



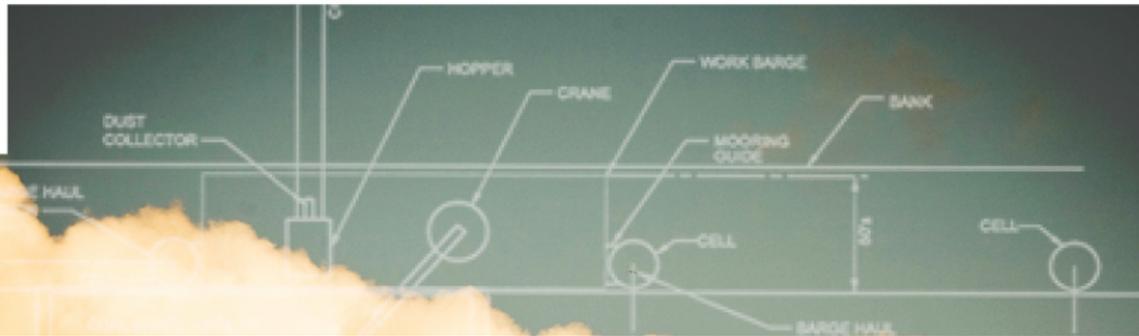
▶ CHP AIR PERMITTING

Project Considerations & the Permitting Process

SPEAKER
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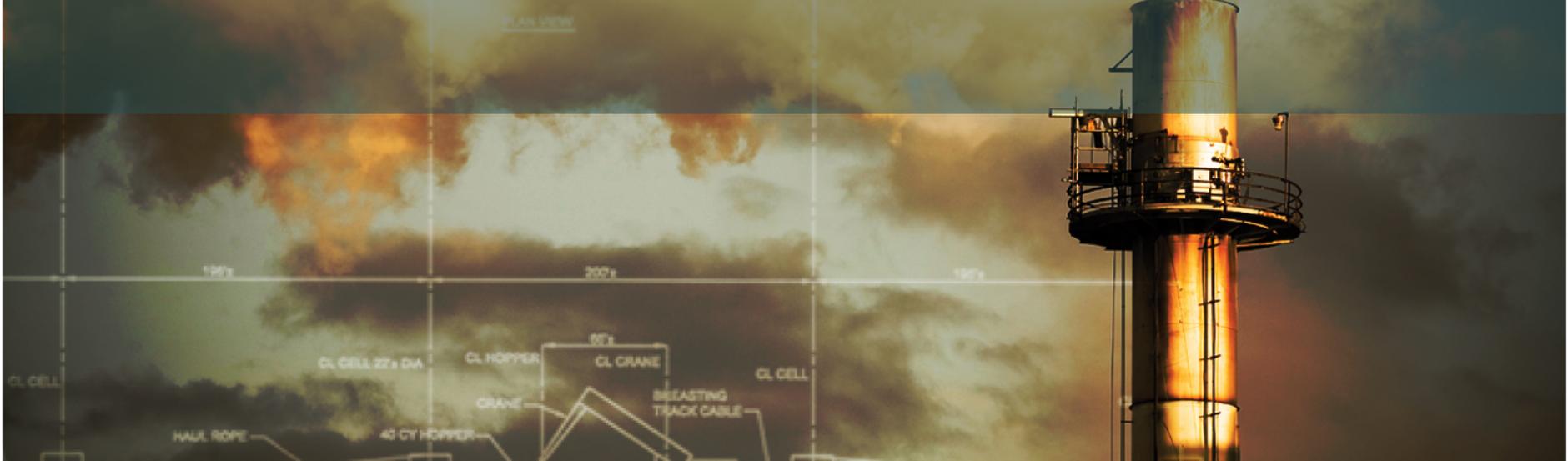
DATE
November 13, 2014





100 YR FLOOD EL. 364.30
LOW WATER EL. 361.00

▶ CHP SYSTEM CONSIDERATIONS



STATE OF *Kentucky*

► Benefits

The efficiency of CHP systems reduces primary fuel consumption, thus decreasing air pollution

