Plant Level Environmental Compliance

Craig Bleth - Environmental Manager
Minnkota Power Cooperative
Minnkota Power Cooperative

- 11 member-owner cooperatives
  - 3 in ND, 8 in MN
- 12 municipals
  (Northern Municipal Power Agency)
- 143,000 customers
- 35,000 square miles
- 399 employees
Minnkota’s Generation Mix – 43% Renewables

Hydro (109 MW) (Garrison Dam) - 9%

Wind (459 MW) (Langdon, Ashtabula, Oliver III Wind Farms) - 34%

Coal (764 MW) (MRYS 1 and 2, Coyote) - 57%
Question

What agency has primary regulatory authority over North Dakota’s seven coal-based power plants?

1. U.S. Environmental Protection Agency
2. Office of Federal Surface Mining and Reclamation
3. ND Department of Health
4. ND Public Service Commission
What agency has primary regulatory authority over North Dakota’s seven coal-based power plants?

1. U.S. Environmental Protection Agency
2. Office of Federal Surface Mining and Reclamation
3. **ND Department of Health**
4. ND Public Service Commission
The Original Primary Environmental Laws

- **Air**
  - Clean Air Act of 1970

- **Water**
  - Federal Water Pollution Control Act of 1972
  - (Clean Water Act)

- **Land (Waste Disposal)**
  - Resource Conservation and Recovery Act of 1976

Did you know that EPA was created in 1970?

And that EPA now has 15,000 + employees?
These primary Environmental Laws are supported by:

1. **Amendments to the original laws (or statutes)** passed by Congress (or state legislatures)
   - A. United States Code,
   - B. ND Century Code

2. **Rules (or Regulations)** written by agencies (like EPA or the NDDH) to implement the laws passed by the legislature
   - B. Very frequent (Federal Register notices)
   - C. Guidelines (not rules, but tend to be treated like them by Agencies)
   - D. **Preamble** to draft or final regulations when published in the Federal Register (written by an Agency to explain the rationale/intent behind the rule)
     - Voluminous – Clean Power Plan (1,560 pages)
Clean Air Act of 1970

- National Ambient Air Quality Standards (NAAQS)
  - For assessment of overall ambient air quality, by state

- Criteria pollutants:
  - Nitrogen dioxide (NO\textsubscript{x})
  - Particulate matter (PM)
  - Sulfur dioxide (SO\textsubscript{2})
  - Carbon monoxide
  - Lead
  - Ozone

What is ambient air quality?

- Ambient air quality refers to the quality of outdoor air in our surrounding environment
- Air quality can be quantified by concentrations of substances identified through monitoring
  - It is typically measured near ground level, away from direct sources of pollution
Clean Air Act of 1970

100% “Attainment” States

As of two years ago, there are 15 states:
1. Arkansas
2. Georgia
3. Hawaii
4. Maine
5. Mississippi
6. Nebraska
7. Nevada
8. North Carolina
9. North Dakota
10. Oklahoma
11. Rhode Island
12. South Carolina
13. South Dakota
14. Vermont
15. Washington

Originally only six states....
Clean Air Act Amendments of 1990

- Acid rain provisions
  - $\text{SO}_2/\text{NO}_x$ emission reductions were required in 1995 and 2000
  - *Allowance trading program was established*
    - a declining number of allowances are available over time
    - Incentivized the installation of emission controls

- 1995 - Continuous Emissions Monitors (CEMS)
CEMS

- **Continuous Emissions Monitoring System**
  - Criteria Pollutants - SO$_2$, NO$_x$, PM
  - Others – Chimney Flow, CO$_2$, Hg

- **Real-time, Quality-Assured data**
  - Daily calibration (with “known” gas concentrations)
  - Quarterly linearity (accuracy across a range of concentrations)
  - Annual Relative Accuracy Test Audit (RATA) by emissions monitoring vendor
Typical Chimney

- Chimney Shell (Concrete)
- Chimney Liner (flue) (Steel or FRP)
- Umbilical
- CEMS Shelter
- Platform
- Annular Space (Stack Elevator)
- Flue Gas

Total Height 550’
How are Criteria Pollutants Controlled?

