

# **Oil and Gas 101: An Overview of Oil and Gas Upstream Activities and Using EPA's Nonpoint Oil and Gas Emission Estimation Tool for the 2017 NEI**

Jennifer Snyder, U.S. EPA

Regi Oommen and Mike Pring, Eastern Research Group

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# Presenters

- Mike Pring, Eastern Research Group
  - [mike.pring@erg.com](mailto:mike.pring@erg.com)
- Jennifer Snyder, U.S. EPA
  - [Snyder.Jennifer@epa.gov](mailto:Snyder.Jennifer@epa.gov)
- Regi Oommen, Eastern Research Group
  - [regi.oommen@erg.com](mailto:regi.oommen@erg.com)



# Training Overview

- Oil and gas production in the United States
- Upstream oil and gas emission sources
- Data resources
- Oil and gas emission estimates in the NEI
- Future plans
- Use and application of the Nonpoint Oil and Gas Emission Estimation Tool



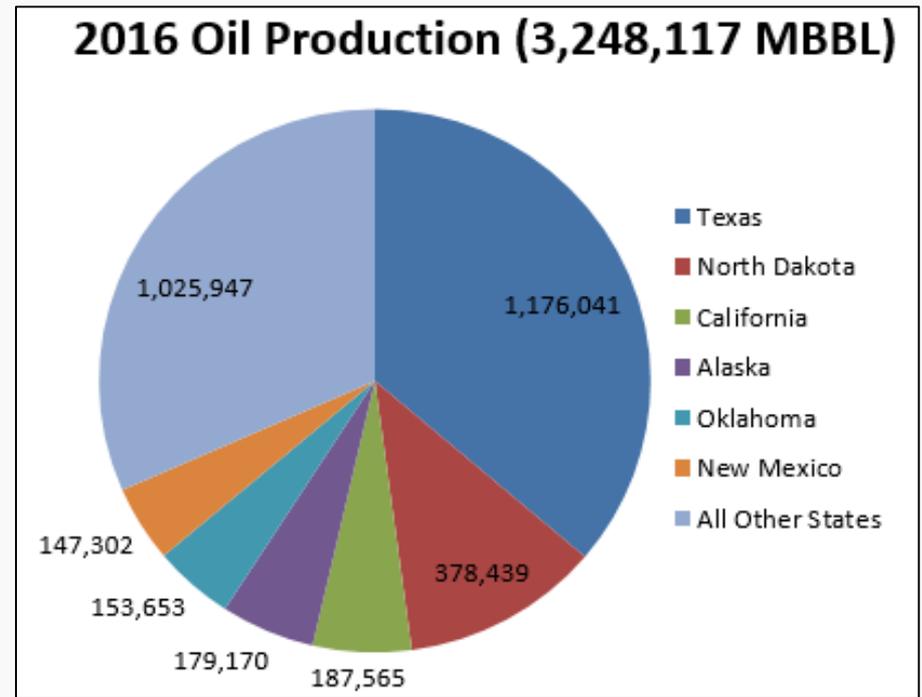
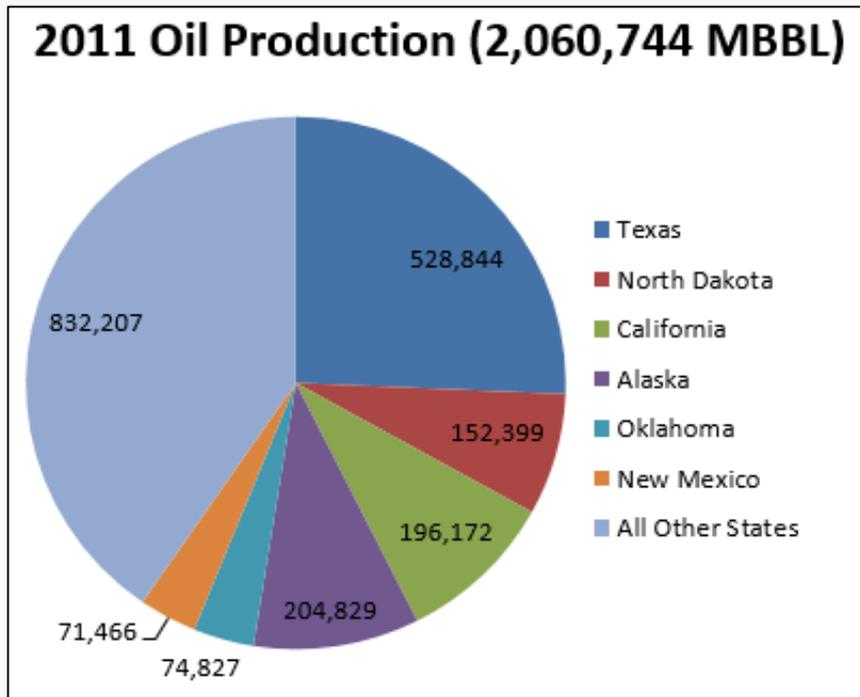
# Oil and Gas Production in the US

- Over 3 billion barrels of crude oil produced in 2016
  - ~50% increase since 2011
  - Down slightly from 2015
  - ~18% of production offshore (was 30% in 2010)
  - Texas, North Dakota, California
- Over 28 trillion cubic feet of gas produced in 2016
  - ~30% increase since 2009
  - ~5% of production offshore
  - Texas, Pennsylvania, Oklahoma

Source: U.S. Energy Information Administration



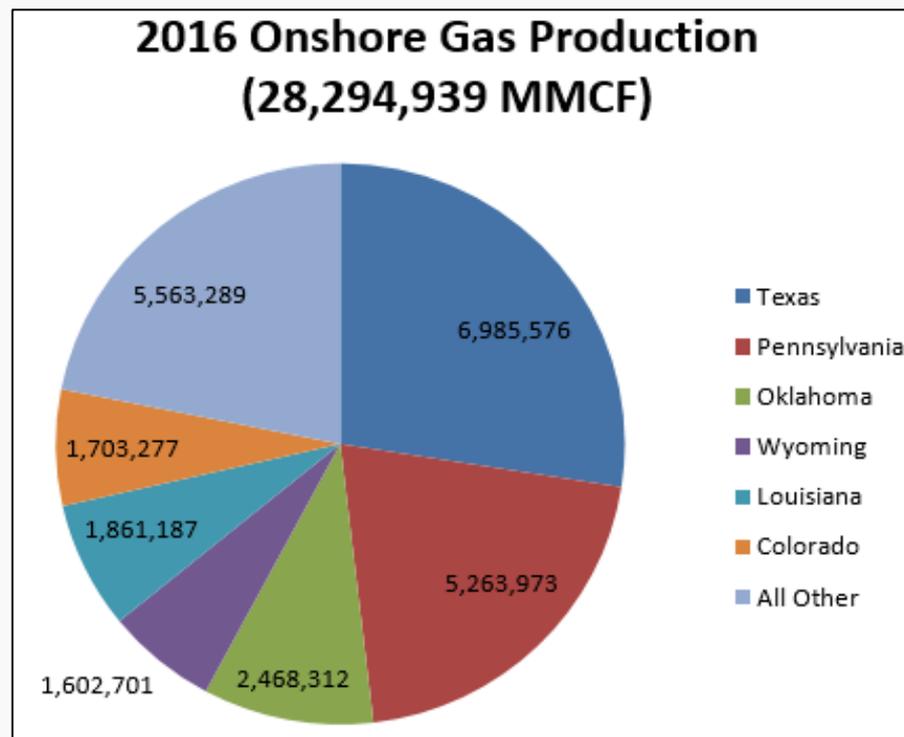
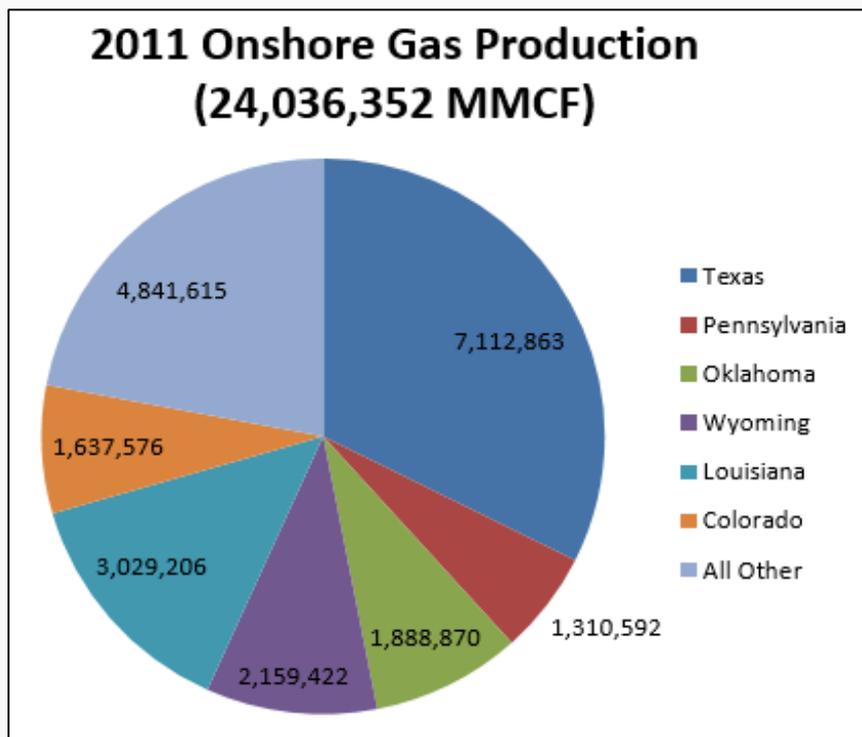
# US Onshore Crude Oil Production



