Overview

• MOVES2014 now contains nonroad capabilities
  – NONROAD2008 model incorporated into MOVES2014
    • with some limitations for output options
  – Calculates inventories
    • For THC, CO, NOx, PM and CO₂ emissions
    • At national, state and county scales
    • For selected calendar years
      – 1990, 1999-2050
  – HC speciation or air toxic emissions not yet available
  – For SIPs, users have options
    • MOVES2014, NONROAD2008, or the nonroad portion of NMIM2008
• Nonroad classifies equipment into twelve “sectors”
  – Recreation, construction, industrial, lawn & garden, agriculture, commercial, logging, airport, oil and gas, mining, pleasure craft and railroad service
Oil and Gas Sector

- Oil and Gas is one of twelve nonroad sectors in MOVES
  - Contains equipment specific to O&G drilling and production
    - Fracturing rigs
    - Mechanical drilling engines
    - Seismography rigs
    - Tractor/skid mounted oil field pumps
  - Other equipment used in O&G industry may be accounted for in other classes (e.g., compressors, generators)
  - Does not include emissions/losses from O&G wells, fluid reservoirs, product containers, pipelines, etc.
  - Results shown are based on current MOVES2014 nonroad output
Emissions = EF (g/hp-hr) * deterioration factor * transientfactor * fuelfactor * population * activity (hr/yr) * avgHP (hp) * loadfactor

- Emission Factors, deterioration factors and transient factors are generated from testing “generic” diesel, gasoline and CNG engines.
- Populations derived from sales data using a growth and scrappage algorithm.
  - Populations computed nationally and allocated by state and county using surrogates which vary by sector.
- Annual activity estimated from surveys.
- Growth modeled through linear growth in the populations.
- AvgHP is the average full rated engine horsepower within a bin.
- Loadfactor are fractions of total rated power and estimated based on engineering judgment.
Current Oil and Gas Sector Factors

- Emission Factors derived from testing diesel and gas engines, not specific ‘rig’ configurations
- Population data is based on equipment sales data purchased from vendors
- Load factor (average) for oil and gas
  - 90% of full rated power for gasoline
  - 43% of full rated power for diesel
- Activity data is from limited surveys and studies. Additional data sources needed.
  - 1,104 hours/year – equipment piece for gasoline/CNG/LPG
  - 1,231 hours/year – equipment piece for diesel
- Growth rate is from a BEA economic analysis of domestic oil and gas production
  - 0.27% annual linear
- National Allocation is based on:
  - Number of employees in O&G production and drilling by county from 2002 CBP NAICS cod 211XXX and 2002 CBP NAICS code 213111
National Nonroad Inventory of THC in 2014

Annual Tons

- Oil and Gas Sector < 0.25 percent

THC

- Recreational
- Construction
- Industrial
- Lawn & Garden
- Agriculture
- Commercial
- Logging
- Airport
- Mining
- Oil & Gas
- Pleasure Craft
- Railroad
National Nonroad Inventory of NOx in 2014

Oil and Gas Sector < 0.50 percent
US National Annual Tons from Oil and Gas Equipment in 2014

- **THC**
  - Gas: 1800 tons
  - Diesel: 200 tons
  - CNG/LPG: 800 tons

- **NOx**
  - Gas: 1000 tons
  - Diesel: 6000 tons
  - CNG/LPG: 1000 tons

Nonroad O&G Equipment Population Distribution by State in MOVES2014
Results Summary

• According to MOVES2014, oil and gas sector contribution to total US non-road inventory is small for all criteria pollutants

• O&G contribution more significant in counties where such activity is concentrated

• Pollutant levels depend on equipment types and fuel types

• O&G is concentrated in a few states
  – 2/3’s of all counties have none

• Current estimates in NONROAD2008 and MOVES2014 are out of date
Challenges

• Current growth estimates reflect the declining O&G industry of the 1990’s, not the robust industry of 2014.
• Data to develop equipment populations are difficult to obtain except in small local settings.
• Data to develop precise load factors or operating profiles are challenging to collect.
• In-use emission testing of working oil field equipment is expensive.
Next Steps, Near Term

- NONROAD2008 is integrated into NMIM, which outputs spatially allocated emissions, including HAPs.
- NONROAD2008 now integrated into MOVES2014 – Outputs spatially allocated emissions in SMOKE-MOVES, however there is no HAP output yet.
- HAP output is planned for MOVES2014a – release date unknown.
- The MOVES team is also analyzing emissions data collected over the past few years (including our own Non-road pilot study).
Next Steps, Long Term – How Can You Help Improve MOVES?

• Just as we did for on-road in MOVES2010 & 2014, we would like to take a fresh look at non-road modeling in MOVES going forward

• We need data, data, and more data to update our model!
  – Emissions = EF (g/hp-hr) * deterioration factor * TransientFactor * fuelfactor * population * activity (hr/yr) * avgHP (hp) * loadfactor
  – Especially on emission factors/DF/TransientFactor, activity, populations, load factors and county level allocations

• We need to update the oil and gas equipment types

• We are interested in user feedback
  – Questions, Suggestions, Discussion?
• How users can customize their NR runs

— …