McIlvaine Hot Topic Hour:
Gas Turbine Emission Control
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PM and Hazardous Air Pollutant Emission Factors For Gas-Fired Combustion Turbines

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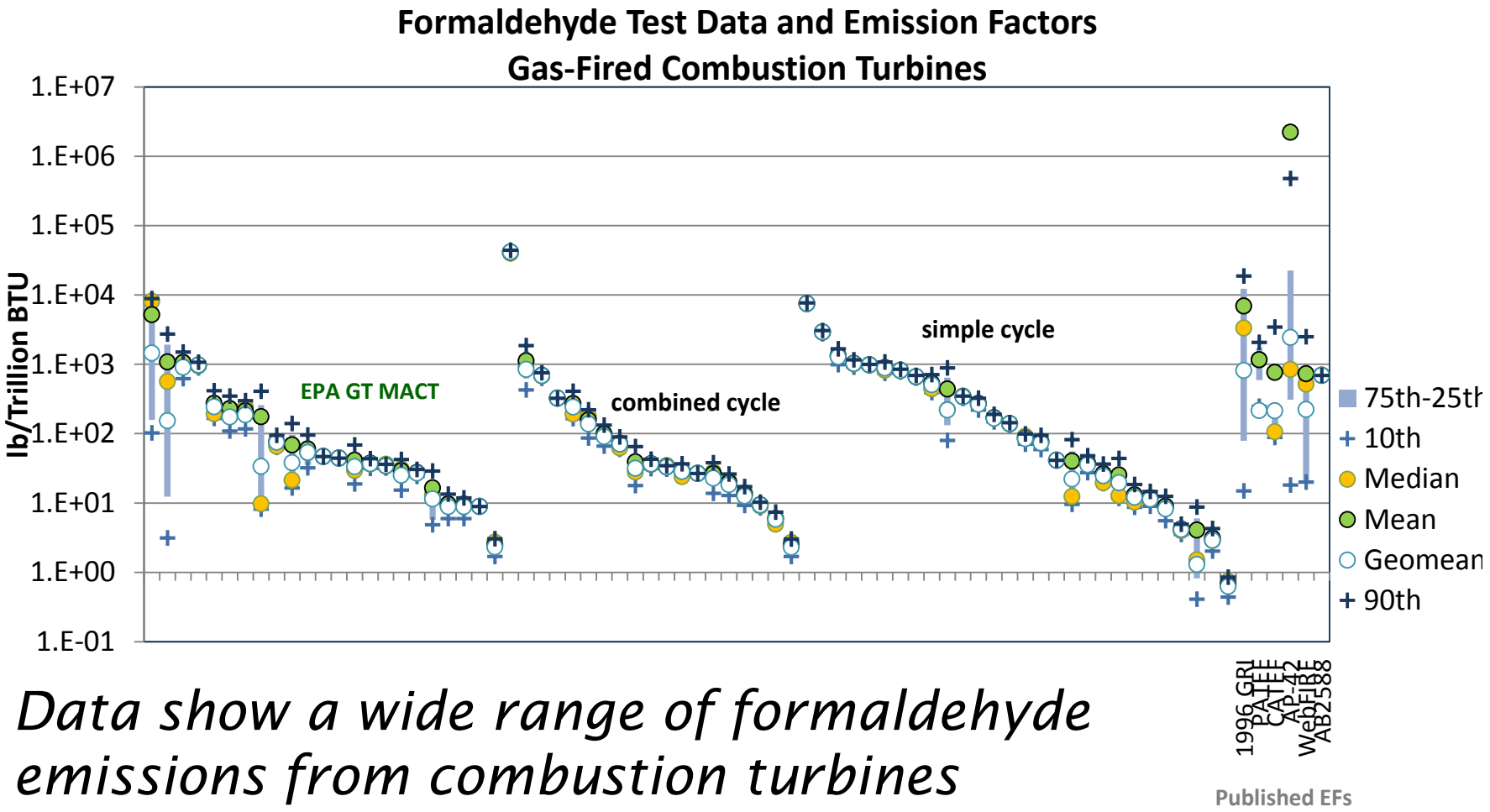
Sources of Combustion Organic HAP Emissions

