

- Feb 11, 2011 air permit
- No more than
  - 50% petcoke
  - 30% TDF
  - 30% wood
  - 20% sewage sludge
- Must meet CAIR, NSPS
- Use Cooling Tower

Pollutant	**Limit**
Opacity	10%, except 20% for 6min/hr
PM	0.010 #/mmBtu
PM10	0.025 #/mmBtu & 21.6 #/hr
SO2	1.4 #/MWh gross, 30day rol. avg.
	109 #/hr, 24 hr RA
NOx	1.0 #/MWh gross, 30 d RA
	78 #/hr, 24 hr RA
CO	0.15 #/mmBtu, 30 d RA; 130 #/hr, 24 hr RA
VOC	0.0036 #/mmBtu ; 3.1 #/hr
Hg	0.0078 #/GWh gross, 12 mo RA
Pb	0.217 #/TBtu; 0.019 #/hr
H2SO4	0.006 #/mmBtu; 5.19 #/hr
HF	0.0017 #/mmBtu; 1.47 #/hr
HCl	0.063 #/mmBtu

For additional information …

AIR ISSUES

- NSR Program http://www.epa.gov/nsr/index.html
- PSD Program http://www.epa.gov/NSR/psd.html
  -NC guidance 16p http://www.ncair.org/permits/mets/psd_guidance.pdf
- NAAQS Limits http://www.epa.gov/air/criteria.html
- CAIR/CSAPR http://www.epa.gov/airtransport/

WATER ISSUES

- CWIS / 316(b) http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/index.cfm
- Effluent Guidelines http://water.epa.gov/scitech/wastetech/guide/steam_index.cfm

SOLID WASTE ISSUES

- Coal combustion residuals http://www.epa.gov/osw/nonhaz/industrial/special/fossil/ccr-rule/index.htm

CLIMATE RULES

- Air permitting requirements http://www.epa.gov/nsr/ghgpermitting.html
- MI PSC Renewable energy http://www.michigan.gov/mpsc/0,1607,7-159-16393---,00.html

Michigan DEQ – http://www.michigan.gov/deq

AirQuality http://www.michigan.gov/deq/0,1607,7-135-3306_28605---,00.html

Doug Carter
Carter1819@comcast.net
703-772-9976