

# Marcellus Shale Gas Air Quality Issues

MASS-A&WMA Conference

Environmental Aspects of Shale Gas Development

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Presented by:

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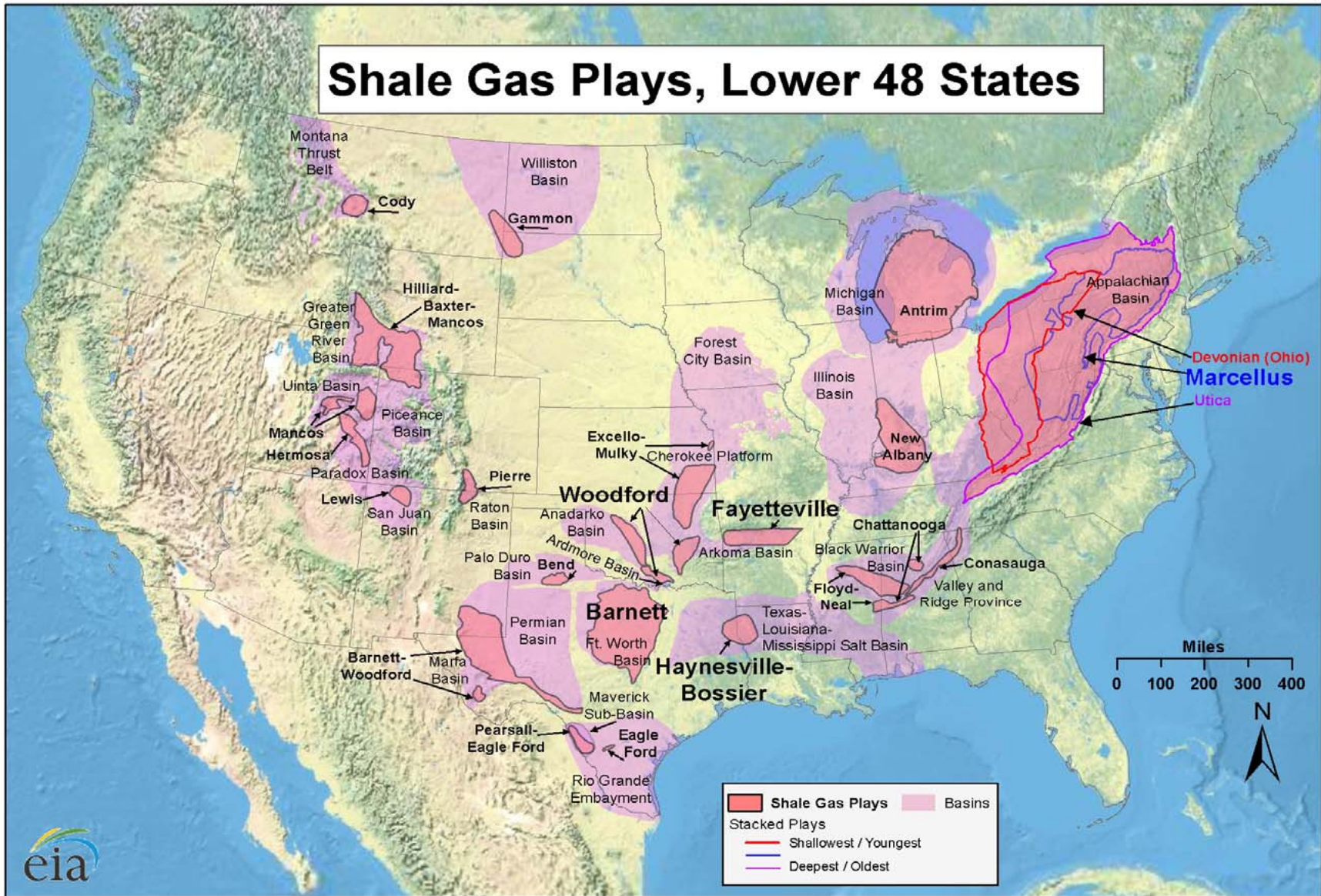
Air & Waste Management  
A s s o c i a t i o n  
Mid-Atlantic States Section

# Overview

- Extent of Shale Gas Formations
- Sources of Air Emissions
- Pollutants Emitted
- Air Quality Permitting
- Source Definition - Aggregation
- GHG Tailoring Rule
- Federal Regulations

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# Shale Gas Plays, Lower 48 States