Source: U.S. Energy Information Administration



# US Onshore Natural Gas Production



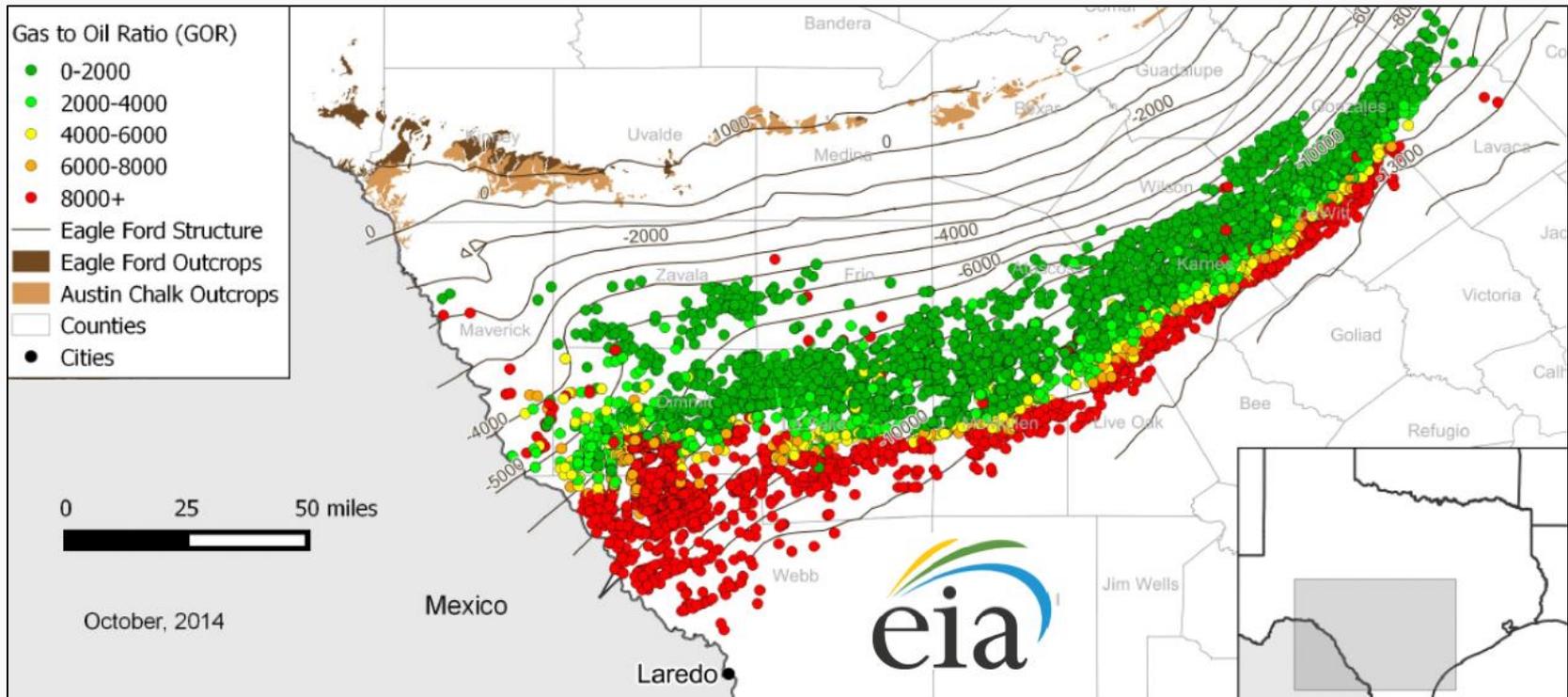
Source: U.S. Energy Information Administration



# Natural Gas, NGLs, Condensate, Oil

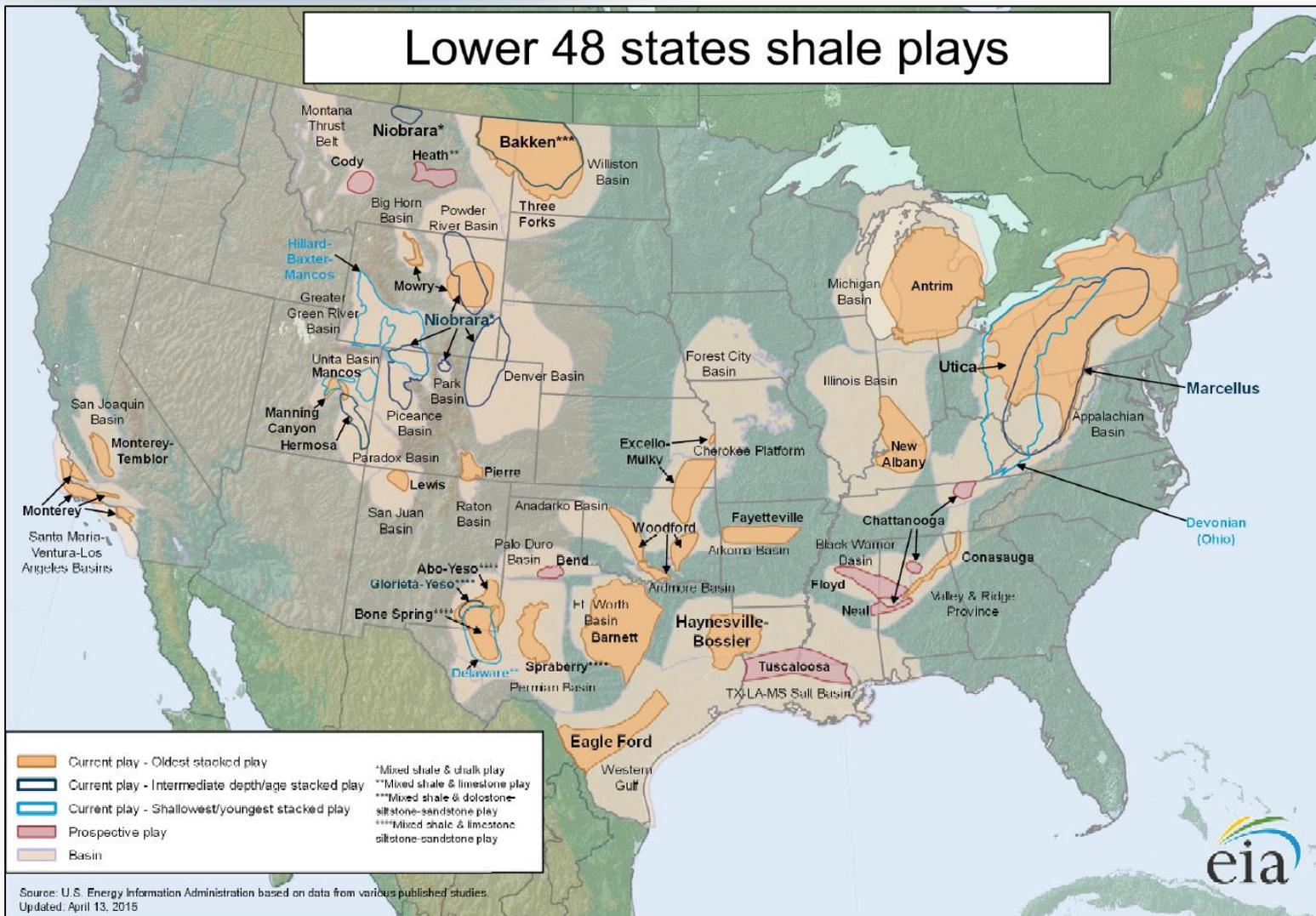
- Natural Gas (C1 – primarily Methane)
- Natural Gas Liquids (C2 – C4)
  - Ethane, Propane, Butane
  - Extracted at gas processing plants
  - “Wet gas”
- Condensate (~C5+)
  - Condenses out of gas stream at surface
- Crude Oil (mixture of heavier hydrocarbons)
  - Distilled into gasoline, kerosene, diesel, jet fuel

