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

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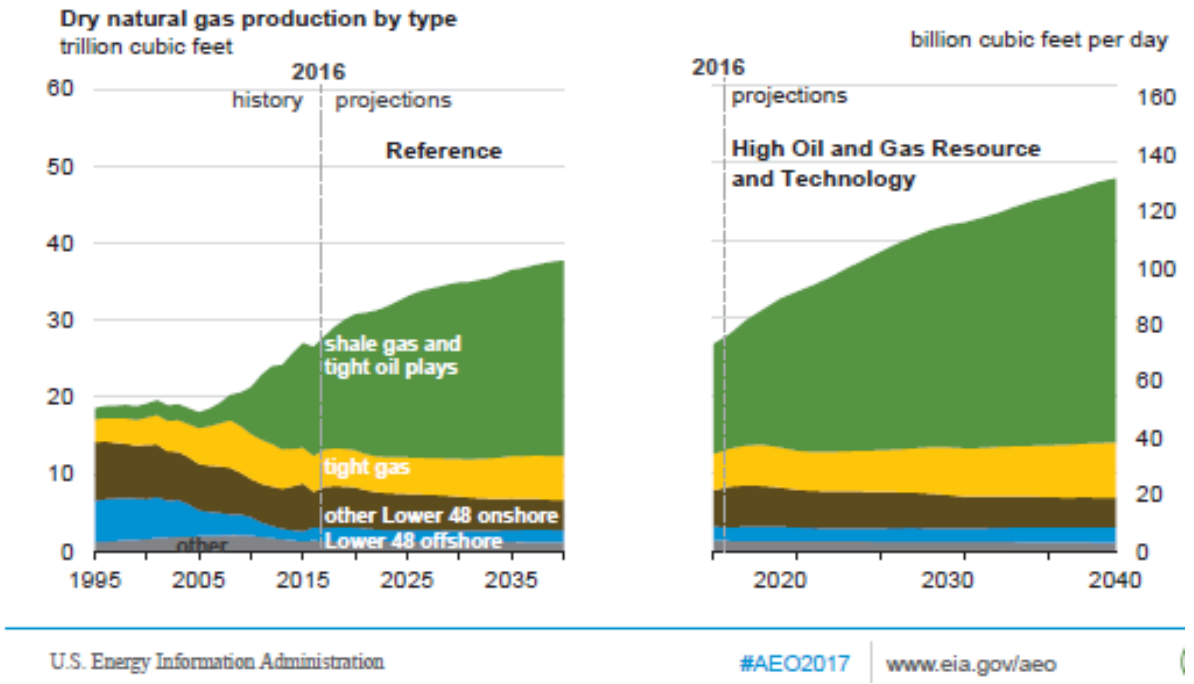
Outline

- 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

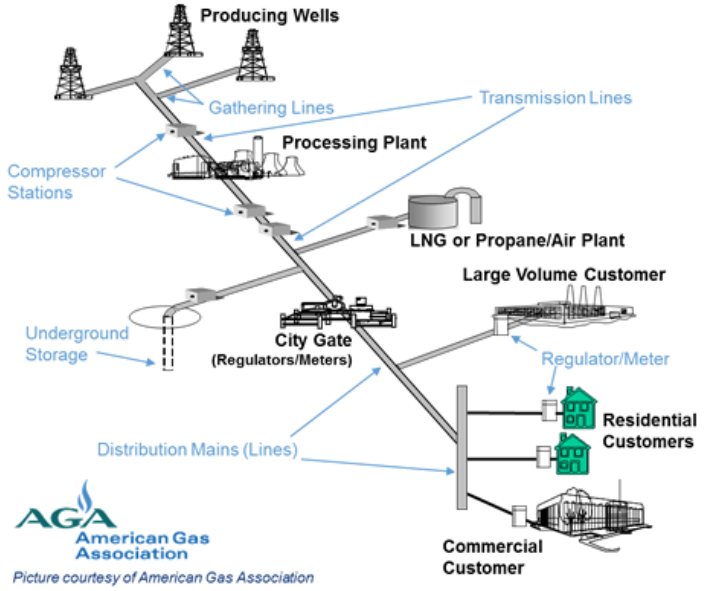
- Challenges for consistent-accurate-precise O&G emission inventories
  - Rapid / continuing change in production types, practices, technologies, commodity price swings, end-user demand, geographic variation, processing and transportation, et cetera
  - Need for projected future emissions incorporating 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