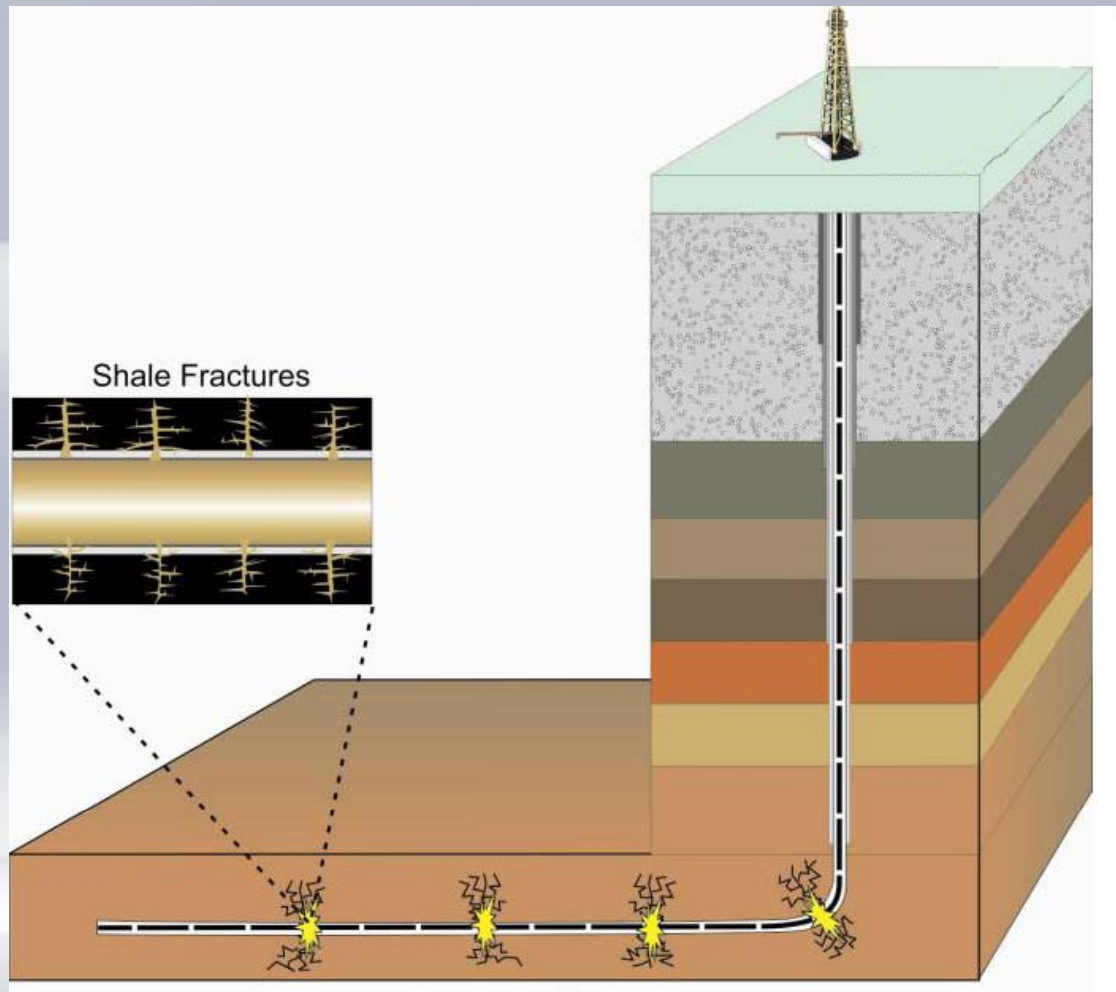
Source: Energy Information Administration based on data from various published studies.  
 Updated: March 10, 2010

