Environmental Permitting for IGCC Power Plants

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Permitting an IGCC Power Plant

- Most electric utility and agency staff have experience with permitting NGCC plants over the last 6-8 years
- Some have worked on PC units
- But what about IGCC plants?

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Permitting an IGCC Plant

- With only two commercial-size IGCC plants in the U.S……..
  - The technology and its permitting requirements are likely to be new to electric utility environmental staff
  - State environmental agency staff may not be familiar with the technology and the <u>new</u> regulations that cover it

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What Regulations Apply to IGCC?

- 40 CFR 60, Subpart Da, NSPS for Utility Steam Generating Units was amended on February 9, 2006:
  - "Subpart Da of 40 CFR 60 will apply to combined cycle and combined heat and power combustion turbines and the associated heat recovery units that burn 75 percent or more (by heat input) synthetic-coal gas (e.g., integrated coal gasification combined cycle power plants) and that meet the applicability criteria of the final rule amendments, respectively."

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New NSPS

Emission	New NSPS	New NSPS on Input Basis (estimated)
NOx	1.0 lb/MWh*	0.14 lb/MMBtu
SO_2	1.4 lb/MWh*	0.2 lb/MMBtu
PM	0.015 lb/MMBtu	0.015 lb/MMBtu

*output-based standards are on a gross generation basis,

so gross heat rate is used to calculate estimated input-based limit

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Emission Rate Basis

- Heat Input - use feedstock to the gasifier, not syngas to the combustion turbines
- Emission limits – divide lbs/hr by feedstock input in MMBtu/hr to get lb/MMBtu
  - On same basis as a PC unit

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Air Emission Controls

Parameter	Typical Emission Control Method
NOx	Saturation of syngas with water and injection of nitrogen into syngas
SO_2	COS hydrolysis followed by amine-based sulfur removal (99% +) – removal of H_2S, not SO_2
Particulate matter	Wet scrubber or dry filters
CO, VOCs	Good combustion practices
HCl, HF, NH_3	Wet scrubber & brine concentrator
Mercury	Sulfur-impregnated activated carbon bed

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Other Air Emissions

- Feedstock handling
- Sulfur Recovery Unit
- Tail gas incinerator
- Tank vents
- Flare (raw and clean syngas)
- Fugitive emissions
- Startup/shutdown
- Intermittent and upset conditions

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NOx BACT Issues

- Is SCR applicable to IGCC?
- Technical issues
  - The fuel is syngas, not natural gas as in NGCC
  - Ammonium sulfate/bisulfate deposit in the HRSG, causing corrosion and lower availability due to numerous washdowns
  - No coal-based IGCC system in the world uses SCR

- Economic Issues
  - No commercial offerings/guarantees with syngas fuel
  - SCR would require lower ammonia slip or deeper sulfur removal – significant cost adder for IGCC technology

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Mercury Emissions

- Mercury can be removed from the syngas prior to sulfur removal

- Activated carbon filter
  - Eastman reports ~94% removal
  - Disposal of several drums of material per year
  - DOE project to evaluate removal of other metals