Regulatory Inventory

source category

emission factors

Facility / Top-down Studies

facility/area-wide

direct measurements

WESTAR
Western States Air Resources Council

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

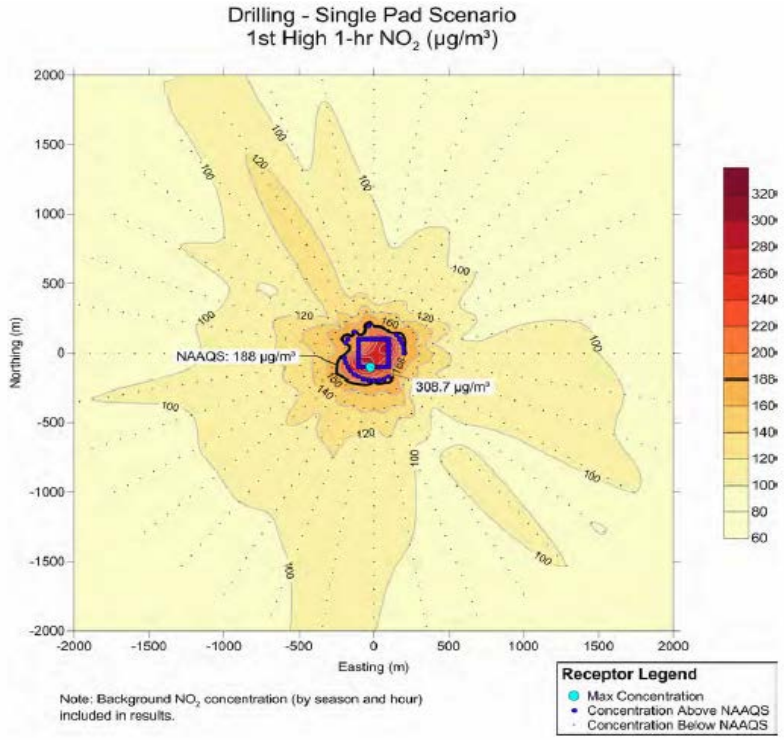
Application Examples for Regulatory Inventories

- 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

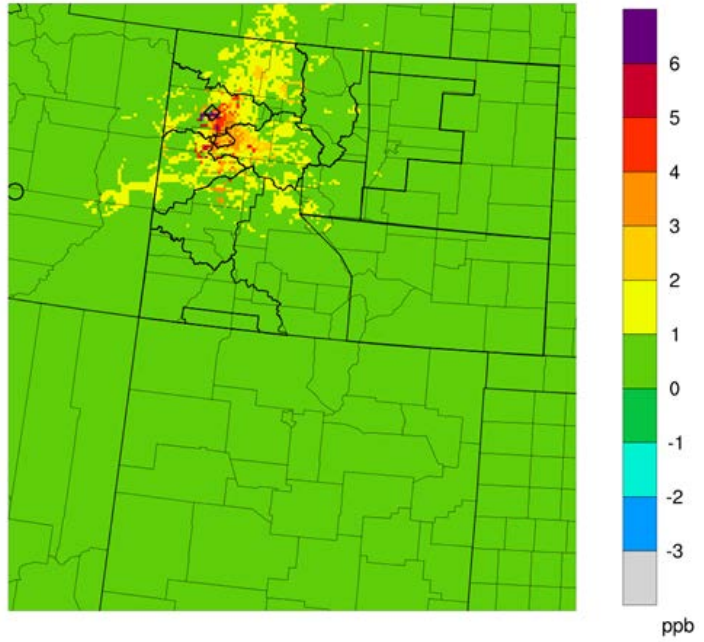
Local (AERMOD, CalPuff)