- Reduces Total Air Pollution
- Does not necessarily reduce air emissions from facility

The electricity generated by a CHP system will decrease the need for electricity generated by the least efficient plants that operate during times of peak electricity use

Properly optimized systems can save facilities money

Gives additional power reliability to a facility

- September 2008 Wind storm
- January 2009 Ice Storm
- Future Grid Reliability problems associated with base load generation decreases in KY

▶ Hurdles

No credit given for emission reduction from base load generation power plants to facility utilizing CHP systems

Process for obtaining air permits can be time and resource intensive

Does facility have personnel to maintain environmental management systems for CHP processes?

Grid was engineered for traditional distribution in one direction

- Technical challenges for adding distributed power generation back into the grid

There are many permits and approvals for every step of the development process

- Zoning and Planning Agencies
- Utilities
- Kentucky Department of Environmental Protection Division of Air Quality (DEP DAQ)

▶ CHP System Installation Considerations

Am I willing to change my source classification status?

- Title V – Large scale CHP systems
 - Power generation with export to grid
 - Large scale Process steam/hot water generation
 - Micro grid generation potential for nearby facilities
- FESOP – Medium scale CHP systems
 - Site base load generation
 - Process steam/hot water or building heat generation
- Minor - Small CHP systems
 - Supplemental power
 - Building space heating
 - Small process hot water generation

CHP SYSTEM CONSIDERATIONS



▶ KY Division of Air Quality (DAQ) Permit Thresholds

Title V Permit Emission Thresholds

- Potential to Emit > 10 ton/yr of Single HAP
- Potential to Emit > 25 ton/yr of All HAPs
- Potential to Emit > 100 ton/yr of a Criteria Pollutant
 - Combustion Emissions including NO_x, CO, SO₂, PM, VOC
- Source's Potential to Emit is not limited by permit below major source emission thresholds

FESOP Permit Emission Thresholds

- Potential to Emit < 10 ton/yr of Single HAP
- Potential to Emit < 25 ton/yr of All HAPs
- Potential to Emit > 100 ton/yr of a Criteria Pollutant but limited by permit condition
 - Combustion Emissions including NO_x, CO, SO₂, PM, VOC
 - Limit's annual operating time to limit emissions

Minor Source Permit

- Potential to Emit > 10 ton/yr but < 100 ton/yr of a Criteria Pollutant
 - All equipment authorized for 8,760 hrs/yr operation



▶ CHP PERMITTING



PERMIT CONSIDERATIONS

Timeline



▶ Permitting Process

Time

- Installing a CHP system requires a detailed engineering and financial feasibility analyses and regulatory approvals prior to commencement of construction
- The process of permitting a CHP system will typically take 3-12 months
 - Dependent upon site location, technology, and site characteristics
- The number of permits and approvals will vary depending on project characteristics
 - Size and complexity of project
 - Geographic location
 - Extent of other infrastructure modifications required
 - Potential environmental impacts of construction and operations

PERMIT CONSIDERATIONS

Regulatory Approval



▶ Regulatory Approvals

Local Utility Company

- Interconnection approval
- Natural gas connection/supply modification to facility

Planning department land use and environmental assessment/review

- Noise, set-backs, zoning restrictions, building permits

KY Department of Environmental Protection (DAQ)

- Air emissions requirements for Criteria Pollutants and HAPs
- Approval for construction
- Confirm that CHP project emissions meet state and federal requirements

PERMIT CONSIDERATIONS

Regulatory Approval



▶ Air Permitting Procedure

1. Owner or Operator completes application forms and submits to DAQ

- Detailed pre-construction design plans necessary for application
- Owner or Operator determines if construction of CHP system changes source classification
 - Title V, FESOP, or Minor