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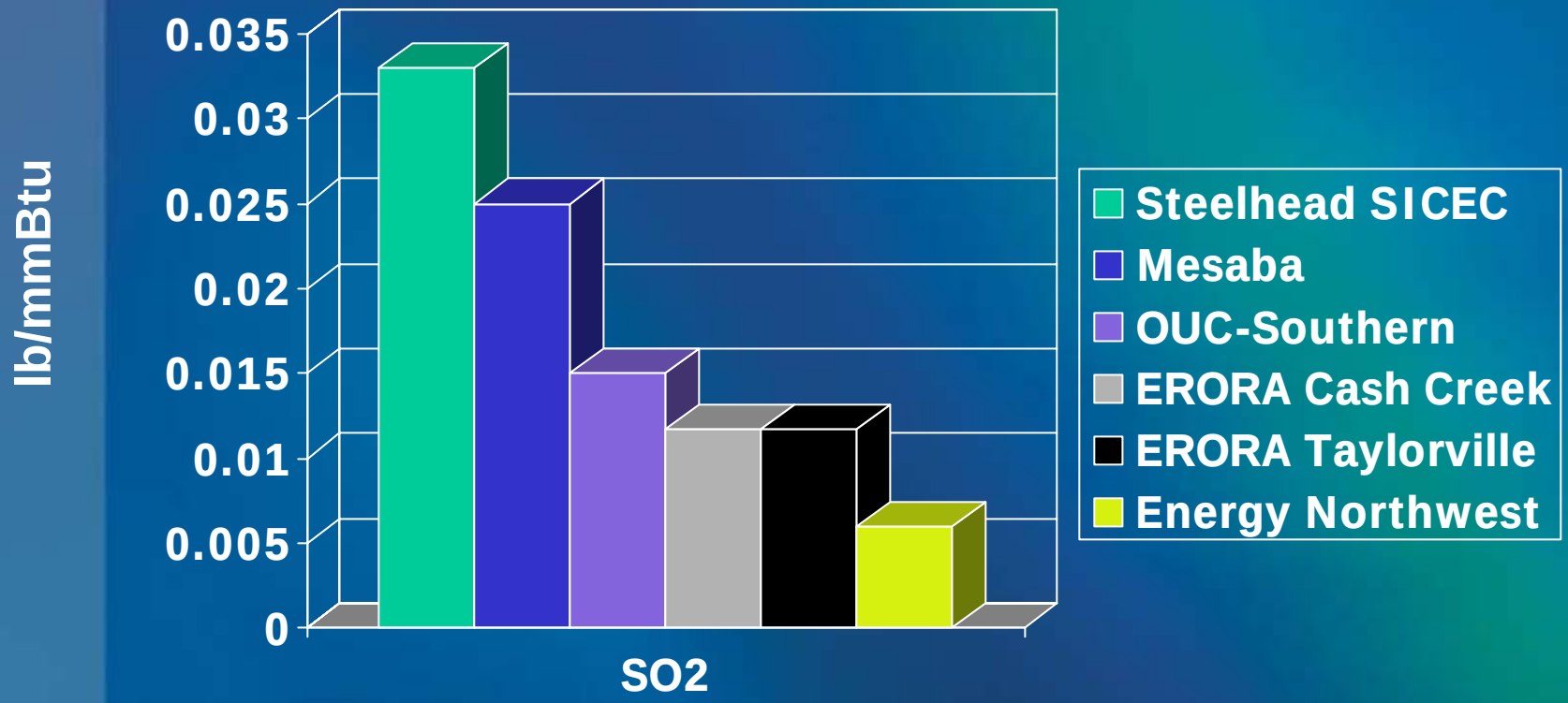
Proposed SO_2 Emission Limits