- 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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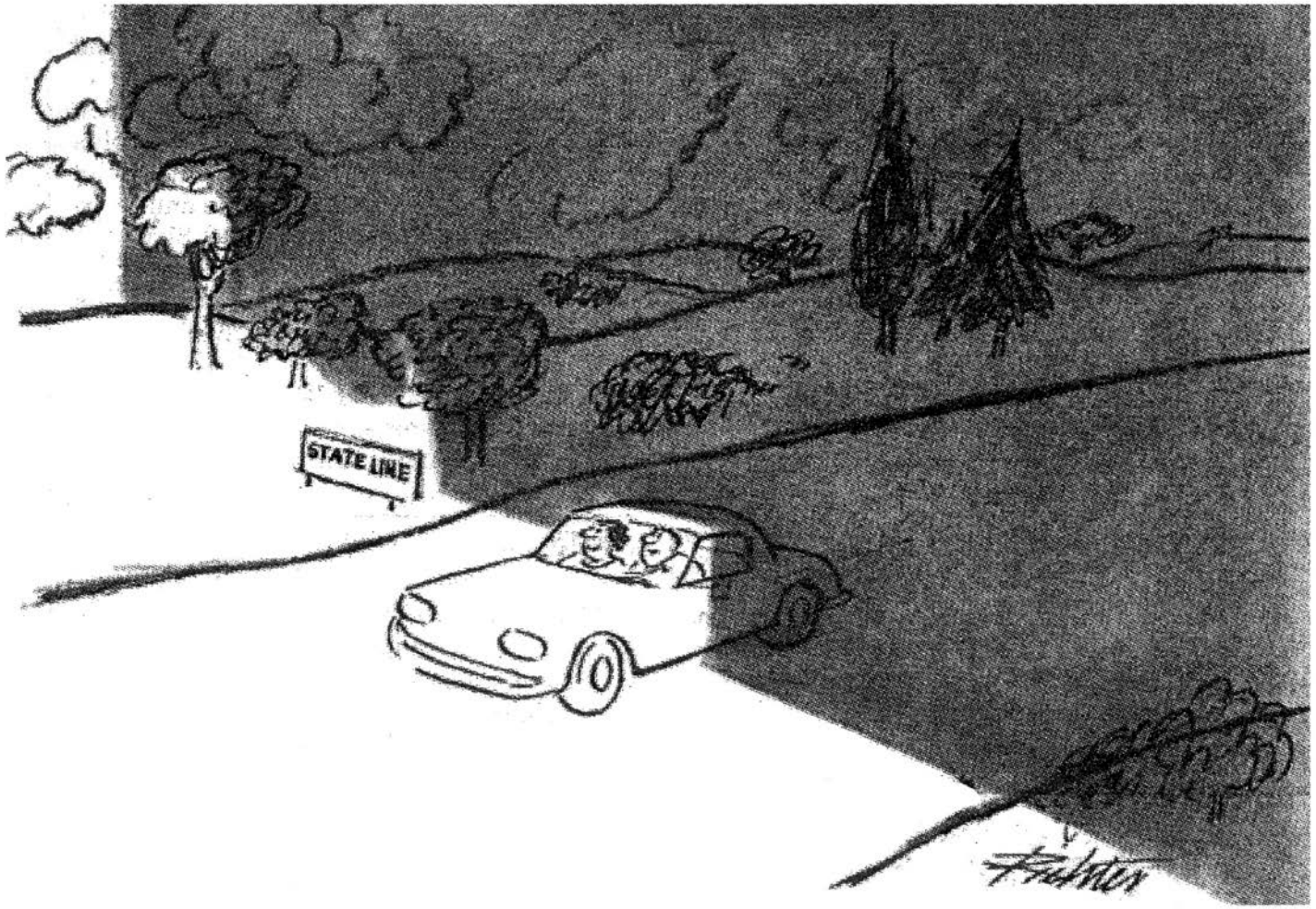

"They have very strict anti-pollution laws in this state."