# Eagle Ford Shale Oil and Gas Well Map

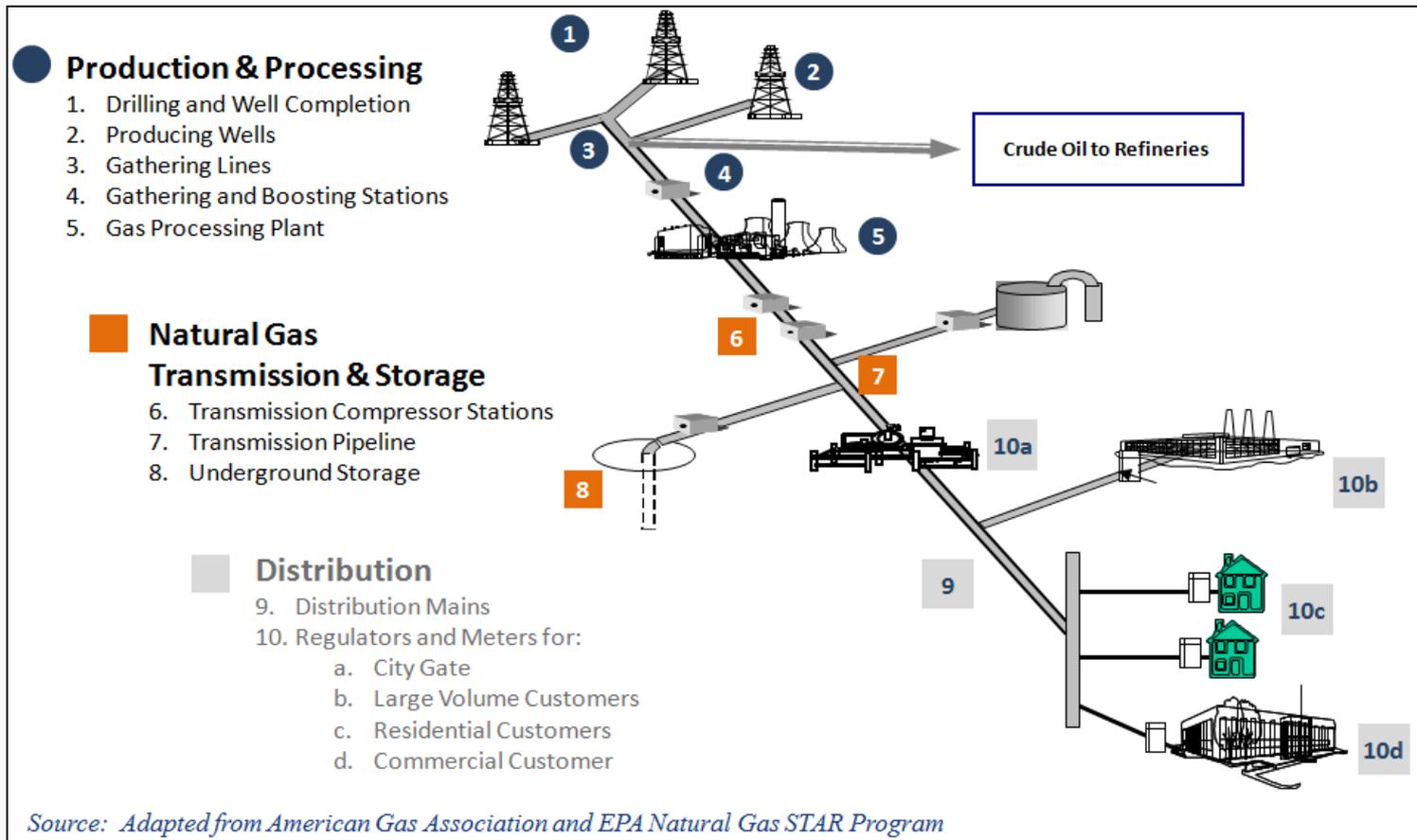


Source: U.S. Energy Information Administration

# Lower 48 states shale plays



# Upstream Oil and Gas Emission Sources





# Upstream Oil and Gas Emission Sources

## Exploration Sources

- Drilling Rigs
- Hydraulic Fracturing Pumps
- Mud Degassing
- Well Completion Venting

## Production Sources

- Artificial Lift Engines
- Associated Gas Venting
- Condensate Tanks
- Crude Oil Tanks
- Dehydrators

## Production Sources (continued)

- Fugitive Leaks
- Gas-Actuated Pneumatic Pumps
- Heaters
- Lateral Compressor Engines
- Liquids Unloading
- Hydrocarbon Liquids Loading
- Pneumatic Devices
- Produced Water Tanks
- Wellhead Compressor Engines



# Tool Estimation Methodologies

- Area (nonpoint) source methodologies
- Based on point source methodologies averaged over the population
- Scaled to the county level using activity factors (well counts, oil production, gas production)
- Refer to “*2014 Nonpoint Oil and Gas Emission Estimation Tool Version 2.2*” (June, 2017) for details

# Exploration - Drilling Rigs

- Used to drill wellbore to target formation
- 2 primary rig types
  - Mechanical
  - Diesel-electric
- Powered by large, diesel engines (~1,000 – 1,500 HP)
- ~2 – 4 weeks



EPA photo.



# Drilling Rigs

- Emissions based on cumulative feet drilled
- Process characteristics needed to estimate emissions
  - Engine size and type (HP)
  - Operating hours (hr/spud)
- Emission factors from EPA's NONROAD model
- Methodology accounts for different types of rig configurations (mechanical and diesel-electric)



# Mud Degassing

- Mud degassing refers to the process of “off-gassing” of entrained gas in the drilling mud once it is outside of the wellbore
- Drilling mud used to keep the drill bit cool, carry out drill cuttings, and maintain wellbore pressure to prevent formation fluids from entering wellbore
- Emissions based on total drilling days
- Emission factor derived from 1977 EPA report “*Atmospheric Emissions from Offshore Oil and Gas Development and Production*”



# Hydraulic Fracturing Pumps

- Emissions based on number of fracture events
- Process characteristics needed to estimate emissions
  - Engine size (HP)
  - Number of engines
  - Operating hours (hr/event)
- Emission factors from EPA's NONROAD model

# Well Completion Venting

- Emissions generated as gas is vented prior to well being brought into production
- For fractured wells, emissions are generated as gas entrained in the flowback fluid is emitted through open vents at the top of flowback tanks
- Fractured wells regulated under NSPS OOOO and OOOOa



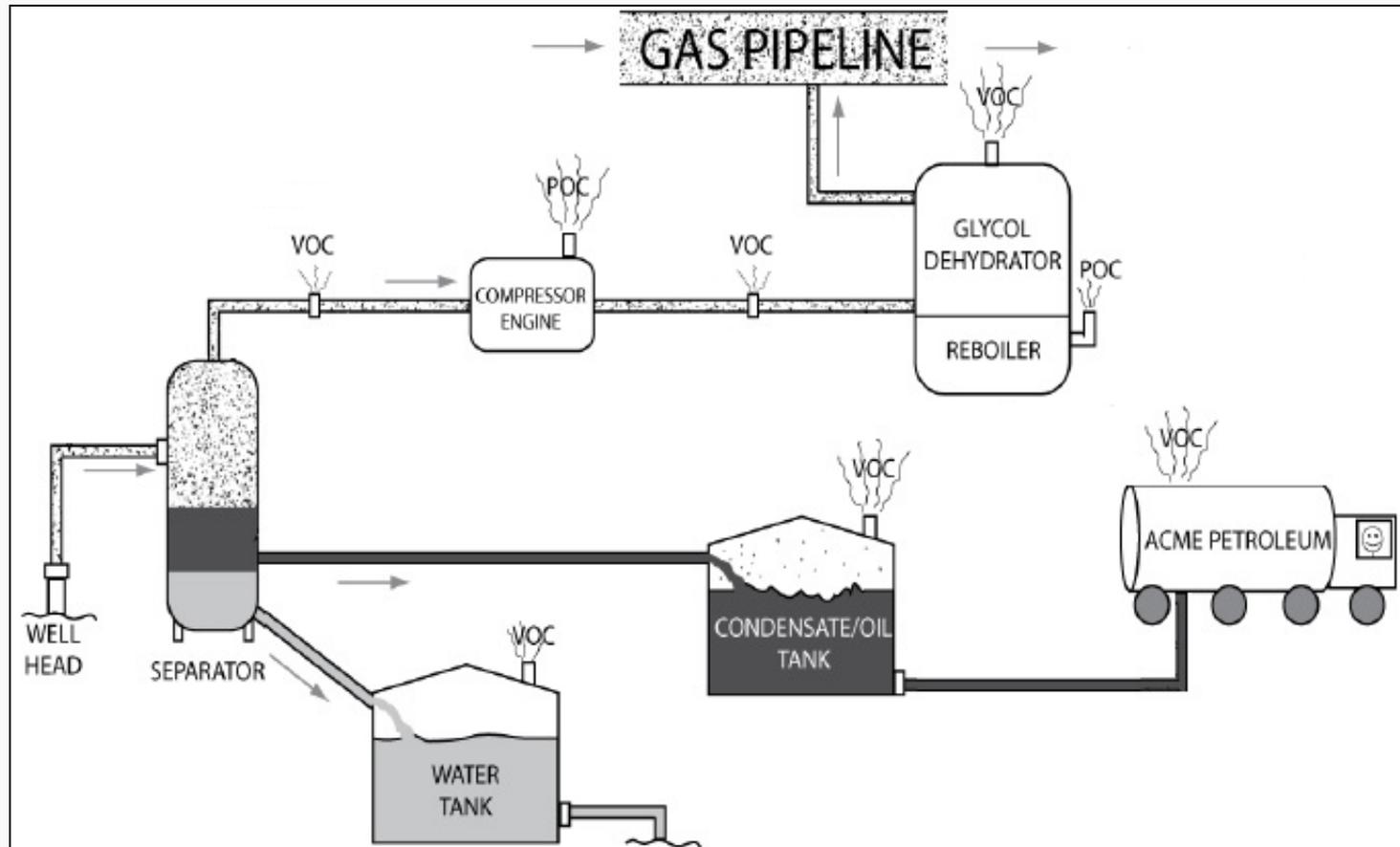
*Example of Green Completion Equipment  
(Source: Weatherford)*



# Well Completion Venting

- Emissions based on number of completion events
- Process characteristics needed to estimate emissions
  - Volume of gas released per completion (MCF/event)
    - Oil and gas
    - Conventional and unconventional
  - Gas composition
  - Controls

# Production Sources



Source : Texas Commission on Environmental Quality Air Permit Reference Guide APDG 5942



# Artificial Lift Engines

- “Pumpjack” engines
- Engines used to lift oil out of the well if there is not enough bottom hole pressure for the oil to flow to the surface
- Generally use casinghead gas



# Artificial Lift Engines

- Emissions based on number of oil wells
- Process characteristics needed to estimate emissions
  - Engine size (HP)
  - Engine operating schedule (hr/yr)
  - Fraction of oil wells with engines
- Emission factors from AP-42
- Electric engines are common, accounted for in methodology



# Associated Gas Venting

- Refers to the practice of venting gas produced at oil wells where the well is not connected to a gas sales pipeline
- May be flared (e.g. Bakken Shale)
- Process characteristics needed to estimate emissions
  - Quantity of gas vented per barrel of oil production (MCF/bbl)
  - Fraction of gas flared
  - Composition of the vented gas



# Condensate Tanks



EPA photo.