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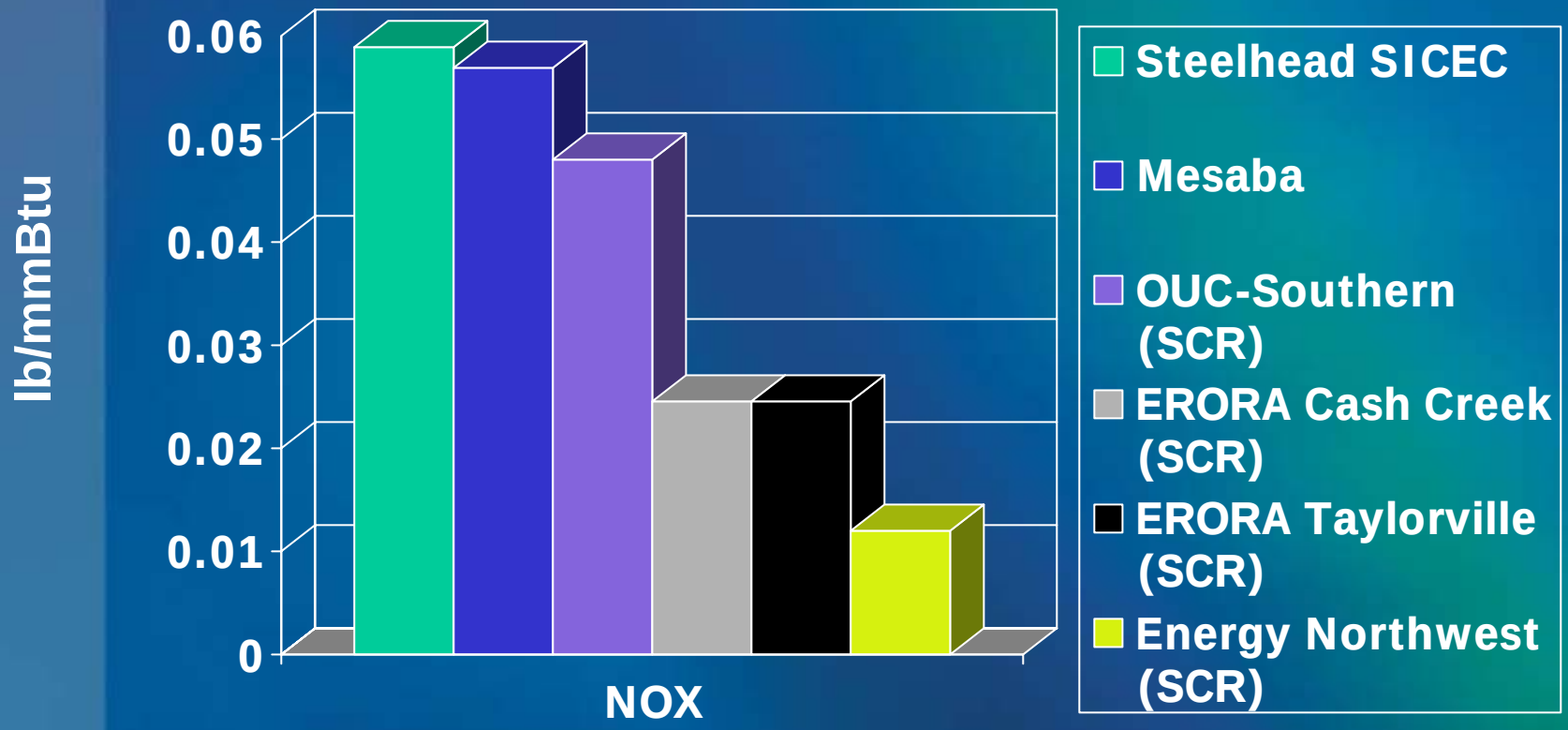
Proposed NOx Emission Limits



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Solid Byproducts

- Slag is the largest volume solid byproduct
- Volume depends on feedstock
  - Higher with coal (5-15% ash)
  - Much lower with pet coke (<1% ash)

- Similar characteristics to slag from wet bottom PC and cyclone units – black, glassy & non-leachable
- Marketable for roofing tiles, sandblasting grit, asphalt filler

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IGCC Slag

- Slag from coal-fired plants has exclusion from RCRA Subtitle C as a “fossil fuel combustion waste” (Bevill waste)
- Slag from coal gasification is covered as a “mineral processing waste”, if feedstock is >50% coal
- If <50% coal, must show that the slag passes appropriate tests to show it is not hazardous

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IGCC Plant Permitting - Summary

- IGCC is different from NGCC and PC
- IGCC has a feedstock (coal) and a fuel (syngas)
- Regulations that cover IGCC are different from those for NGCC and PC units
- Unique emission sources
- Specific method for calculating heat input and emission limits
- Solid wastes are minimized and marketable

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