2. DAQ reviews Application

- Facility and DAQ likely to have discussions regarding CHP project and emissions
- DAQ can issue a notice of deficiency (NOD) for an incomplete permit application
 - NOD can add additional processing time to permit process

3. DAQ issues Revised Construction/Operating Permit

- Title V Permits require public notice (adds 30 days to permit process)
- Facility-wide air permit issued with authorization to construct CHP emission unit

4. Source demonstrates compliance with applicable permit requirements

PERMIT CONSIDERATIONS

Proactive Measures



▶ Help Facilitate the Permitting Process

Hold preliminary meetings with DAQ

- Discuss permit requirements
- Educate DAQ staff about the CHP project's technology
- Ask DAQ about their regulatory concerns regarding the project
- Determine if CHP system exceeds relevant emissions thresholds

Develop CHP process design plans early

- DAQ always wants detailed information, the more you can provide the better
- Complete applications submitted early in design phase minimize delays

Negotiate design changes with DAQ

- Advocate for project by asking to DAQ to consider technical and economic considerations
 - $BACT \leq \$10,000 / \text{ton emissions reduced} = \text{Threshold for required control installation}$
- Use any EPA guidance that can support your design criteria

PERMIT CONSIDERATIONS

Limitations



▶ KY DAQ Does not have a streamlined CHP permitting process

Because CHP Permits-by-Rule (PBR) do not exist in KY -

- Facility is required to perform extensive regulatory review for small and mid size projects
- Significant permit requirements for small and medium projects
- Requirements for air pollution control devices are not a specified by equipment size, but rather by facility's and/or project's potential emissions

Existing Facilities close to Title V Emission Thresholds

- Adding a CHP emission source can trigger new additional permit requirements
- Adding a CHP emission source can move facility into the major source category
- Do emissions of criteria pollutants and air toxics impact surrounding communities?



▶ CHP FEDERAL AIR REGULATIONS



STATE OF *Kentucky*

PERMIT CONSIDERATIONS

Federal Regulatory Requirements



▶ Mercury Air Toxics Rule (MATS) 40 CFR 63 Subpart UUUUU

Electric utility steam generating unit (EGU) that supplies more than 1/3 of the potential output and more than 25 megawatts to the grid

***Fossil fuel* means natural gas, oil, coal, and any form of solid, liquid, or gaseous fuel derived from such material.**

- Biogas & Biodiesel fuel use can exempt a source from this regulation

Emission standards and compliance very rigorous

CHP projects subject to this MACT standard must prove to be economically lucrative

- Tight emissions standards
- Extensive record keeping and monitoring requirements
- Costly continuous emissions monitoring systems required for compliance

PERMIT CONSIDERATIONS

Federal Regulatory Requirements



▶ Major Source Boiler MACT (non EGU) 40 CFR 63 Subpart DDDDD

Applicable to all boilers at Major Sources of Air Pollution for HAPs

- Coal, biomass, oil, seasonal/limited use
- 21 specific subcategories of boilers listed in regulation

Emission limitations, operating limits, and work practice standards

- HCl, Mercury, CO, PM
- Emission limits, operating limits, and work practice standards based on:
 - Rated heat input size (MMBtu/hr)
 - Alternative output based emission limits
 - Fuel Subcategory (e.g. - Fuel cells designed to burn biomass/bio-based solid)

Compliance Requirements

- Performance stack testing & fuel analysis
- Develop site-specific monitoring plan for continuous monitoring systems (CMS)

CMS required for certain boilers

- continuous emission monitoring system (CEMS) – CO / HCl / PM
- continuous opacity monitoring system (COMS) – Surrogate for PM
- continuous parameter monitoring system (CPMS) – BLDS

PERMIT CONSIDERATIONS

Federal Regulatory Requirements



▶ Area Source Boiler MACT (non EGU) 40 CFR 63 Subpart JJJJJ

Applicable to all boilers at a facility

- Coal, biomass, oil, gaseous fuels, liquid fuels, seasonal/limited use boilers

Emission limitations & operating limits

- New & existing coal-fired boilers, new biomass boilers, new distillate oil boilers
 - HCl, Mercury, CO, PM