# Condensate Tanks

- Emissions based on condensate production
- Emissions occur from flashing, working, and breathing losses
- Flashing losses are generally the largest component and occur when gases entrained in a liquid “flash off” as the pressure drops
- Emissions per barrel of condensate needed to estimate total county-level emissions (lb/bbl)
- Regulated under NSPS OOOO and OOOOa

# Crude Oil Tanks

- Used to store crude oil at a well pad or central tank battery prior to transfer to a refinery
- Some oil fields pipe oil directly downstream and do not have tanks in the field
  - Accounted for in Tool
- Largest VOC source as calculated by the Tool



Permian Basin Tank Battery  
Source: Google Earth



# Crude Oil Tanks

- Emissions based on oil production
- Emissions occur from flashing, working, and breathing losses
- Emissions per barrel of crude oil needed to estimate total county-level emissions (lb/bbl)
- Regulated under NSPS 0000 and 0000a

# Dehydrators

- Use glycol to remove water from gas stream to prevent corrosion or freezing issues downstream
- Small reboiler used to regenerate the glycol
- May be located at well pad, or at centrally located gathering station



EPA photo.

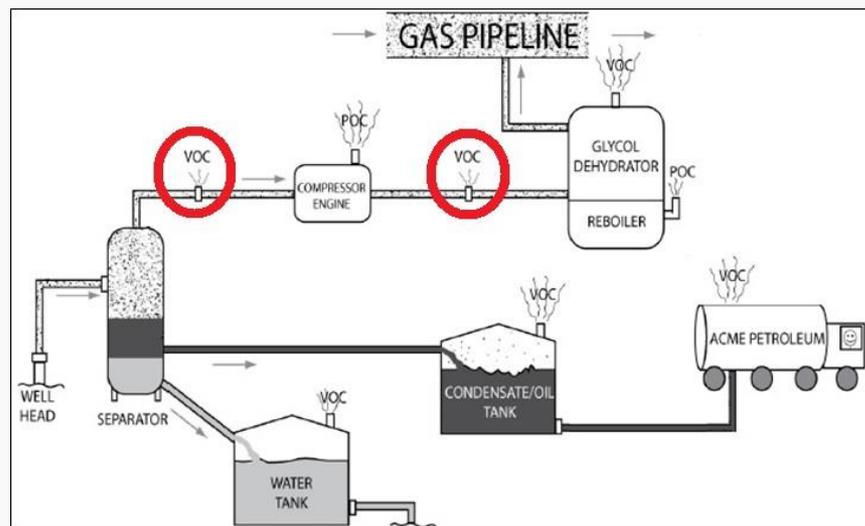


# Dehydrators

- Emissions generated from the still vent and the reboiler
- Emissions from the still vent based on gas production
  - Emissions per throughput (lb/MMSCF)
- Emissions from the reboiler based on gas well count
  - Number of dehydrators per well
  - Reboiler size (MMBtu/hr) and operating schedule (hr/yr)
- NESHAP HH and HHH may require controls

# Fugitive Leaks

- Emissions of gas that escape through well site components such as connectors, flanges, and valves
- Source category only covers components located at the well pad
- Regulated under NSPS 0000a



Source : Texas Commission on Environmental Quality Air Permit Reference Guide APDG 5942



# Fugitive Leaks

- Emissions based on well count
- Process characteristics needed to estimate emissions
  - Counts of fugitive components by type per well
  - Operating schedule (hr/yr)
  - Composition of leaked gas
- Emission factors from “Protocol for Equipment Leak Emission Estimates” (EPA, 1995)



# Gas-Actuated Pneumatic Pumps

- Small gas-driven plunger pumps used to provide a constant supply of chemicals or lubricants
- Commonly used in sites where electric power is unavailable
- Gas-actuated pumps vent by design

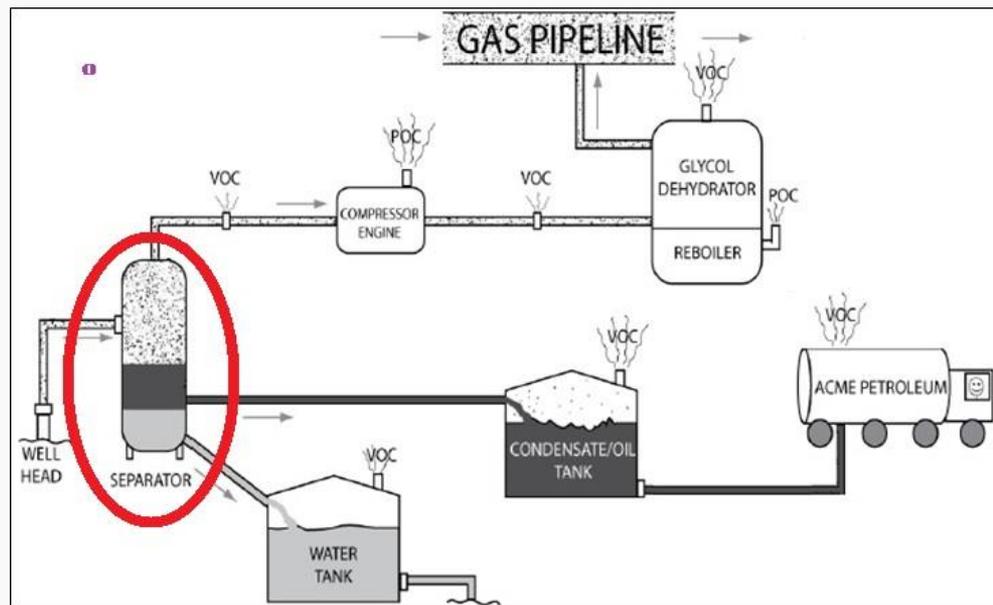


# Gas-Actuated Pneumatic Pumps

- Emissions based on well counts
- Kimray pumps
- Chemical injection pumps (CIP)
- Certain pumps regulated under NSPS 0000a
- Process characteristics needed to estimate emissions
  - Count of pumps per well (oil, gas, CBM)
  - Pump vent rate (SCF per throughput or day)
  - Composition of vented gas

# Heaters

- Line heaters - used to maintain temperatures as pressure decreases to prevent formation of hydrates (Marcellus Shale)
- Heater treaters – used to heat oil/water emulsions to aid in separation (Bakken Shale, Permian Basin)



Source : Texas Commission on Environmental Quality Air Permit Reference Guide APDG 5942



# Heaters

- Emissions based on the number of wells
- Heaters used as control devices regulated under NSPS OOOO and OOOOa
- Process characteristics needed to estimate emissions
  - Number of heaters per well
  - Heater size (MMBtu/hr)
  - Operating schedule (hr/yr)
  - H<sub>2</sub>S content (to estimate SO<sub>2</sub>)



# Lateral Compressor Engines

- Large “line” engines
- May serve ~10 to 100 wells
- Used at gathering or booster stations (mid-stream)
- Natural gas-fired
- Rich-burn or lean-burn



# Lateral Compressor Engines

- Emissions based on the number of gas wells
- Compressors regulated under NSPS 0000 and 0000a
- Process characteristics needed to estimate emissions
  - Number of gas wells served by a lateral engine
  - Engine size (HP)
  - Operating schedule (hr/yr)
  - Control information



# Liquids Unloading

- Used to remove accumulation of fluids in the wellbore
- Also known as “well blowdowns”
- May be controlled (flaring or plunger lifts)