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# Sources of Air Emissions

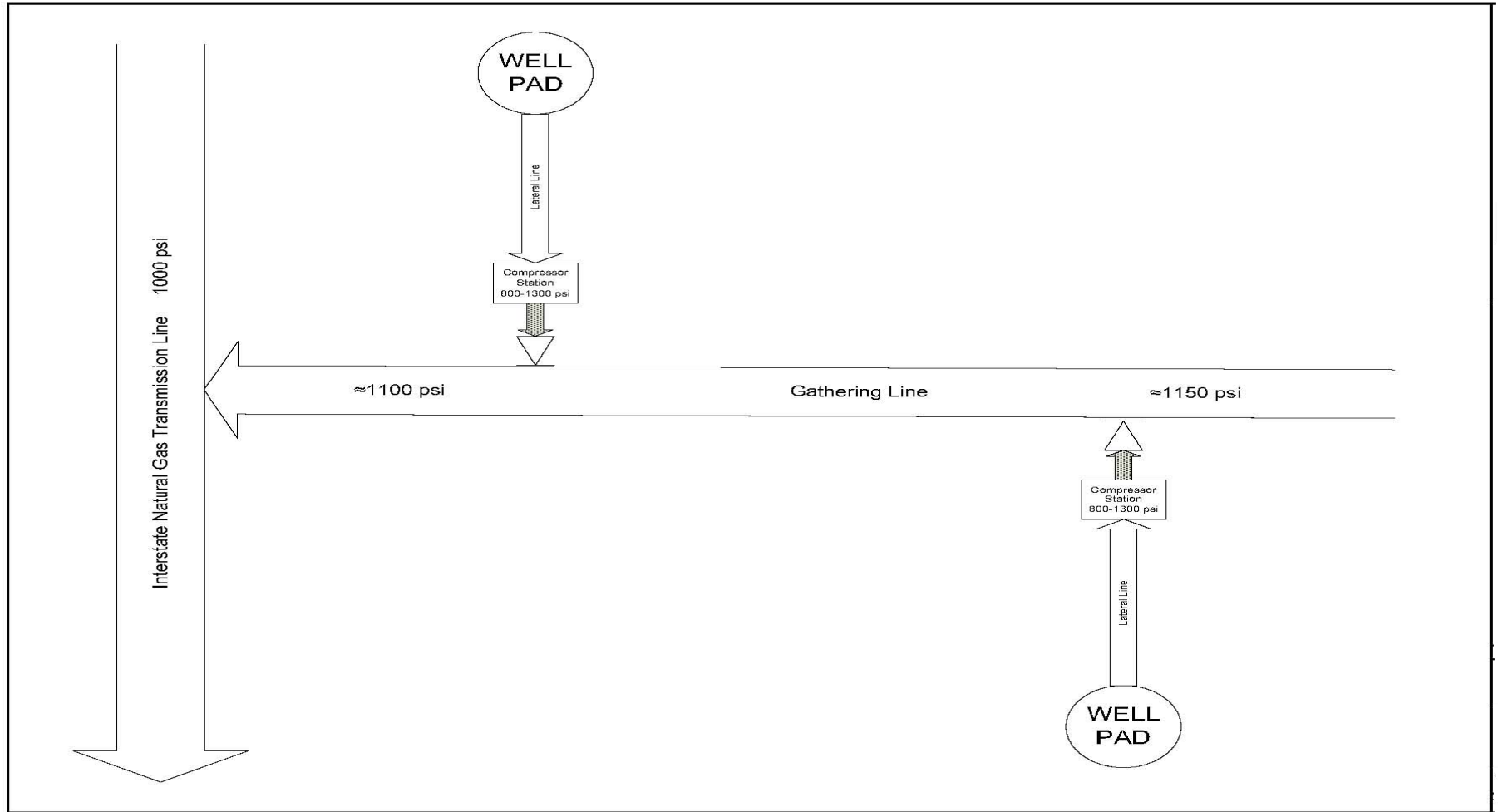
- Sources of emissions
  - Well Development
    - Drilling
    - Fracturing shale formations
    - Initial well completions
  - Gas Compression Stations
    - Reciprocating internal combustion engines
    - Dehydration units
    - Separators
    - Re-boilers

# Shale Gas Wells



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# Gas Collection & Transmission



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# Pollutants Emitted

- Emission Profiles
  - Combustion products
    - Nitrogen oxides (NO<sub>x</sub>)
    - Carbon monoxide (CO)
    - Particulate matter (PM/PM<sub>10</sub>/PM<sub>2.5</sub>)
    - Sulfur dioxide (SO<sub>2</sub>)
    - Total Hydrocarbons (THC/VOCs)
  - Process Emissions
    - Methane (GHGs)
    - Total hydrocarbons (THC/VOCs)
    - Hazardous Air Pollutants (HAPs)

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# Air Quality Permitting

- Permits and Rules
  - State “pre-construction” air permitting requirements
  - Federal “pre-construction” air permitting requirements
  - State/Federal operating permit requirements
  - State implementation plan (SIP) rules
  - Federal rules (e.g., NSPS and NESHAP)



# Air Permitting Process

- Individual air permit construction applications and operating permits
- General Operating Permits
- Public Notices
- Public Hearing
- Municipal Notifications