Work practice standards for all categories of boilers including energy assessment and tune-ups

- Biomass emission standards less stringent than other fuels (GACT based)
- Focus of regulation is on operation of boiler to minimize pollution and combust fuel at optimal conditions

Compliance Requirements

- Performance stack testing & fuel analysis
- Develop site-specific monitoring plan for continuous monitoring systems (CMS)

CMS required for certain boilers

- continuous emission monitoring system (CEMS) – CO / HCl / PM
- continuous opacity monitoring system (COMS) – Surrogate for PM
- continuous parameter monitoring system (CPMS) – BLDS

PERMIT CONSIDERATIONS

Federal Regulatory Requirements



► Potential Emission Examples

Boiler or furnace type	Boiler size (MMBTU/hr)	Annual Hours of Operation	tons / yr (tpy)						
			NO _x	SO _x	CO	VOC	PM/PM ₁₀	Formaldehyde	CO ₂
Wood-fired (<100MMBTU/hr input) -- uncontrolled	38	8760	81.56	4.16	99.86	2.83	66.58	0.73	32,455
Distillate oil #1 or #2 or diesel fuel (<100MMBTU/hr input)	99	8760	61.95	0.67	15.49	1.72	6.19	0.19	69,069
Residual oil #5 or #6 (<100MMBTU/hr input)	43	8760	69.06	99.82	6.28	2.02	12.56	0.08	31,390
Natural gas (<100MMBTU/hr input) -- uncontrolled	99	8760	42.51	0.26	35.71	2.34	3.23	0.03	51,014
Natural gas (<100MMBTU/hr input) -- low-NOx burners	99	8760	21.26	0.26	35.71	2.34	3.23	0.03	51,014

PERMIT CONSIDERATIONS

Federal Regulatory Requirements



New Source Performance Standards (NSPS) for Stationary Combustion Turbines 40 CFR 60 Subpart KKKK

Stationary combustion turbines > 10 but less than < 250 mmBtu/hr heat input (< 73 MW)

- Biogas & Natural Gas
- Requires low sulfur fuel, requirements vary dependent of fuel type

If you have two or more turbines that are connected to a single generator, each turbine must meet the emission limits for NO_x

Out-put based emission standards for NO_x and SO₂ based on gross energy output for CHP systems

Initial Performance test required for CHP systems followed by annual testing

§ 60.4305(b)

- Stationary combustion turbines regulated under this subpart are exempt from the requirements
 - 40 CFR 60 Subpart GG
- Heat recovery steam generators and duct burners regulated under this subpart are exempted from the requirements of
 - 40 CFR 60 Da, 40 CFR 60 Db, and 40 CFR 60 Dc

§ 60.4335(b)(4)

- For combined heat and power units complying with the output-based standard, install, calibrate, maintain, and operate meters for useful recovered energy flow rate, temperature, and pressure, to continuously measure the total thermal energy output in British thermal units per hour (Btu/h).

PERMIT CONSIDERATIONS

Federal Regulatory Requirements



▶ Major Source Stationary Combustion Turbines MACT 40 CFR 63 Subpart YYYY

Emission limitations & operating limitations for HAP emissions at a major source of HAPs

- Requirements for initial and continuous compliance with emission and operating limits
- Biogas, Natural Gas, & Distillate Oil (Low Sulfur Diesel)
- Additional requirements for landfill gas, digester gas, or gasified MSW

§ 63.6095(d) Stay of standards for gas-fired subcategories.

- New or reconstructed stationary combustion turbine that is a lean premix gas-fired stationary combustion turbine or diffusion flame gas-fired stationary combustion turbine:
 - Comply with the Initial Notification requirements set forth in §63.6145
 - Other requirement of this subpart not applicable until EPA takes final action to require compliance and publishes a document in the Federal Register

§ 63.6092 Are duct burners and waste heat recovery units covered by subpart YYYY?

