



MOVES2014 NONROAD Model Oil and Gas Sector

2014 Oil and Gas Conference

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Overview

- MOVES2014 now contains nonroad capabilities
 - NONROAD2008 model incorporated into MOVES2014
 - with some limitations for output options
 - Calculates inventories
 - For THC, CO, NO_x, 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 (eg., 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



MOVES2014 Nonroad Equation

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

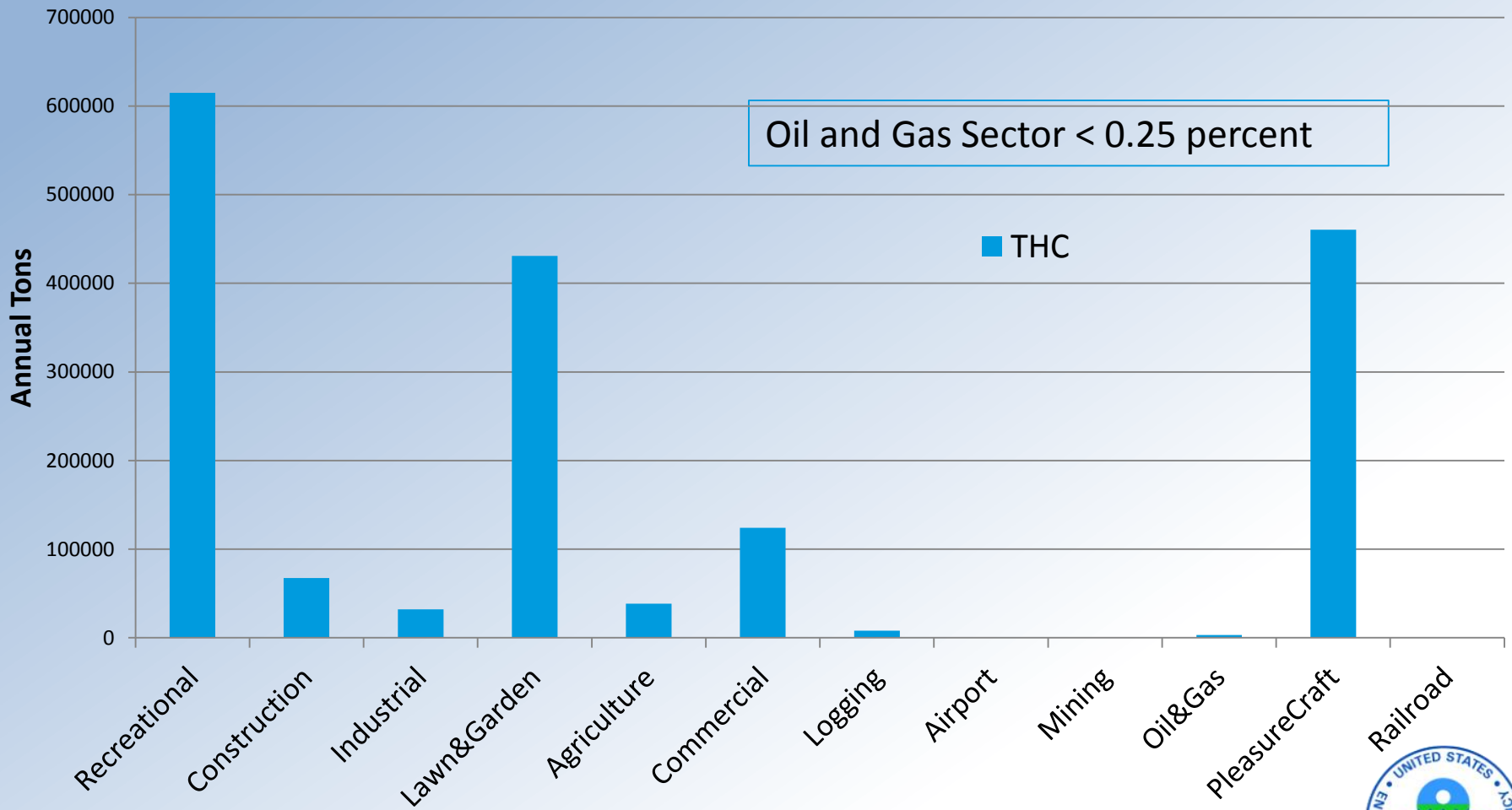


Current Oil and Gas Sector Factors

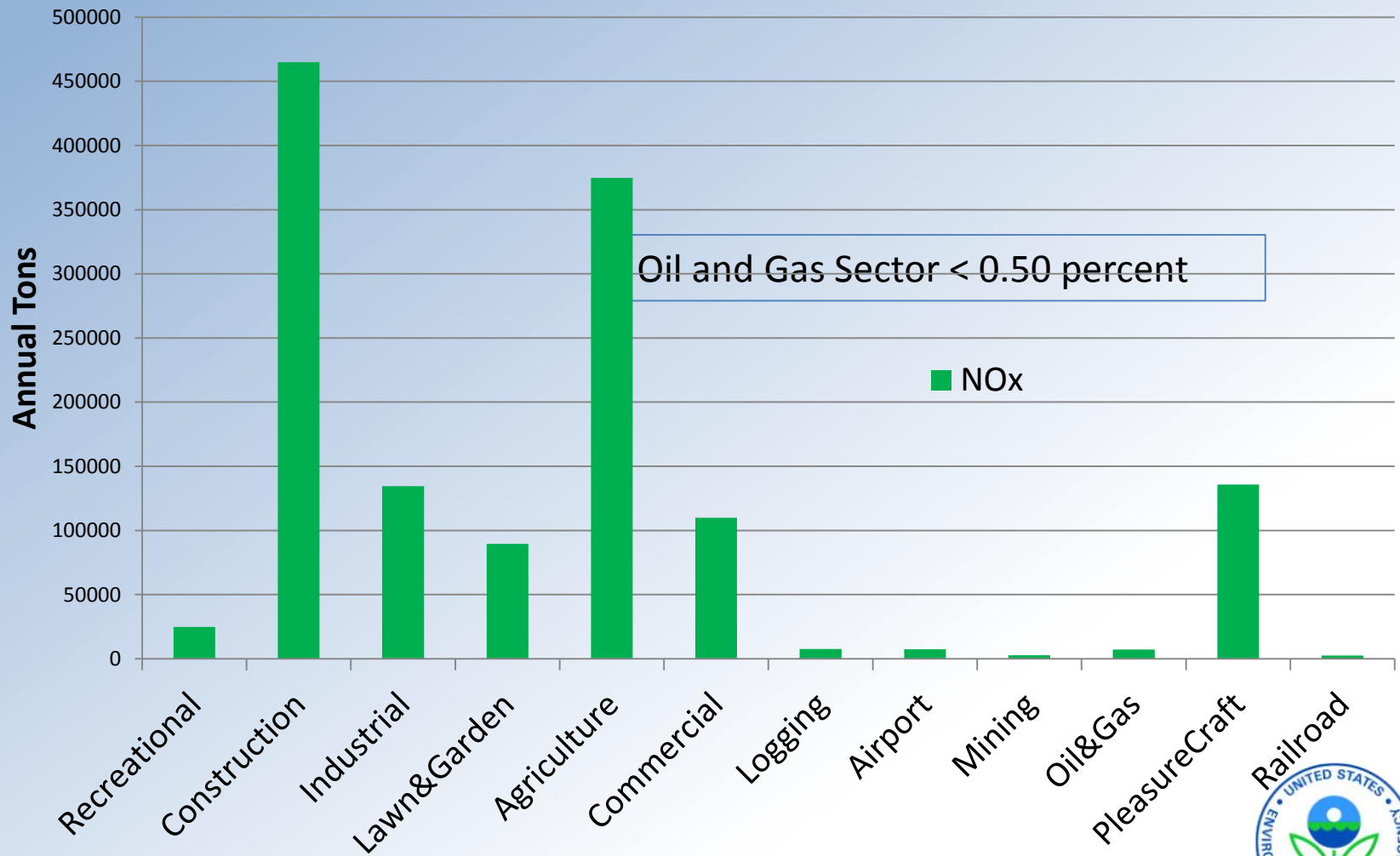
- Emission Factors derived from testing diesel and gas engines, not specific ‘rig’ configurations
- Population data is based on equipment sales data purchased from vendors
- Load factor (average) for oil and gas
 - 90% of full rated power for gasoline
 - 43% of full rated power for diesel
- Activity 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