- **Criteria pollutants:**
  - Nitrogen dioxide \((\text{NO}_x)\)
  - Particulate matter (PM)
  - Sulfur dioxide \((\text{SO}_2)\)
  - Carbon monoxide
  - Lead
  - Ozone

...and Mercury
Control of $\text{SO}_2$

**Flue Gas Desulfurization (FGD) Scrubber**

Lime ($\text{CaO}$) + Sulfur Dioxide (g) $\rightarrow$ Gypsum (s)
(or Limestone)
(Sulfur from Coal)
(Solid Waste for Disposal)

$\text{CaO} + \text{SO}_2 \rightarrow \text{CaSO}_4$
SO₂ Scrubber Absorber Vessel

- 40-foot diameter, 100 feet high
Formation and Control of NO\textsubscript{x}

- Oxidized nitrogen compounds (NO\textsubscript{x}) form when:
  - Nitrogen is exposed to high temps during combustion
  - Oxygen from the combustion air is available to present to react and combine with the nitrogen

- Prevent it from forming
  - Control combustion
  - Use less air in the cyclones
  - Complete combustion in the upper furnace, at a lower temperature
  - Called Over-fire” air (or OFA”)
OFA reduces the air used in the Cyclone Barrels

Fuel-rich conditions in the staged barrels produce a lower net NOₓ formation.

Baseline Barrel

“Staged” Barrel
OFA
Post-Combustion NO$_x$ Reduction

- Take NO$_x$ out after it’s formed...

- SNCR (Selective Non-Catalytic Reduction)
  
  - Urea injection in upper furnace will react with and reduce NO$_x$
  
  - The reaction breaks down NO$_x$ to nitrogen, carbon dioxide and water
SNCR

1,650 deg. F.

2,100 deg. F.
Particulate Removal Equipment

Fabric Filter Baghouse

Electrostatic Precipitator
Mercury Controls

(Mercury and Air Toxics Standards)

- Issued in 2012
- Compliance by April 16, 2015
- Mercury Emission Limit of 4#/Tbtu
- 50-60% Removal
Clean Power Plan (CPP)

- EPA’s first effort to regulate carbon dioxide (CO₂)
- Mandates that CO₂ from power plants be reduced
- Each state given a different CO₂ requirement
  - North Dakota required to reach 45% (by rate) reduction by 2030

- Although EPA predicted reductions in electricity rates, utilities projected minimum cost increases of 50%
Goal was to achieve 32% national emission reduction by 2030 from 2005 levels

North Dakota
- Proposed Rule - 11% rate-based reduction
- Final Rule - 45% rate-based reduction (37.5% mass-basis)

No credit for renewables installed before 2013
- MPC – 359 MW, or 30% of nameplate generation not credited

EPA’s Building Blocks
- Efficiency improvement at power plants
- Replace coal with new natural gas fired plants (lower CO₂)
- Replace coal with other renewables and nuclear (no CO₂)

State Implementation Plan (NDDH) Required
Legal Controversy over CPP

- **Front Loaded (most of the reduction by 2022)**
  - Supreme Court stayed the rule due to “Irreparable Harm”
  - Allow litigation to proceed, but delayed compliance dates
  - Plaintiffs were individual utilities, associations, and 26 states

- **Significant legal questions...**
  1. Final Rule differed too greatly from Proposed Rule (a notice & comment problem)
  2. “Fenceline” issue – the utility considered the “source”, not the facility (never applied this way before)
  3. Displacement of state regulatory authority – coerces states to implement a federal energy policy (opposite of cooperative federalism)
  4. Instead of setting performance standards for a source as authorized, EPA instead required generation shifting

- Present Status – Repeal/Replace
There are Worldwide Considerations....

For every coal plant EPA predicted CPP would shut down: ...31 more are already planned or being built across the globe!

EPA-Projected Coal Retirements

Total Global Proposed Capacity: 1,167,114

Sources: U.S. Chamber of Commerce, Institute for 21st Century Energy, Coal-Fired Power Plants Planned and Under Construction (citing Platts database, September 2015); EPA CPP RIA.
1.3 Billion people worldwide are living without electricity

- The worldwide fuel of choice to generate new electricity will be coal.
- Clean coal technologies developed in the U.S can be exported to nations that will use coal-fired electricity to eradicate energy poverty.