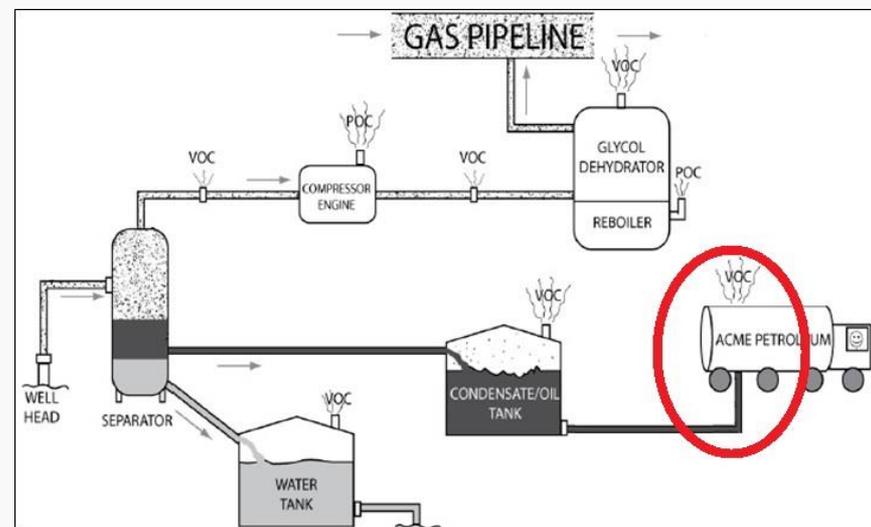


# Liquids Unloading

- Emissions based on the number of gas wells
- Process characteristics needed to estimate emissions
  - Number of unloading events per well
  - Volume of vented gas per liquids unloading event (MCF/event)
  - Composition of vented gas
  - Control information

# Hydrocarbon Liquids Loading

- Emissions generated during transfer of liquids from tanks to trucks
- As with storage tank emissions, where liquids are piped directly downstream, no emissions from this category
  - Accounted for in Tool



Source : Texas Commission on Environmental Quality Air Permit Reference Guide APDG 5942



# Hydrocarbon Liquids Loading

- Emissions based on oil and condensate production
- AP-42 loading loss equation used to estimate emissions
- Tank vapor composition needed to estimate VOC and HAP emissions

$$L = 12.46 \times \left( \frac{S \times V \times MW_{gas}}{T} \right)$$



# Pneumatic Devices

- Use high-pressure gas to produce mechanical motion (levers, switches)
- Largest CH<sub>4</sub> source under Subpart W and in the GHG EI (production sector)
- 2<sup>nd</sup> largest VOC source as calculated by the Tool

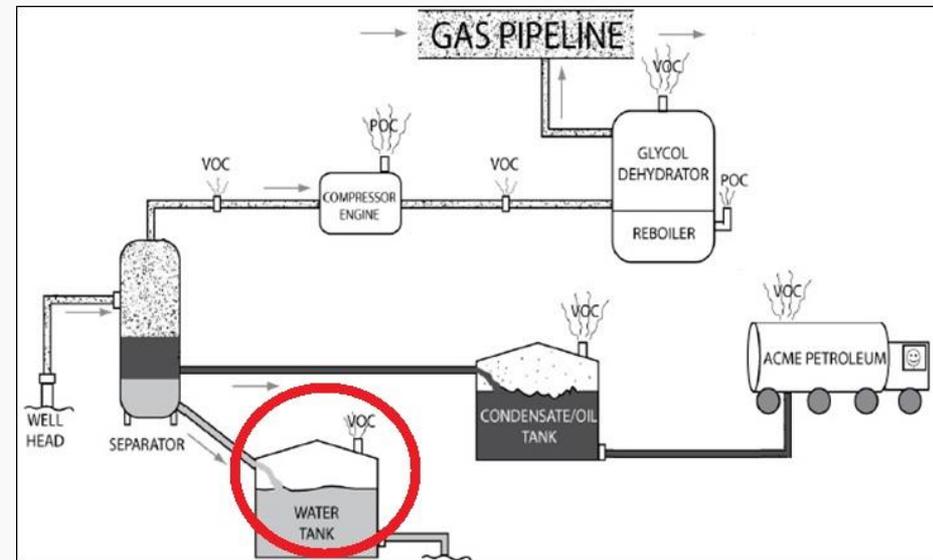


# Pneumatic Devices

- Emissions based on the number of wells
- Process characteristics needed to estimate emissions
  - Number of devices per well
  - Type of devices (high, low, and intermittent-bleed)
  - Volume of vented gas per device (SCF/hr/device)
  - Operating schedule (hr/yr)
  - Composition of vented gas
- Regulated under NSPS OOOO and OOOOa

# Produced Water Tanks

- Store water separated at the wellhead
- Emissions generated from working and breathing losses
- Water may be injected underground to maintain pressure (waterflooding) or for disposal



Source : Texas Commission on Environmental Quality Air Permit Reference Guide APDG 5942

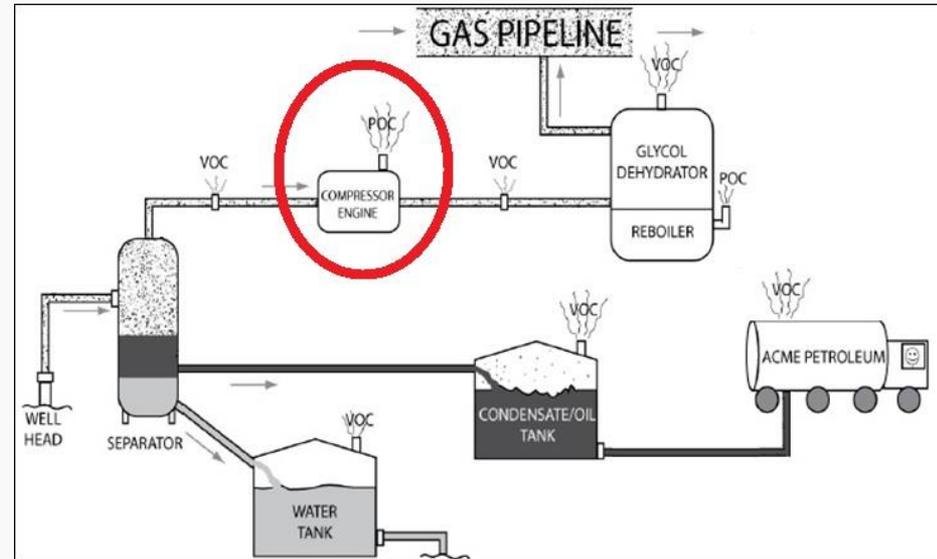


# Produced Water Tanks

- Emissions based on produced water production
- Emissions occur from working and breathing losses
- Process characteristics needed to estimate emissions
  - Emissions per barrel of production (lb/bbl)
  - Fraction of produced water directed to tanks
  - Composition of the tank vapors

# Wellhead Compressor Engines

- Provide energy to move produced gas downstream to gathering or boosting station
- Brought onsite as well pressure drops
- Utilize produced gas as fuel
- Largest NO<sub>x</sub> source as calculated by the Tool



Source : Texas Commission on Environmental Quality Air Permit Reference Guide APDG 5942



# Wellhead Compressor Engines

- Compressors regulated under NSPS OOOO and OOOOa
- Emissions based on the number of gas wells
- Process characteristics needed to estimate emissions
  - Fraction of gas wells requiring compression
  - Engine size (HP)
  - Operating schedule (hr/yr)
  - Control information



# Data Resources

- National Oil & Gas Committee Information Repository
- Existing Studies
- EPA Natural Gas STAR Program
  - <https://www.epa.gov/natural-gas-star-program/natural-gas-star-program>
- Industry Surveys
- State Permitting/Inventory Data



# Existing Studies

- National Oil & Gas Committee Information Repository
  - <http://vibe.cira.colostate.edu/ogec/home.htm>
- Texas Commission on Environmental Quality (TCEQ)
  - [https://www.tceq.texas.gov/airquality/airmod/project/pj\\_report\\_ei.html](https://www.tceq.texas.gov/airquality/airmod/project/pj_report_ei.html)
- Western Regional Air Partnership (WRAP)
  - <https://www.wrapair2.org/emissions.aspx>



# Industry Surveys

- Send directly to industry, focused or broad
- Recent Industry Surveys/Examples
  - CenSARA
  - TCEQ
  - WRAP



# State Permitting/Inventory Data

- Permit Applications
- Annual Emissions Inventory Submittals
- Dehydrator Simulation Software
  - Gas Research Institute (GRI) GLYCalc Model
  - ProMax®, Aspen HYSYS®, etc.
- Storage Tank Simulation Software
  - American Petroleum Institute (API) E&P TANKS
  - ProMax®, Aspen HYSYS®, etc.



