Oil and Gas Emission Inventories and Applications for Estimating Impacts to Health and Welfare

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Outline

- O&G regulatory air emission inventories
  - Regulatory drivers and structure
  - Scope and methods
  - Strengths and limitations
- Health and welfare analysis applications
  - Basis for estimating exposure
  - Sample applications
Clean Air Act - Emissions Management Structure

- Cumulative environmental burden - NAAQS, Regional Haze, PSD increment
  - Pollution allowed – track emissions rates and change over time
  - CAA cooperative federalism - focus on emissions mgmt. structures in state programs
    - Solutions at appropriate geographic scale reduce air quality impact and environmental exposure

- Challenges for consistent-accurate-precise O&G emission inventories
  - Rapid / continuing change in production types, practices, technologies, commodity price swings, end-user demand, geographic variation, processing and transportation, et cetera
  - Need for projected future emissions incorporating growth / control
    - Future emissions are to be based on changes from a well-characterized historic base year, to assess air quality response
Regulations

• State permitting, registration, and/or reporting (tracking) via rules and emissions control strategies in “implementation plans”
  • At source / process level – compiled in national databases and basin studies
  • Allows integrated GHG, health (criteria), and air toxics pollutant strategies
  • Ancillary benefit - less waste of O&G commodity products

• Federal technology-based control rules / national GHG emissions reporting

• Federal mineral leasing process - NEPA analysis
Scope

• Sources: wells → gathering/processing → transmission/distribution → end user (domestic)
  • Source category classification (SCC): process specific
    • E.g., tank flashing, pneumatic controllers, drill rig diesel engine, 4-stroke natural gas engines)
• Pollutants: Criteria pollutants / air toxics / GHGs
• Spatial: US-wide
  • Point: Source location (lat/lon)
  • Nonpoint: County-level
• Temporal: Annual
  • US-wide: triennial (historical), several future years
  • Project/NEPA: project dependent
Methods

- Point sources: Direct reporting to State/Local/Tribal Agencies
- Nonpoint sources: Emissions = Activity × Emission factors
- Emission factors
  - Reference compilations/models (e.g., AP-42, MOVES)
  - Manufacturer Specifications
  - Industry models (e.g., E&P Tank, ProMax)
  - Based on evolving equipment and control configurations
    - Timely update is critical
Strengths, Limitations

• **Strengths**
  • Existing requirements to develop emission inventories (e.g., US-wide triennial updates, NEPA)
  • Consistency in organizational structure
  • Comprehensive: wells → end user
  • Designed to be used within CAA and NEPA regulatory framework
    • Controls strategy analysis, air quality impacts analysis

• **Limitations and Future Improvements**
  • Analysis required to develop health and welfare analyses
  • Inconsistent data collection and/or methods can lead to regional differences
  • Emission factor updates typically lag research
Inventories – Fundamental Input for Estimating Exposure

• Emissions control technology and strategy rules lead to lower emissions rates in the future
  • Per capita, unit-level, process activity emissions rates are all lower for new equipment and operational practices – competition and regulation interact
  • Equipment turnover and best practices implementation are both fundamental regulatory assumptions
• Future air quality impacts and exposure estimates are from projections of individual emissions sectors like O&G exploration and production
  • Emissions standards and operating costs for all other sectors are interlinked with O&G E&P – electricity production, mobile engine fuel consumption, et cetera
  • Assessed in cumulative impact modelling that include O&G with other source sectors
• Rural vs. Urban
• Production estimates from economic forecasts provide one means to assess future emissions
• Basins are geographic areas with infrastructure investments and cultural / economic knowledge of O&G E&P, so historic trends also affect future emissions estimates
Application Examples for Regulatory Inventories

- Analyses of criteria pollutant and air toxics monitoring data
- Nonattainment planning to achieve NAAQS
- Regional haze planning for progress in reducing anthropogenic emissions
- NEPA project and resource mgmt. planning
- Tracking of national / state criteria pollutant trends / GHG emissions goals
- Regional modelling of background / transported ozone, PM, regional haze
- Chronic exposure studies – linkages to emissions regulation strategies
Modeling Applications

Local (AERMOD, CalPuff)

- Local applications to estimate exposure at nearby receptors
- Modeled exposures typically compared to reference exposure limits (RELs)
- Example map, well drilling concentration gradients:

Regional (CAMx, CMAQ)

- Regional, multi-source applications to estimate by sector/cumulative impacts
- Model chemistry allows for modeling of more pollutants than can be measured
- Example map, O&G development contributions to ozone in Colorado:
Acknowledgements & Sample Resources

- EPA
  - EPA Triennial National Emission Inventory (compiled from state inputs)
  - EPA Modeling Platforms
  - Inventory of U.S. Greenhouse Gas Emissions and Sinks
  - Greenhouse Gas Reporting Program
- BLM
  - NEPA Project and Planning
  - Colorado Air Resources Management Modeling Study
- WESTAR-WRAP
  - O&G Emissions Inventory Project: Greater San Juan and Permian Basin
  - O&G Emissions Inventory Project: ND-SD-MT Williston and MT North Central (Great Plains) Basins
  - Regional Planning Organizations (WESTAR-WRAP, MARAMA, CenSARA, LADCO, SESARM)
    - National Oil and Gas Emissions Analysis project
    - National Oil & Gas Emissions Committee Information Repository
    - Regional modeling studies for air quality planning
- State and Tribal Inventory Studies
Thank you.

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“They have very strict anti-pollution laws in this state.”