PM and Hazardous Air Pollutant Emission Factors For Gas-Fired Combustion Turbines

Glenn C. England
ENVIRON International Corporation
Irvine, California
gengland@environcorp.com
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
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

![Graphs showing CO and CH₂O conversion over time for different catalysts.]

- CO Conversion, %
- CH₂O Conversion, %
- Time, hrs

- Catalyst #2
- Catalyst #8
- Catalyst #9
PM Emission Factors for Natural Gas-fired Combustion Turbines

• AP-42
  – Biased by artifacts?

• Dilution method
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