# State Permitting/Inventory Data

- EPA (Cindy Beeler) Presentation
  - GRI-GLYCalc and E&P TANK Example Applications
  - [http://vibe.cira.colostate.edu/ogec/docs/meetings/2015-03-12/NationalOGEmissionWorkGroup\\_031215\\_GLYCalc\\_EPTank4.pdf](http://vibe.cira.colostate.edu/ogec/docs/meetings/2015-03-12/NationalOGEmissionWorkGroup_031215_GLYCalc_EPTank4.pdf)
- Data may be used to develop “nonpoint” factors
  - GRI-GLYCalc - fugitive gas composition and dehydrator emission factors
  - E&P TANK – VOC and HAP emission factors



# GRI-GLYCalc Gas Composition

WET GAS STREAM

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Temperature: 95.00 deg. F  
 Pressure: 994.70 psia  
 Flow Rate: 2.48e+005 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	1.08e-001	1.27e+001
Carbon Dioxide	1.90e-001	5.46e+001
Hydrogen Sulfide	9.99e-005	2.22e-002
Nitrogen	1.02e-001	1.86e+001
Methane	8.96e+001	9.39e+003
Ethane	5.67e+000	1.12e+003
Propane	2.33e+000	6.71e+002
Isobutane	5.93e-001	2.25e+002
n-Butane	5.95e-001	2.26e+002
Isopentane	2.33e-001	1.10e+002
n-Pentane	1.62e-001	7.63e+001
Cyclopentane	9.99e-003	4.58e+000
n-Hexane	5.59e-002	3.15e+001
Cyclohexane	4.29e-002	2.36e+001
Other Hexanes	6.99e-002	3.94e+001
Heptanes	4.10e-002	2.68e+001
Methylcyclohexane	3.60e-002	2.31e+001
Benzene	1.60e-002	8.16e+000
Toluene	1.30e-002	7.82e+000
Ethylbenzene	9.99e-004	6.93e-001
Xylenes	4.00e-003	2.77e+000
C8+ Heavies	1.21e-001	1.35e+002

DRY GAS STREAM

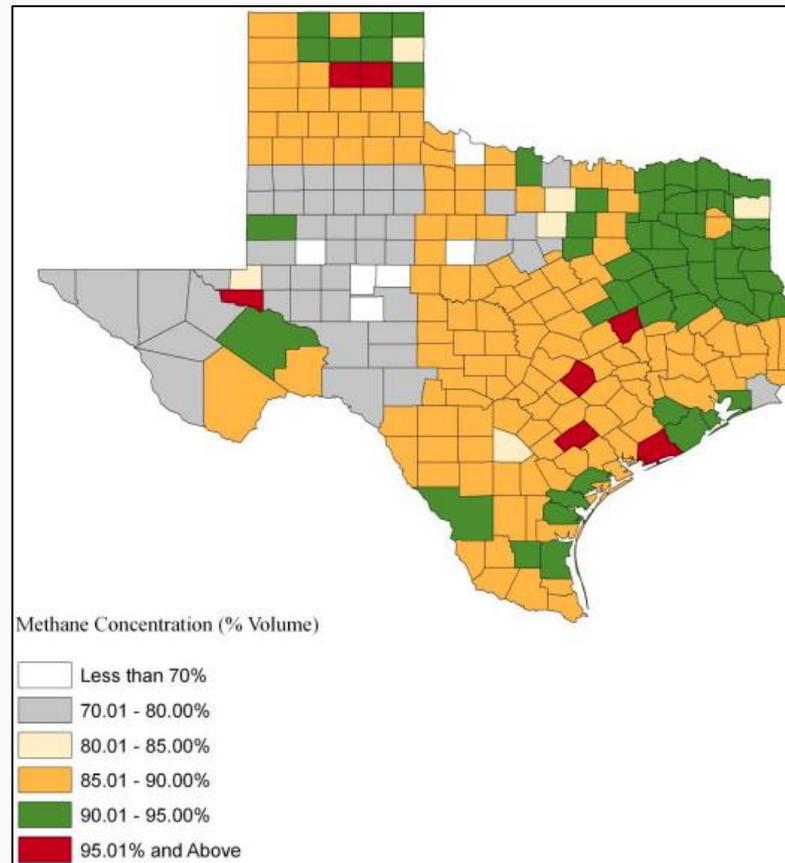
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Temperature: 95.00 deg. F  
 Pressure: 994.70 psia  
 Flow Rate: 2.48e+005 scfh

Component	Conc. (vol%)	Loading (lb/hr)
Water	4.17e-003	4.90e-001
Carbon Dioxide	1.89e-001	5.42e+001
Hydrogen Sulfide	9.59e-005	2.13e-002
Nitrogen	1.02e-001	1.86e+001
Methane	8.97e+001	9.39e+003
Ethane	5.68e+000	1.11e+003
Propane	2.33e+000	6.69e+002
Isobutane	5.93e-001	2.25e+002
n-Butane	5.94e-001	2.25e+002
Isopentane	2.32e-001	1.09e+002
n-Pentane	1.61e-001	7.59e+001
Cyclopentane	9.79e-003	4.48e+000
n-Hexane	5.56e-002	3.13e+001
Cyclohexane	4.15e-002	2.28e+001
Other Hexanes	6.96e-002	3.91e+001
Heptanes	4.05e-002	2.65e+001
Methylcyclohexane	3.47e-002	2.22e+001
Benzene	1.18e-002	5.99e+000
Toluene	8.47e-003	5.09e+000
Ethylbenzene	5.94e-004	4.12e-001
Xylenes	2.00e-003	1.38e+000
C8+ Heavies	1.17e-001	1.30e+002



# GRI-GLYCalc Gas Composition





# GRI-GLYCalc Dehydrator Emissions

CONTROLLED REGENERATOR EMISSIONS	
Component	lbs/hr
Hydrogen Sulfide	<0.0001
Methane	0.0088
Ethane	0.0096
Propane	0.0123
Isobutane	0.0061
n-Butane	0.0081
Isopentane	0.0027
n-Pentane	0.0025
Cyclopentane	0.0006
n-Hexane	0.0009
Cyclohexane	0.0025
Other Hexanes	0.0011
Heptanes	0.0006
Methylcyclohexane	0.0014
Benzene	0.0065
Toluene	0.0027
Ethylbenzene	0.0001
Xylenes	0.0004
C8+ Heavies	<0.0001
<b>Total Emissions</b>	<b>0.0668</b>
Total Hydrocarbon Emissions	0.0668
Total VOC Emissions	0.0484
Total HAP Emissions	0.0106
Total BTEX Emissions	0.0097

FLASH TANK OFF GAS	
Component	lbs/hr
Hydrogen Sulfide	0.0001
Methane	4.5066
Ethane	1.2750
Propane	0.8493
Isobutane	0.2991
n-Butane	0.3260
Isopentane	0.1343
n-Pentane	0.1012
Cyclopentane	0.0081
n-Hexane	0.0389
Cyclohexane	0.0362
Other Hexanes	0.0479
Heptanes	0.0287
Methylcyclohexane	0.0277
Benzene	0.0127
Toluene	0.0096
Ethylbenzene	0.0005
Xylenes	0.0018
C8+ Heavies	0.0356
<b>Total Emissions</b>	<b>7.7396</b>
Total Hydrocarbon Emissions	7.7395
Total VOC Emissions	1.9579
Total HAP Emissions	0.0635
Total BTEX Emissions	0.0246



# E&P TANKS

```

*****
Project Setup Information
*****
Project File           : C:\Program Files\API\E&P TANK version
Flowsheet Selection   : Oil Tank with Separator
Calculation Method    : AP42
Control Efficiency    : 95.0%
Known Separator Stream : Low Pressure oil
Entering Air Composition : No
-----
Production Rate       : 301.2[bbbl/day]
Days of Annual operation : 355 [days/yr]
-- Emission Summary

```

Item	Uncontrolled [ton/yr]	Uncontrolled [lb/hr]	Controlled [ton/yr]	Controlled [lb/hr]
Total HAPs	14.210	3.244	0.711	0.162
Total HC	566.994	129.451	28.350	6.473
VOCs, C2+	500.099	114.178	25.005	5.709

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-- Emission Composition
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No	Component	Uncontrolled [ton/yr]	Uncontrolled [lb/hr]	Controlled [ton/yr]	Controlled [lb/hr]
1	H2S	0.000	0.000	0.000	0.000
2	O2	0.000	0.000	0.000	0.000
3	CO2	3.783	0.864	3.783	0.864
4	N2	1.607	0.367	1.607	0.367
5	C1	66.895	15.273	3.345	0.764
6	C2	113.476	25.908	5.674	1.295
7	C3	141.081	32.210	7.054	1.611
14	C8	8.178	1.867	0.409	0.093
15	C9	1.717	0.392	0.086	0.020
16	C10+	0.023	0.005	0.001	0.000
17	Benzene	0.489	0.112	0.024	0.006
18	Toluene	1.242	0.284	0.062	0.014
19	E-Benzene	0.147	0.034	0.007	0.002
20	Xylenes	1.259	0.287	0.063	0.014
21	n-C6	11.006	2.513	0.550	0.126
22	2,2,4-trimethylp	0.064	0.015	0.003	0.001



**BREAK**

# NATIONAL EMISSIONS INVENTORY (NEI)

The full NEI is on a 3-yr cycle (e.g. 2011, 2014, 2017)

- Point sources (87,000 facilities)
- Nonpoint and mobile sources (county-process)
- Fires (daily/point)
- Biogenic soil and vegetation (county)

States, locals, and tribes are required to submit CO, SO<sub>x</sub>, NO<sub>x</sub>, VOC, PM<sub>10</sub>, PM<sub>2.5</sub>, NH<sub>3</sub>, and Lead.

- Basis is National Ambient Air Quality Standards (NAAQS) parts of the Clean Air Act
- Use CAA-based emissions thresholds for “point”. States can go lower.