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# Pennsylvania Permitting

- List of exempt activities (subject to change)
- General permits (limits on application – 30 day issuance)
  - GP-5 (Natural Gas Production Facilities) – Proposed revisions out for public comment
  - GP-9 (Diesel IC Engines)
  - GP-11 (Non-road engines for drilling and temporary generators)
- State Minor Source Permit (Not subject to Title V)
- Nonattainment areas
  - Ozone (Pennsylvania part of Ozone Transport Region)
  - PM<sub>2.5</sub>
- State BAT for Minor Source Permits

# West Virginia Permitting

- List of exempt activities (subject to change)
- General permits (limits on application – 45 day issuance)
  - G30-D (Natural Gas Production Facilities - NGPF)
  - G33-A (NGPF – adds engines subject to Part 60, Subpart JJJJ)
  - G35-A (NGPF - with glycol dehydration units)
- Rule 13 , Minor Source Permit (no State BAT)
- Nonattainment areas
  - Ozone (NOT part of the Ozone Transport Region)
  - PM<sub>2.5</sub>

# Ohio Permitting

- List of exempt equipment and activities (subject to change)
- General permits (typical issuance less than 30 days)
  - GP 5.1 and 5.2 (Unpaved Roads and Parking Lots)
  - **GP 12 (Oil and Gas Well-Site Production Operations)**
- State Minor Source Permit (Not subject to Title V or NSR)
- Nonattainment areas
  - Ozone (NOT part of the Ozone Transport Region)
  - PM<sub>2.5</sub>
- State BAT for Minor Source Permits
  - Established in general permit for affected sources

# Ozone Nonattainment

- Northeast Ozone Transport Region (OTR)
  - Established by § 7511c (a) of the Clean Air Act (CAA)
  - Includes Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, New York, New Jersey, Pennsylvania, Maryland, Delaware, the northern counties of Virginia, and the District of Columbia
  - Entire area is minimally considered as a moderate ozone nonattainment area

# Ozone Nonattainment

## ▪ OTR Requirements

- §7511c (b)(1)(A): enhanced vehicle inspection and maintenance
- §7511c (b)(1)(B): Reasonably Available Control Technology (RACT) for major (> 50 ton) VOC sources
- §7511a (b)(1)(A)(ii)(II): RACT for major (>100 to) NO<sub>x</sub> sources
- §7511c (b)(2):
  - Any stationary source that emits or has the potential to emit at least 50 tons per year of VOC shall be considered a major stationary source
  - Such sources shall be subject to the requirements which would be applicable to major stationary sources if the area were classified as a moderate nonattainment area.

# Ozone Nonattainment

- Nonattainment New Source Review (NSR) Requirements
  - 100 tpy major source threshold for NO<sub>x</sub> nonattainment NSR (NNSR) permitting vs. 250 tpy in “attainment areas”
  - 50 tpy major source threshold for VOC NNSR permitting vs. 250 tpy in “attainment areas”
  - For existing facilities, aggregation of contemporaneous VOC or NO<sub>x</sub> emission increases
  - Lowest Achievable Emission Rate (LAER) and emission offset requirements

# PM<sub>2.5</sub> Nonattainment

- Scattered fine particulate matter (PM<sub>2.5</sub>) non-attainment areas throughout state
  - Major modification threshold is 10 tpy and includes condensable PM
  - PM<sub>2.5</sub> NNSR rules include aggregation of contemporaneous PM<sub>2.5</sub> emission increases
  - Sulfur dioxide (SO<sub>2</sub>) is a PM<sub>2.5</sub> precursor
  - NO<sub>x</sub> is a precursor pollutant for PM<sub>2.5</sub> emissions



# PM<sub>2.5</sub> Nonattainment

- Significant increase in PM<sub>2.5</sub> precursors (NO<sub>x</sub> and SO<sub>2</sub>) in PM<sub>2.5</sub> nonattainment area triggers NNSR
- PM<sub>2.5</sub> Emission Reduction Credits (ERCs) are generally not available
- Direct PM<sub>2.5</sub> ERCs and PM<sub>2.5</sub> precursor ERCs must be in the vicinity of the project

# Prevention of Significant Deterioration

- Best Available Control Technology (BACT)
- Ambient air quality impacts analysis
- “Double Jeopardy” for ozone and PM<sub>2.5</sub> precursor pollutants NO<sub>2</sub> and SO<sub>2</sub>
- Stringent new National Ambient Air Quality Standards (NAAQS) for PM<sub>2.5</sub>, NO<sub>2</sub>, and SO<sub>2</sub>

# Source Definition for Permitting

- **Source Aggregation**
  - Why is aggregation important?
    - PTE of “source” defines air permitting requirements (and schedule)
    - The definition of “source” under NSR and Title V has its roots in the case of *Alabama Power v. Costle*, 636 F.2d 323 (D.C. Cir. 1979)
    - Source was limited by the four statutory terms, “structure, building, facility or installation”
    - U.S. EPA can treat contiguous and commonly owned units as a single source if they fit within these terms