- Duct burners and waste heat recovery units are considered steam generating units and are not covered under this subpart. In some cases, it may be difficult to separately monitor emissions from the turbine and duct burner, so sources are allowed to meet the required emission limitations with their duct burners in operation.

PERMIT CONSIDERATIONS

Federal Regulatory Requirements



▶ Potential Emission Examples

TABLE 1 - Stationary Natural Gas-Fired Turbines

Fuel: <u>Natural Gas</u>		Fuel Input: 230 MMBtu/hr		
Pollutant	Emission Factor (lb/MMBtu)	Emission Factor Source	Emission Rate (lb/hr)	Emissions (ton/yr)
NO _x	Uncontrolled	Table 3.1-1	73.60	322.368
	Water-Steam Injection	Table 3.1-1	29.90	130.962
	Lean-Premix	Table 3.1-1	22.77	99.7326
CO	Uncontrolled	Table 3.1-1	18.86	82.6068
	Water-Steam Injection	Table 3.1-1	6.90	30.222
	Lean-Premix	Table 3.1-1	3.45	15.111
SO ₂ ^b	0.0034	Table 3.1-2a	0.78	3.42516
VOC	0.0021	Table 3.1-2a	0.48	2.11554
PM (total) ^a	0.0066	Table 3.1-2a	1.52	6.64884
Total HAPs	0.001	Table 3.1-3	0.23	1.0074

TABLE 2 - Stationary Distillate Oil-Fired Turbines

Fuel: <u>Distillate Oil</u>		Fuel Input: 95 MMBtu/hr		
Pollutant	Emission Factor (lb/MMBtu)	Emission Factor Source	Emission Rate (lb/hr)	Emissions (ton/yr)
NO _x	Uncontrolled	Table 3.1-1	83.60	366.168
	Water-Steam Injection	Table 3.1-1	22.80	99.864
	CO			
CO	Uncontrolled	Table 3.1-1	0.31	1.37313
	Water-Steam Injection	Table 3.1-1	7.22	31.6236
Lead	0.000014	Table 3.1-2a	0.00	0.0058254
SO ₂ ^b	0.033	Table 3.1-2a	3.14	13.7313
VOC	0.00041	Table 3.1-2a	0.04	0.170601
PM (total) ^a	0.012	Table 3.1-2a	1.14	4.9932
Total HAPs	0.000426	Table 3.1-4	0.04	0.1772586

TABLE 3 - Stationary Landfill Gas-Fired Turbines Potential Emissions

Fuel: <u>Landfill Gas</u>		Fuel Input: 50 MMBtu/hr		
Pollutant	Emission Factor (lb/MMBtu)	Emission Factor Source	Emission Rate (lb/hr)	Emissions (ton/yr)
NO _x	0.14	Table 3.1-1	7.00	30.66
CO	0.44	Table 3.1-1	22.00	96.36
SO ₂	0.045	Table 3.1-2b	2.25	9.855
VOC	0.013	Table 3.1-2b	0.65	2.847
PM-10	0.023	Table 3.1-2b	1.15	5.037
Total HAPs	0.0002	Table 3.1-6	0.01	0.0438

TABLE 4 - Stationary Digester Gas-Fired Turbines

Fuel: <u>Digester Gas</u>		Fuel Input: 140 MMBtu/hr		
Pollutant	Emission Factor (lb/MMBtu)	Emission Factor Source	Emission Rate (lb/hr)	Emissions (ton/yr)
NO _x	0.16	Table 3.1-1	22.40	98.112
CO	0.017	Table 3.1-1	2.38	10.4244
SO ₂	0.0065	Table 3.1-2b	0.91	3.9858
VOC	0.0058	Table 3.1-2b	0.81	3.55656
PM-10	0.012	Table 3.1-2b	1.68	7.3584
Total HAPs	0.00046	Table 3.1-7	0.06	0.282072

PERMIT CONSIDERATIONS

Federal Regulatory Requirements



New Source Performance Standard (NSPS) for Compression Ignition (CI) Internal Combustion Engines (ICE) - 40 CFR 60 Subpart III

§ 60.4203

- Engines manufactured by stationary CI internal combustion engine manufacturers must meet the emission standards as required in § [60.4201](#) and § [60.4202](#) during the certified emissions life of the engines.
 - Certified emissions life* means the period during which the engine is designed to properly function in terms of reliability and fuel consumption, without being remanufactured, specified as a number of hours of operation or calendar years, whichever comes first.