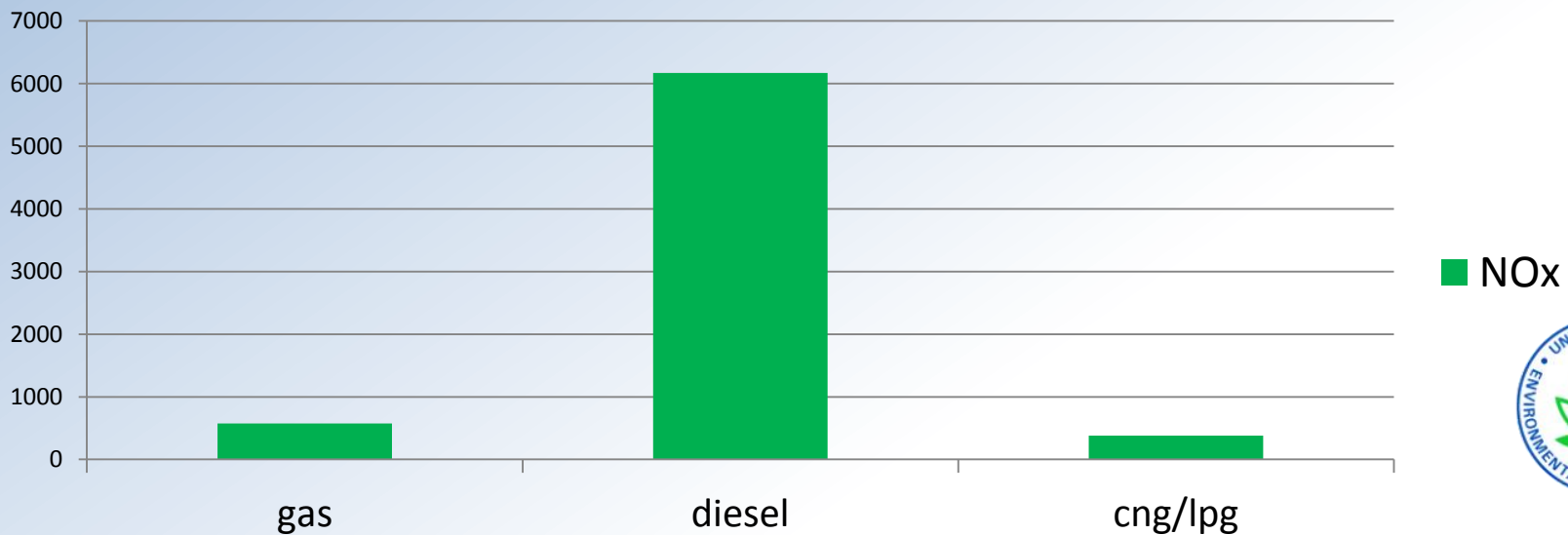
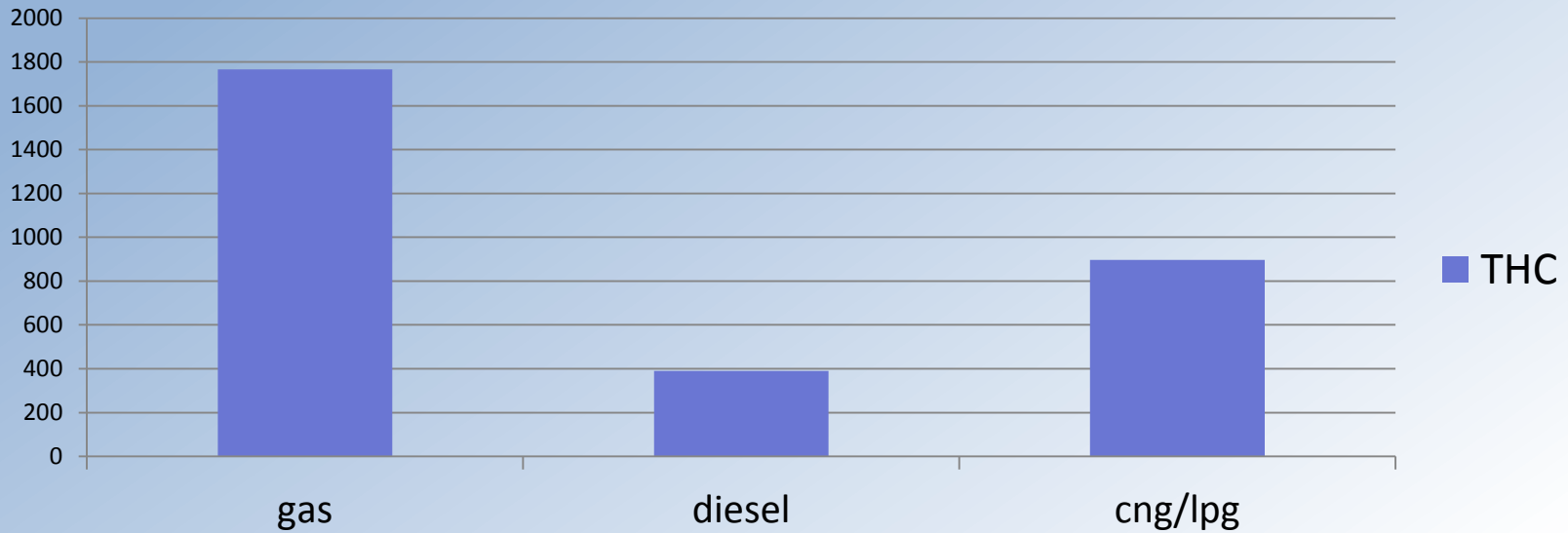
National Nonroad Inventory of THC in 2014