# Source Definition for Permitting

- The U.S. EPA defined “stationary source” facility to mean any building, structure, or facility which meets three criteria:
  - (1) belong to the same two-digit SIC Code;
  - (2) are under the control of the same company; and
  - (3) are located on one or more contiguous or adjacent properties

# Source Definition for Permitting

- U.S. EPA issued source aggregation guidance for oil and gas activities (Jan. 2007)
  - Guidance indicated that well sites and other production activities occurring over large geographical distances should be treated as separate sources
  - U.S. EPA withdrew the January 2007 guidance (Sept. 2009)
- Pennsylvania issued aggregation guidance document in 2011 that included a “distance” test

# GHG Tailoring Rule

- PSD for GHGs is triggered for new construction projects that result in GHG emissions of at least 100,000 tpy regardless of any other pollutant
- Modifications at existing major facilities that result in GHG emissions increases of 75,000 tpy
- Facilities that emit at least 100,000 tpy of GHG as CO<sub>2</sub>e will be subject to Title V permitting

# Federal Regulations

- Standards of Performance for New Stationary sources (NSPS) requirements
  - 40 CFR Part 60 Subpart KKK – Standards of Performance of Equipment Leak VOC from Onshore Natural Gas Processing Plants
  - 40 CFR Part 60 Subpart LLL- Standards of Performance for Onshore Natural Gas Processing: SO<sub>2</sub> Emissions
  - 40 CFR Part 60 Subpart JJJJ– Standards of Performance for Stationary Spark Ignition Internal Combustion Engines
  - 40 CFR Part 60 Subpart IIII – Standards of Performance for Compression Ignition Internal Combustion Engines
  - 40 CFR Part 60 Subpart KKKK—Standards of Performance for Stationary Combustion Turbines

# Federal Regulations

- NESHAP requirements – major and possibly area sources of HAP
  - 40 CFR Part 63 Subpart HH – National Emission Standards for Hazardous Air Pollutants from Oil and Natural Gas Production Facilities
  - 40 CFR Part 63 Subpart HHH – National Emission Standards for Hazardous Air Pollutants: Oil and Natural Gas Production and Natural Gas Transmission and Storage
  - 40 CFR Part 63 Subpart ZZZZ - National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion engines



# Proposed Federal Regulations

- Part 60, Subpart OOOO
  - VOC emissions from all oil and gas operations not already covered under Subpart KKK which include:
    - Well completions - “green completions”
    - Compressors
    - Pneumatic Controllers
    - Condensate and Crude Oil Storage Tanks

# Proposed Federal Regulations

- Centrifugal compressors would have to be equipped with dry seal systems.
- Owners/operators of reciprocating compressors would have to replace rod packing systems every 26,000 hours of operation
- Pneumatic Controllers – new and replacement controllers cannot be gas driven

# Proposed Federal Regulations

- Condensate and Crude Oil Storage Tanks
  - Tanks with greater than 1 barrels per day throughput must reduce VOC emissions by 95 percent
- Additional leak detection and repair requirements

# Air Permitting Timing Issues

- General permits and applicability
- Air permitting “exemptions”
- Components of processing plants and compressor stations are air emission sources
- Major/minor sources are subject to differing requirements and timelines
- Air permits must be obtained prior to “beginning actual construction”

# Air Permitting Timing Issues

- Typical “minor source” permitting timeline:
  - Application Preparation (source) is 2 to 3 months (typical)
    - Best Available Technology (BAT) for new sources
  - Agency review is typically 4 months, but can be up to 6 months
  - PSD permitting could take 18 months

# Air Permitting Timing Issues

- Typical “major” source permitting timeline (PSD and/or NNSR)
  - Application Preparation (source) typically 4 months
    - BACT in attainment areas
    - LAER in non-attainment areas
    - Dispersion modeling (PSD)
    - Emission offsets (NNSR)
  - Technical review can be up to 12 months (or longer)
  - Public comment period and possible hearing = 30 days
  - U.S. EPA review and comment = 45 days
  - Total timeline = 18 months

# Summary

- State and federal agencies are reviewing the environmental impact of shale gas development for air, water and waste, and proposing new and revised rules.
- New state and federal regulations will likely slow the pace of completion of new wells.
- There will be a continuing debate over the relative benefit/harm of shale gas development.

# Thank You

## Speaker Contact Information

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