§ 60.4201

- Stationary CI internal combustion engine manufacturers must certify their 2007 model year and later non-emergency stationary CI ICE with a maximum engine **power less than or equal to 2,237 kilowatt (KW) (3,000 horsepower (HP)) and a displacement of less than 10 liters per cylinder** to the certification emission standards for new nonroad CI engines in [40 CFR 89.112](#), [40 CFR 89.113](#), [40 CFR 1039.101](#), [40 CFR 1039.102](#), [40 CFR 1039.104](#), [40 CFR 1039.105](#), [40 CFR 1039.107](#), and [40 CFR 1039.115](#), as applicable, for all pollutants, for the same model year and maximum engine power

Standards vary depending on use and type of engine

- Fire Pump and Emergency CI ICE requirements different from CHP CI ICE Use
- If permitted as an Emergency RICE and change to CHP could require permit modification
- Has specific emission requirements for all engines size which generate power for non-emergency events
- Has record keeping, monitoring, performance testing for all engine categories
- Allows for special fuel use by petition of administrator (DEP DAQ)

PERMIT CONSIDERATIONS

Federal Regulatory Requirements



▶ New Source Performance Standard (NSPS) for Spark Ignition (SI) Internal Combustion Engines (ICE) - 40 CFR 60 Subpart JJJ

Emission Standards for NO_x, CO, VOC in g/HP-hr or ppmvd (15% O₂)

§ 60.4241(c)

- Certification of stationary SI ICE to emission standards specified in §60.4231(d) or §60.4231(e) **is voluntary**
- manufacturers who decide to certify are subject to all of the requirements indicated in this subpart with regard to the engines included in their certification.
- Manufacturers must clearly label their stationary SI engines as certified or non-certified engines.
 - Ask for an engine that has a certificate of conformity if possible

Standards vary depending on use and type of engine

- Fire Pump and Emergency RICE requirements different from CHP Use
- If permitted as an Emergency RICE and change to CHP (non-emergency) could require permit modification

Compliance requirements more stringent for non-certified engines and increased based on engine output

- Has specific emission requirements for all engines size which generate power for non-emergency events
 - Has record keeping, monitoring, performance testing for all engine categories

PERMIT CONSIDERATIONS

Federal Regulatory Requirements



▶ Reciprocating Internal Combustion Engine (RICE) MACT 40 CFR 63 Subpart ZZZZ

Emission limitations / Operating limitations for HAP emissions from RICE at:

- major sources of HAP emissions
- area sources of HAP emissions

Emission Limits & Work Practice Standards

- Regulation mainly imposes additional performance testing requirements for large engine sets
- 70% CO reduction requirements
- 76% Formaldehyde emission reductions

Emission Standards vary depending on use and type of engine

- Fire Pump and Emergency RICE units exempt from 40 CFR 63 ZZZZ except for initial notification
- If permitted as an Emergency RICE and change to CHP could require permit modification
- Allowable fuels include natural gas, biogas, dual-fuel units, diesel fuel, and liquid fuels
- Has specific emission requirements for all engines size which generate power for non-emergency events
 - Engines < 250 brake HP at Area Source (HAPs) only comply with 40 CFR 60 IIII or 40 CFR 60 JJJJ
 - Engines < 500 brake HP at Major Source (HAPs) only comply with 40 CFR 60 IIII or 40 CFR 60 JJJJ