Hazardous Air Pollutants (HAPs) and GHGs can also be voluntarily submitted

- EPA augments the data to make HAPs more complete

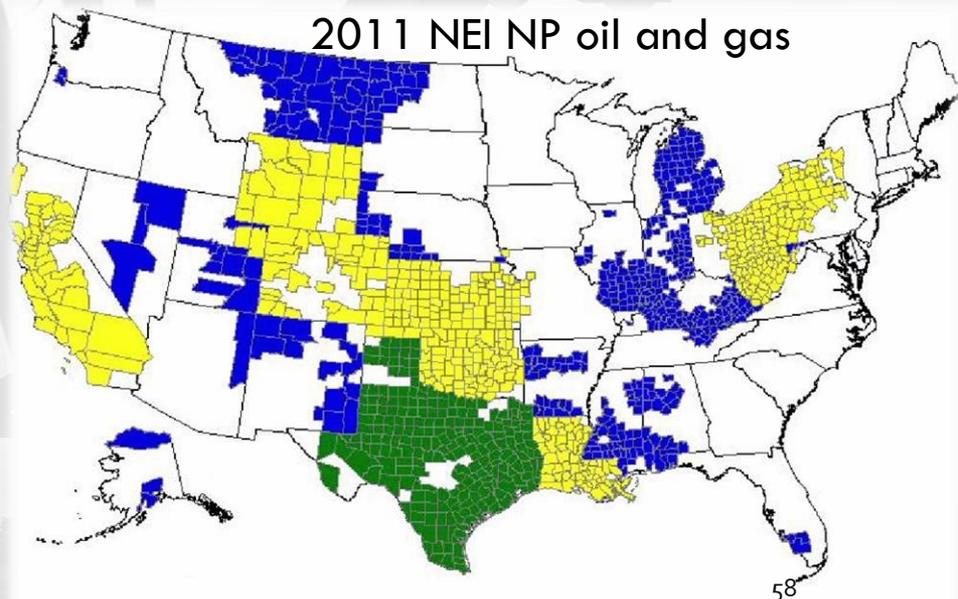
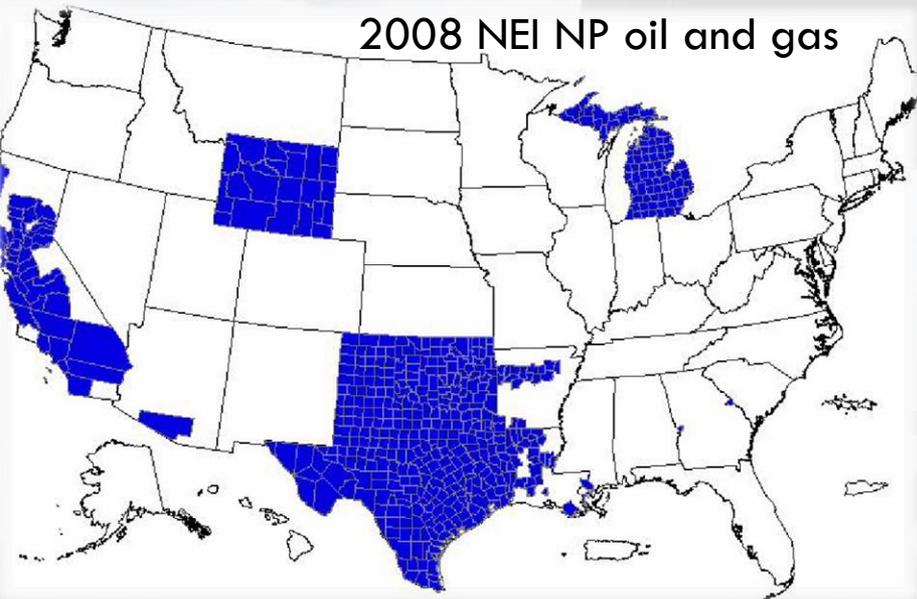
# ROLE OF STATES VS. EPA

States are responsible for the emissions estimates

SLTs can choose to accept EPA estimates; however, states choose method to apply

- EPA methods are assumptions about activity and emissions rates that can be improved with local understanding

In the absence of SLT data, EPA still has to create a complete inventory.



# COLLABORATIVE EFFORTS

- National Oil and Gas Emissions Committee (meets monthly)
- Internal agencywide EPA Oil and Gas Team that includes regional experts, regulation writers, EF developers, modelers
- Working closely with WRAP/WESTAR to help adjacent states share data; hope to do the same with MARAMA
- Working with OAP to incorporate GHG EI and RP data and methods (whole gas/venting)

# ALIGNING THE INVENTORIES

NEI covers criteria pollutants and their precursors and HAPs

Office of Atmospheric Program's EI covers GHGs

Two offices are working to align the inventories

- Methodologies
- Equipment counts
- Activity data
- Emission factors

# NEW PROCESS FOR NONPOINT IN 2017

Lean Event November 2016

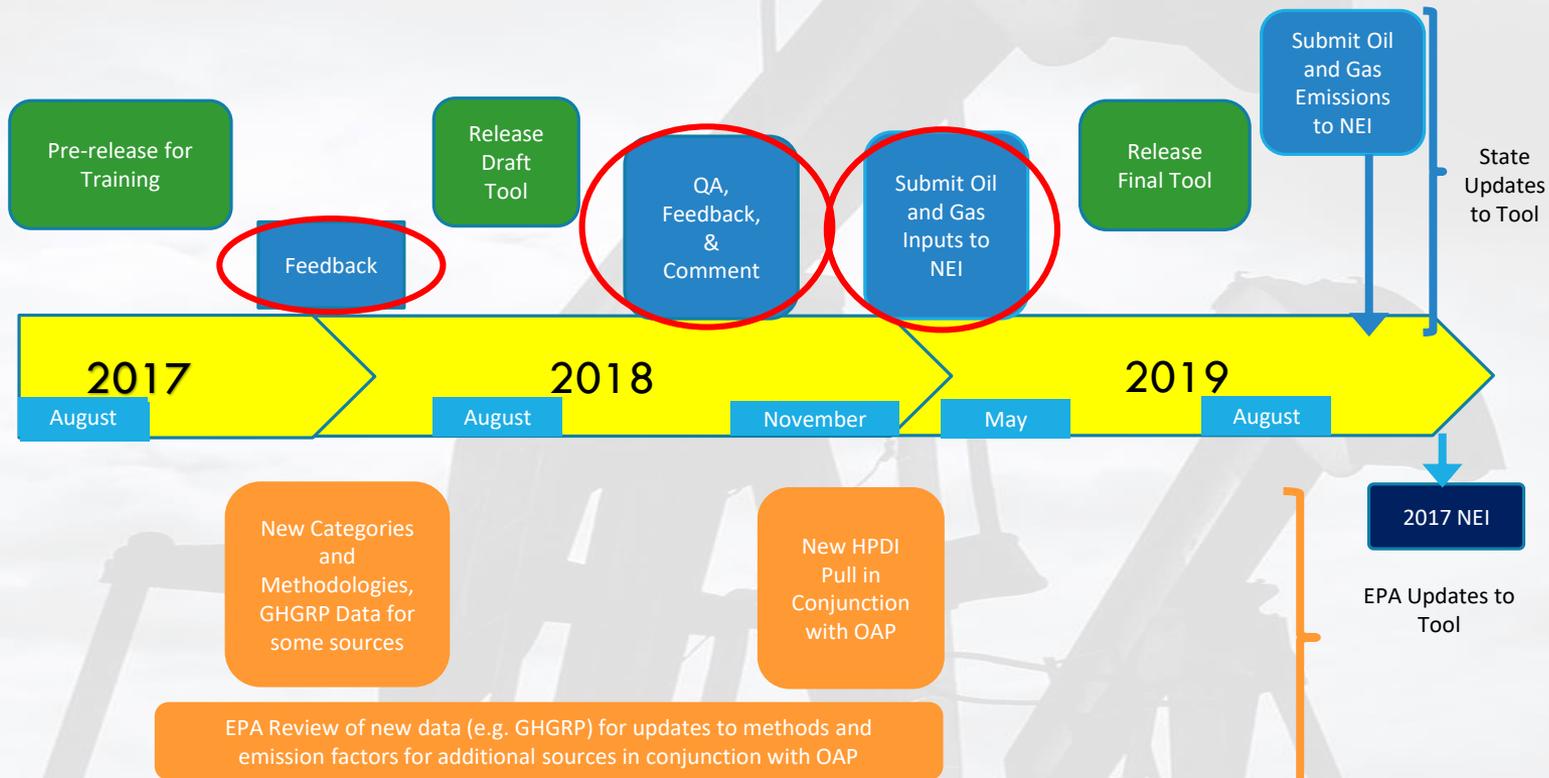
Outcome from this lean event included:

- Agreement to do early coordination and buy-in on methods and implementation
- Goal of release of one version of the NEI, rather than 2 or 3 (but a later release date))
- Division of the nonpoint data category into 3 bins, in order to create focus
  - Bin 1: no expected changes in methodology, no point source subtraction
  - Bin 2: changes in methodology, no point source subtraction
  - Bin 3: more complex source categories, with point source subtraction (Oil and Gas fits in here)

# IMPORTANT DATES FOR BIN 3

Action	Date
EPA posts draft tool and estimates	8/31/2018
SLT comments due	11/30/2018
SLTs submit inputs or emissions for Category 3 tools	12/1/18 -5/31/2019
EPA posts revised tools and estimates	2/28/2019
EPA posts final tools and estimates using SLT submitted inputs	8/31/2019
2017 v1 NEI Release in EIS for nonpoint	12/31/2019
2017 v1 Public Release	1/31/2020

# OIL AND GAS 2017 NEI TIMELINE



# THE OUTPUT IS ONLY AS GOOD AS THE INPUT!

Review the inputs for accuracy for your state.