- Quenching of combustion intermediates
  - CO, formaldehyde, acetaldehyde, acrolein, etc.
- Combustion byproduct formation via fuel fragments
  - Benzene, toluene, ethylbenzene, xylene, hexane, naphthalene, PAH, POM, etc.
- Pathways that allow escape before destruction, e.g.,
  - Large scale turbulence
  - Quenching on surfaces
  - Poor mixing
- Gas-solid interactions
  - Generally not significant for gas combustion

Natural Gas HAP Emission Factors

- Emission factors
  - Available data from various resources
    - AP-42, CATEF, PATEF, GRI, EPRI, GT MACT
    - Generally based on data 10+ years old
    - Mix of power generation, pipeline compressor, industrial applications and sizes
  - Since then,
    - Measurement techniques, QC have improved (?)
    - Changes in GT technology, e.g. combustors, Flex, recuperators
    - Refinements in post-combustion emission controls
    - New post-combustion emission control technologies

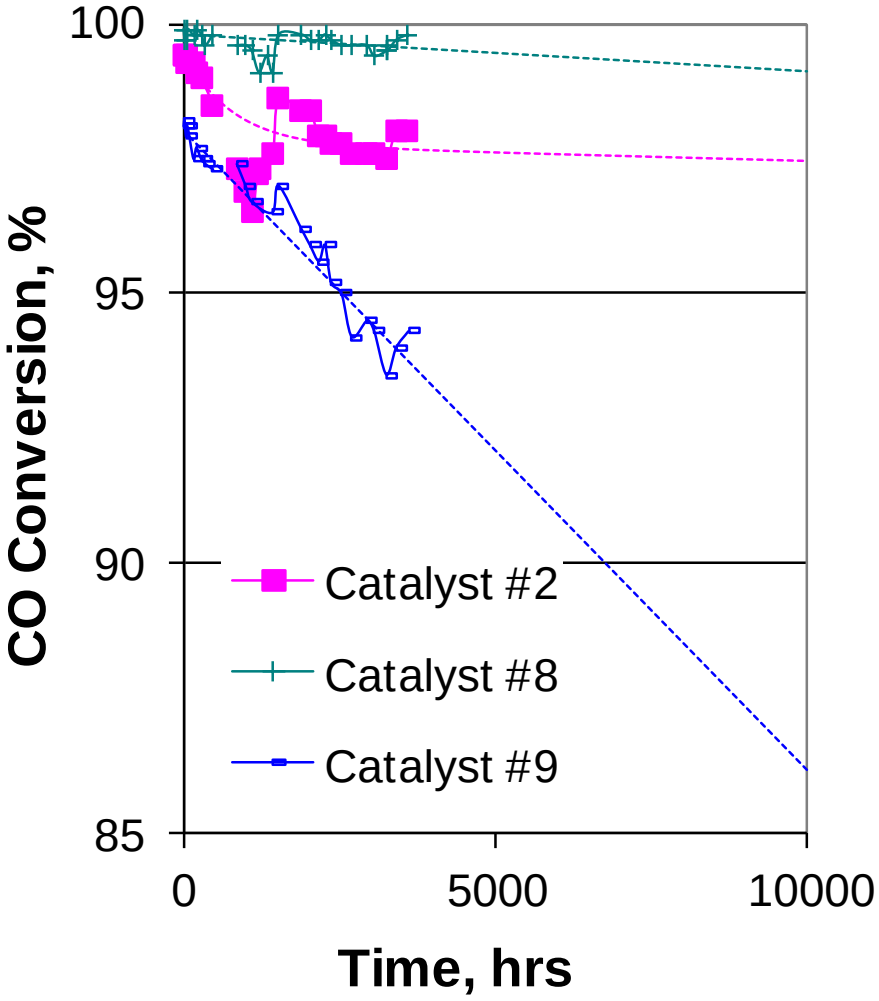
Formaldehyde Data & Emission Factors

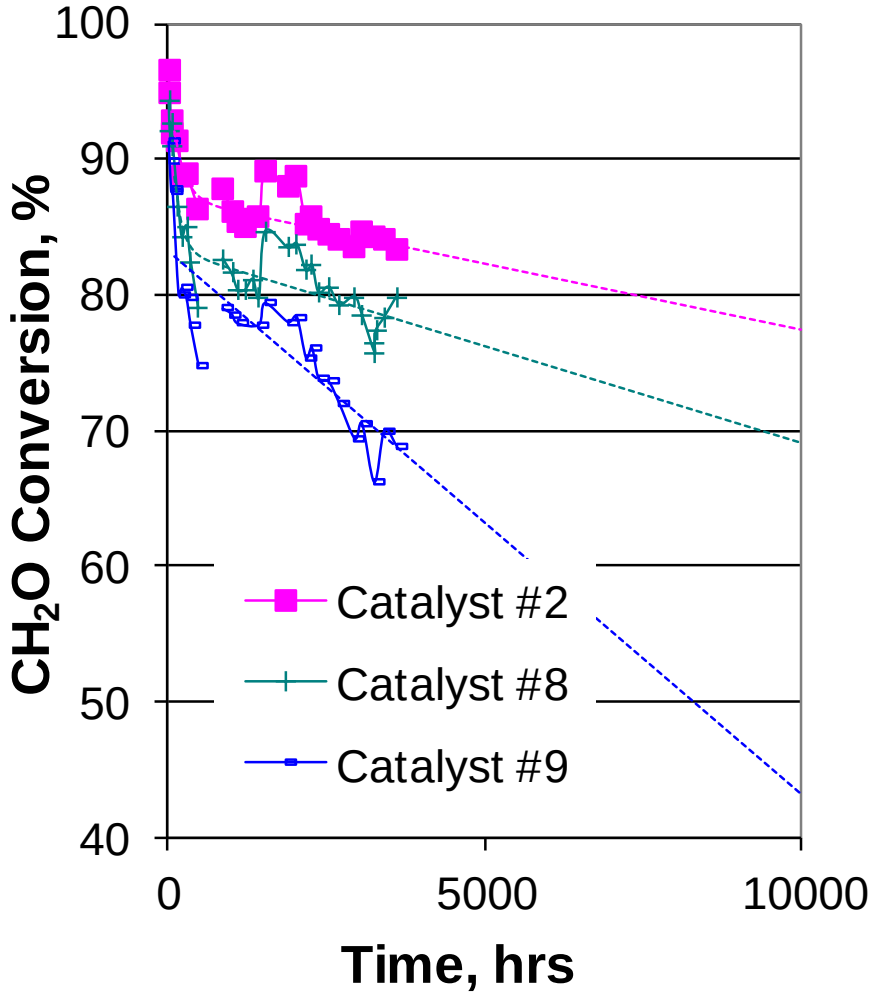


Data show a wide range of formaldehyde emissions from combustion turbines

Measurement vs. process variability?