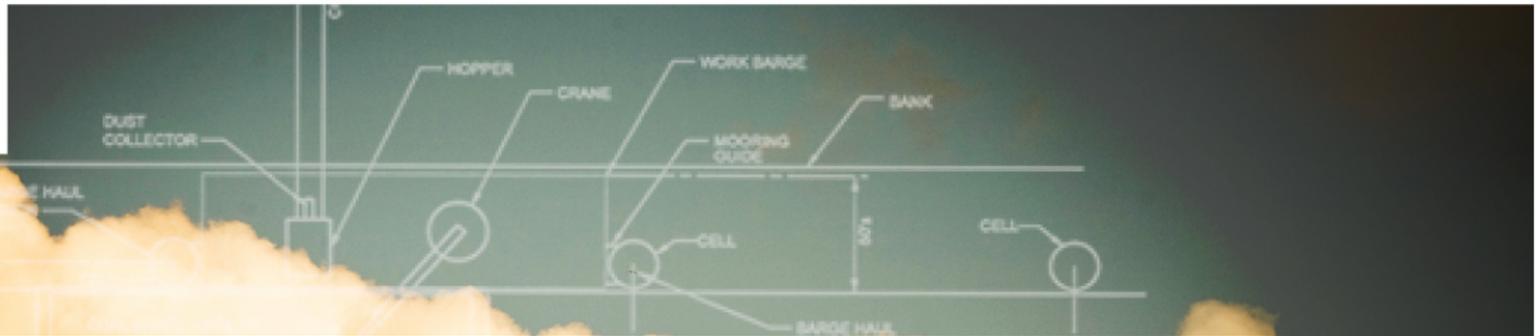
PERMIT CONSIDERATIONS

Federal Regulatory Requirements



► Potential Emission Examples

Engine Type (Stationary engines only)	# Engines	Load (%)	Potential to Emit (hours/year)	Horsepower (bhp)	Potential to Emit* (tons/year)				
					VOC/NMHC	NOx	SOX	CO	PM10
Diesel Engines									
Tier 1	1	80%	8760	1,500	11.6	80.0	1.9	98.5	4.6
Tier 2	1	80%	8760	2,750	5.1	96.9	1.1	55.2	3.2
Tier 3	1	80%	8760	2,750	5.1	96.9	1.1	55.2	3.2
Tier 4	1	80%	8760	2,750	5.1	96.9	1.1	55.2	3.2
Tier 4 - Gen Sets	1	80%	8760	4,750	5.1	18.3	1.8	95.4	0.8
Other Engines									
Gasoline Engine	1	80%	8760	60	0.5	2.3	0.1	92.4	0.2
Rich-burn natural gas engine, no catalyst	1	80%	8760	900	0.8	59.2	0.0	99.7	0.3
Propane engine, no catalyst	1	80%	8760	2,200	59.3	99.2	0.2	92.1	3.6
Rich Burn - Rule 4702 Compliant	1	80%	8760	2,400	19.1	19.8	0.0	97.3	0.7
Lean Burn - Rule 4702 Compliant	1	80%	8760	6,000	17.4	82.5	0.0	99.2	0.0



▶ CONCLUSIONS



STATE OF *Kentucky*

▶ CHP Permits

Facility Classification (Minor / Major) determines initial air permitting requirements

- Large scale CHP projects receive more permit scrutiny from utilities and DAQ
- If CHP emission unit meets the definition of an EGU by federal regulations it will require a longer time-line for permit issuance
- Title V Permitting can require facility to evaluate pollution prevention and BACT from non CHP permitted emission units

Federal air regulations are the main driver of day-to-day compliance requirements

- Minor source state permits do not reduce federal air regulatory requirements
- Federal Regulations require emission standards for CHP systems based on:
 - Gross energy output
 - Heat input
- Area source and Major source requirements in federal regulations do not differ greatly for
 - Record Keeping
 - Monitoring
 - Reporting



THANK YOU

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