Source: Mike Nasi, April 19, 2017
The primary ‘criteria pollutants’ that power plants must currently manage are:

1. Nitrogen dioxide (NO\textsubscript{x})
2. Sulfur dioxide (SO\textsubscript{2})
3. Particulate matter (PM)
4. Sulfur trioxide (SO\textsubscript{3})
5. Carbon dioxide (CO\textsubscript{2})
6. Items 1 through 3
7. All of the above
8. None of the above
The primary ‘criteria pollutants’ that power plants must currently manage are:

1. Nitrogen dioxide (NOₓ)
2. Sulfur dioxide (SO₂)
3. Particulate matter (PM)
4. Sulfur trioxide (SO₃)
5. Carbon dioxide (CO₂)
6. **Items 1 through 3**
7. All of the above
8. None of the above
Air Monitoring Activity

- Build your own air monitor
- Materials:
  - Container (milk carton or coffee can)
  - String (for hanging) or pole
  - Black permanent marker
  - Vaseline
  - Hole punch
  - Magnifying lens
Current Solid Waste Regulations

North Dakota Solid Waste Management Rules

- Permitting and requirements for landfills for coal ash and FGD waste
- Liners, groundwater monitoring and financial assurance required

- New Federal Coal Combustion Residuals Rule ("CCR" Rule, effective April, 2015)
  - Layered “Over the Top” of existing ND Rules
  - Public-facing websites required
  - No permitting, but reliance on “citizen lawsuits” by E-NGO’s (Sierra Club, NRDC, etc.)
  - Similar to ND Rules, although there are some conflicting requirements
Composite Liner Construction

Clay and Synthetic Membrane (HDPE)
Beneficial Uses of Coal Combustion Products
Current Water Regulations

- North Dakota Pollutant Discharge Elimination System (NDPDES) permits
  - Point Sources
  - Sampling and reporting
  - Effluent limitations

- Stormwater permits
  - Non-Point Sources
  - Sampling and reporting

- Spill Prevention and Countermeasures Plans (SPCC)
  - Oil spill prevention
Conclusion - Key Points

- Regulations and standards apply to all facilities
- Compliance with regulations is non-negotiable
- Every facility has unique design circumstances and may have different emission control line-ups
- Investments in technology have reduced emissions dramatically
  - $2 billion in APC installed in ND ($400M at MRYS)
  - $100 million per year in O&M ($15M/year at MRYS)
- Advances in technology continue to be made
- Our industry has a history of meeting the challenge of new regulations
- Technology being developed in the U.S. is state-of-the-art
- Technology developed here will meaningfully impact the worldwide development and use of coal
Young Station Unit 2 Chimney Foundation

- 42 miles of Rebar
- 1\(\frac{3}{8}\) inch diameter
Young Station Unit 2 Chimney Foundation (Getting Ready – about 8:00 a.m.)
18 Hours Later – about 2:00 a.m.
26 Hours Later – 10:00 a.m.
The following summer...
Media Coverage

**Power Company Plans Monster Concrete Pour**

*By Associated Press*

KXTV-12
Verified 1:35 a.m. CT, Thurs., Sept. 30, 2009

Minnkota power cooperative is planning to pour 5,000 cubic yards of concrete as a foundation for a new emission stack next weekend. Minnkota engineer Kevin Thomas said the foundation will be 11 feet thick by 140 feet across and will support an emission stack 600 feet high when it goes up next year.

A pair of batch plants will be set up on site, and a convoy of 30 trucks will be available. Foundation will use fly ash from the coal-firing plant near Minnkota.

**Trump's 'Big Pour' topped by Minnkota**

*By LAUREN DONOVAN*

Bismarck Tribune

09-30-2009: news-local

Trump's 'Big Pour' topped by Minnkota

Minnkota Power Cooperative Wednesday topped Trump's record for a continuous concrete pour by a long way...
Questions?