Oxidation Catalysts …can be effective for CO and o-HAPs





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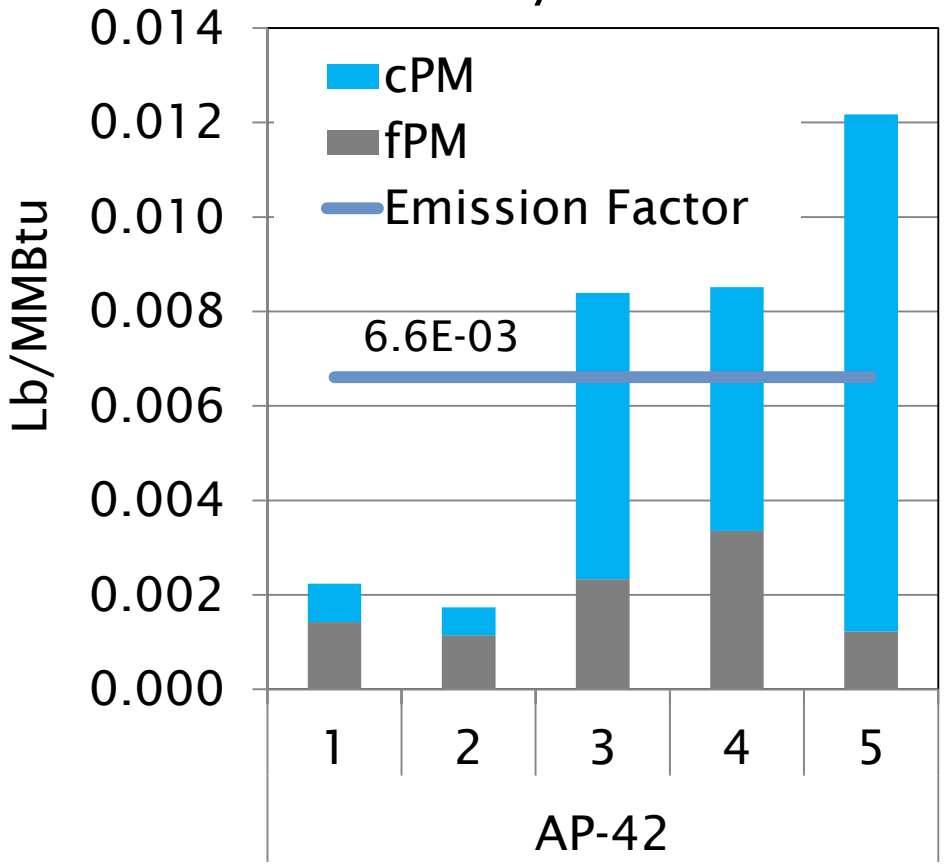
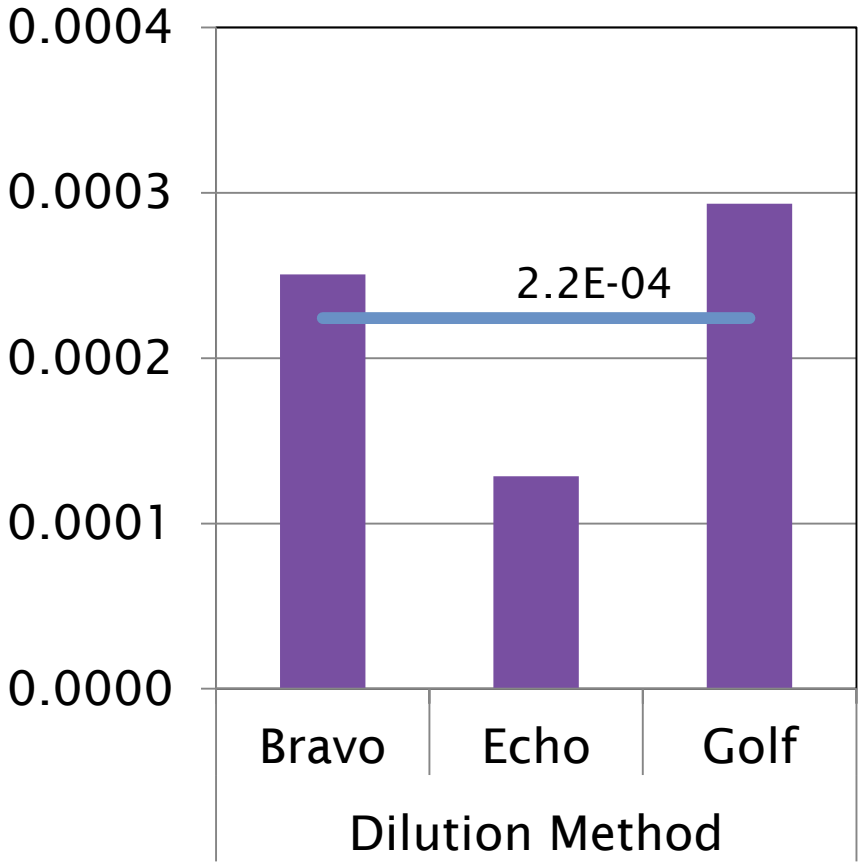
PM Emission Factors for Natural Gas-fired Combustion Turbines

- AP-42
  - 5 tests (1994 & 1996)
  - Biased by artifacts?
- Dilution method
  - 3 tests (England, 2001-2003)





Gas Turbine Emission Factor Improvement

- PM
  - Need improved test methods and test data
  - Dilution vs. hot filter/cooled impinger methods
- HAPs
  - EPRI HAP Emission Factor project initiated 2013
  - Review natural gas emission factors and newer data
  - Do newer data indicate need for emission factor updates?
    - Size, load
    - Turbine technology
    - Post-turbine emission controls
    - Startup/shutdown
  - **Seeking newer data for combustion turbines**
  - If data are adequate, update emission factors in 2015