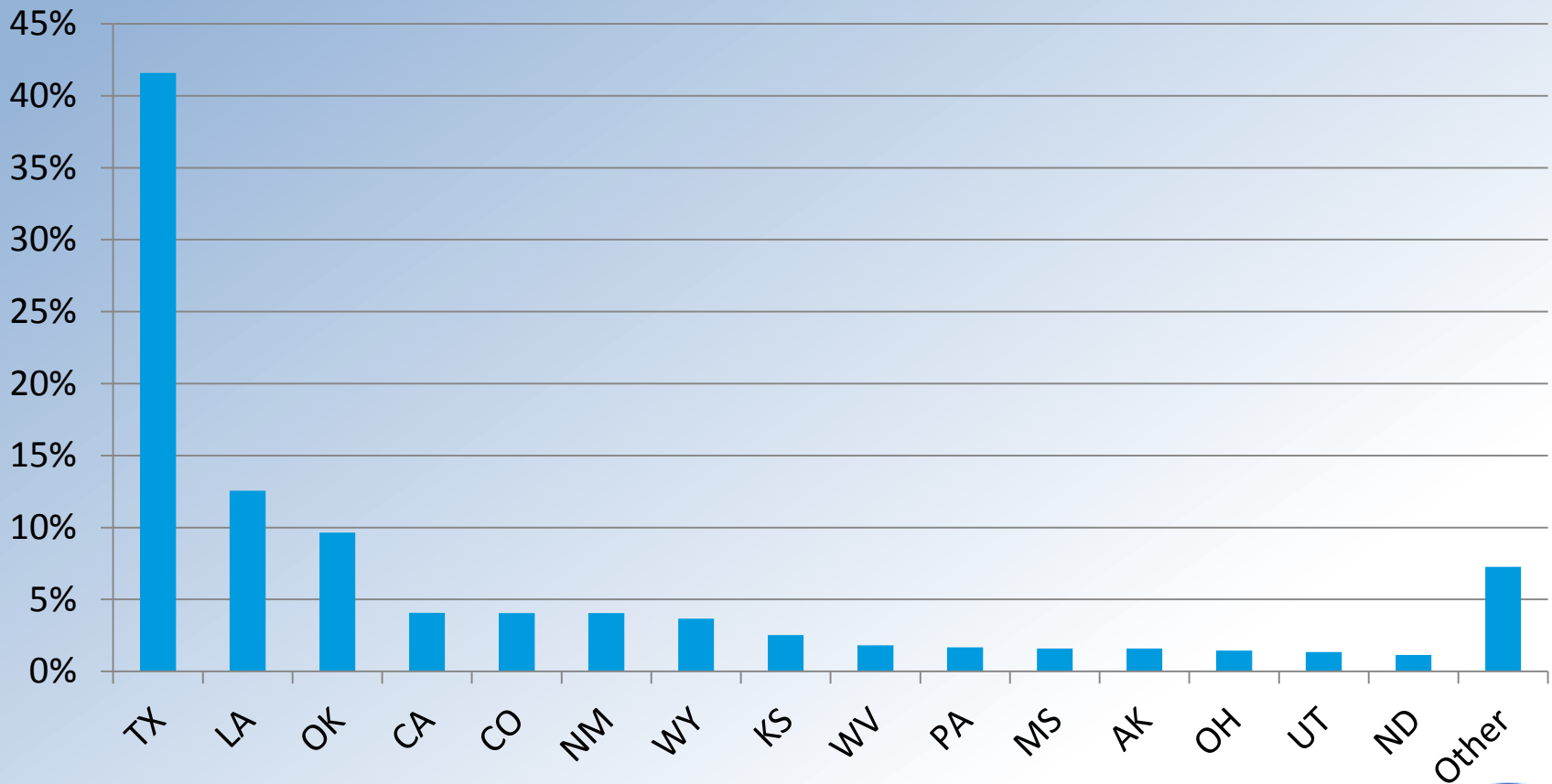
National Nonroad Inventory of NOx in 2014



US National Annual Tons from Oil and Gas Equipment in 2014



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?



Appendix?

- How users can customize their NR runs
 - ...