- Gather process characterization data
- Contact oil and gas commission in your state
- Review permit data to see if equipment counts are accurate
- Do your own survey
- Talk to your RPO or neighboring states

**START NOW!**



# 2017 NEI PLANS (BUDGET RELIANT)

No planned updates to the database structure for the 2017 Tool (re-engineered for the 2014 NEI).

- New categories and methodologies
  - Add CBM Dewatering Pumps category
  - Abandoned wells
    - EPA/OAR/OAP currently developing draft estimates for abandoned wells for methane
    - For GHG EI, this may add up to millions of metric tons of methane
    - EIAG is working to adapt this methodology for the NEI to estimate VOC and speciated HAPs
- Disaggregate selected emissions algorithms that combine multiple processes into a single SCC (e.g., dehydrators) to individual components (dehydrator, flare, and reboiler)

# 2017 NEI PLANS (BUDGET RELIANT)

- Recode the tool for conventional/unconventional emissions calculations (need based)
- Include additional pollutants
  - SPECIATE profiles include pollutants not in the Tool
  - Gas analysis includes pollutants not in the Tool
- Update basin factors
  - Default conventional oil well completion value
  - Nonroad engine factors
  - 2017 Subpart W data mining/updates
  - Other recent studies?

# 2017 NEI PLANS (BUDGET RELIANT)

- Add tribal reservation layer to activity data (consider also basin factor data)
- Add new control technologies:
  - Vapor recovery units (VRU)
  - Electrified engines
- Pull HPDI data (Fall 2018)
  - Consider updated methodology for oil/condensate distinction (EIA-based?)
- Final 2017 Tool (August 2019)

# TO IMPROVE EMISSIONS, WE CAN...

Keep coordinated through better targeted and ongoing communication

Use the opportunity periods during the NEI cycle to focus efforts

Define new processes to update building blocks of emissions:

- Methods and their assumptions
- Test data and its use
- Emissions factors

Select source categories of common interest and collectively review:

- Find ways to update for improvements that meet different uses
- Resolve inconsistencies or clearly define and accept them



**BREAK**



# Acknowledgements

- National Oil and Gas Committee
- ERG Staff
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  - Steve Mendenhall
  - Stephen Treimel
  - Jody Tisano



# Overview of the Presentation

- Introduction/Timeline of the Tool Development
- 2014 NEI Oil and Gas Tool Coverage
- Walking through the Tool
- Case Studies using the 2014 Tool
- Development Plans for the 2017 NEI Oil and Gas Tool



# Where We Were

- 2011 Oil and Gas Tool
  - Converted from Excel Workbook to Access
  - Spreadsheet-type formatted tables

BASIN	STATE_COUP	STATE_ABBR	COUNTY_NAME	SOURCE_CATEGORY	FUG_VALVES_GAS	REF_FUG_VA
Mid-Gulf Coast Basin	01001	AL	Autauga	FUGITIVES	13.82857	CENSARA_STUDY
Mid-Gulf Coast Basin	01003	AL	Baldwin	FUGITIVES	13.82857	CENSARA_STUDY
S.GA Sedimentary Prov	01005	AL	Barbour	FUGITIVES	13.82857	CENSARA_STUDY
Appalachian Basin (Eastern Overthrust Area)	01007	AL	Bibb	FUGITIVES	13.82857	CENSARA_STUDY
Appalachian Basin (Eastern Overthrust Area)	01009	AL	Blount	FUGITIVES	13.82857	CENSARA_STUDY
Mid-Gulf Coast Basin	01011	AL	Bullock	FUGITIVES	13.82857	CENSARA_STUDY
Mid-Gulf Coast Basin	01013	AL	Butler	FUGITIVES	13.82857	CENSARA_STUDY
Appalachian Basin (Eastern Overthrust Area)	01015	AL	Calhoun	FUGITIVES	13.82857	CENSARA_STUDY
Piedmont-Blue Ridge Prov	01017	AL	Chambers	FUGITIVES	13.82857	CENSARA_STUDY
Appalachian Basin (Eastern Overthrust Area)	01019	AL	Cherokee	FUGITIVES	13.82857	CENSARA_STUDY
Mid-Gulf Coast Basin	01021	AL	Chilton	FUGITIVES	13.82857	CENSARA_STUDY
Mid-Gulf Coast Basin	01023	AL	Choctaw	FUGITIVES	13.82857	CENSARA_STUDY
Mid-Gulf Coast Basin	01025	AL	Clarke	FUGITIVES	13.82857	CENSARA_STUDY
Piedmont-Blue Ridge Prov	01027	AL	Clay	FUGITIVES	13.82857	CENSARA_STUDY
Piedmont-Blue Ridge Prov	01029	AL	Cleburne	FUGITIVES	13.82857	CENSARA_STUDY
S.GA Sedimentary Prov	01031	AL	Coffee	FUGITIVES	13.82857	CENSARA_STUDY
Black Warrior Basin	01033	AL	Colbert	FUGITIVES	13.82857	CENSARA_STUDY
Mid-Gulf Coast Basin	01035	AL	Conecuh	FUGITIVES	13.82857	CENSARA_STUDY
Piedmont-Blue Ridge Prov	01037	AL	Coosa	FUGITIVES	13.82857	CENSARA_STUDY
Mid-Gulf Coast Basin	01039	AL	Covington	FUGITIVES	13.82857	CENSARA_STUDY
Mid-Gulf Coast Basin	01041	AL	Crenshaw	FUGITIVES	13.82857	CENSARA_STUDY
Black Warrior Basin	01043	AL	Cullman	FUGITIVES	13.82857	CENSARA_STUDY
S.GA Sedimentary Prov	01045	AL	Dale	FUGITIVES	13.82857	CENSARA_STUDY
Mid-Gulf Coast Basin	01047	AL	Dallas	FUGITIVES	13.82857	CENSARA_STUDY
Appalachian Basin (Eastern Overthrust Area)	01049	AL	DeKalb	FUGITIVES	13.82857	CENSARA_STUDY

# Where We Are

- 2014 Oil and Gas Tool
  - Re-engineered to enhance user experience
  - Dashboard, buttons, import/export procedures

Geographic and Source Selections

## Oil and Gas Tool: Production Activities - Dashboard View

Back to Home Page    Reset All Selections/Go to TOOL

Step 6 - View/Edit Basin Factors    Step 7 - View/Edit Basin Factors    Step 8 - Point Source Activity Adjustments    Step 9 - Point Source Emission Adjustments    Step 10 - Final Emissions    Master References

Step 1 - Select Geographic Level    Step 2 - Select Source Category Level    Step 3 - Select Source Category Level    Step 4 - Select Specific Source Category    Step 5 - View/Edit County-Level Activity Data

Please select the geographic level at which you are generating emission estimates.

AREA_TYPE	PICK_ONE
EIA SUPPLY REGION	<input type="checkbox"/>
EPA REGION	<input type="checkbox"/>
NATIONWIDE	<input type="checkbox"/>
NEMS REGION	<input checked="" type="checkbox"/>
OZONE ATTAINMENT STATUS	<input type="checkbox"/>
REGIONAL PLANNING ORGANIZATION	<input type="checkbox"/>
STATE	<input type="checkbox"/>
SUBPART W BASIN	<input type="checkbox"/>
*	<input type="checkbox"/>

Record: 14 of 8    No Filter    Search

**EIA Supply Region**



When finished, click here to complete this step.

After making the selection, click this button.



# 2014 Tool Coverage – Source Categories

- Exploration Sources:
  - Drilling
  - Mud Degassing
  - Hydraulic Fracturing
  - Well Completions



# 2014 Tool Coverage – Source Categories

- Production Sources:
  - Artificial Lifts
  - Associated Gas
  - Condensate Tanks
  - Crude Oil Tanks
  - Dehydrators
  - Fugitives
  - Gas-Actuated Pumps
  - Heaters
  - Lateral/Gathering Compressors
  - Liquids Unloading
  - Loading Operations
  - Pneumatic Devices
  - Produced Water
  - Wellhead Compressors



# 2014 Tool Coverage – Pollutants

- Criteria Pollutants:
  - CO, NH<sub>3</sub>, NO<sub>x</sub>, PM10-PRI, PM2.5-PRI, SO<sub>2</sub>, VOC
- HAPs:
  - BTEX, formaldehyde, and Other HAPs
- Other Pollutants:
  - Hydrogen sulfide



# 2014 Tool Data Sources

- Methodologies: EPA, CenSARA, and Texas calculation tools
- Activity Data: HPDI, state-provided activity data, state OGC databases, EIA, GHGRP, RigData
- Emission Factors: mostly EPA AP-42; API, Climate Registry, GHGRP
- Basin Factors: EPA; CenSARA; state feedback; SPECIATE



# 2014 Tool Results

- Source category coverage: 54 SCCs from 18 source categories
- Pollutant coverage: 50 pollutants
- Geographic coverage: 34 states, 1157 counties, 65 basins
- Emission records generated:
  - From Tool = 939,493
  - To EIS = 749,096

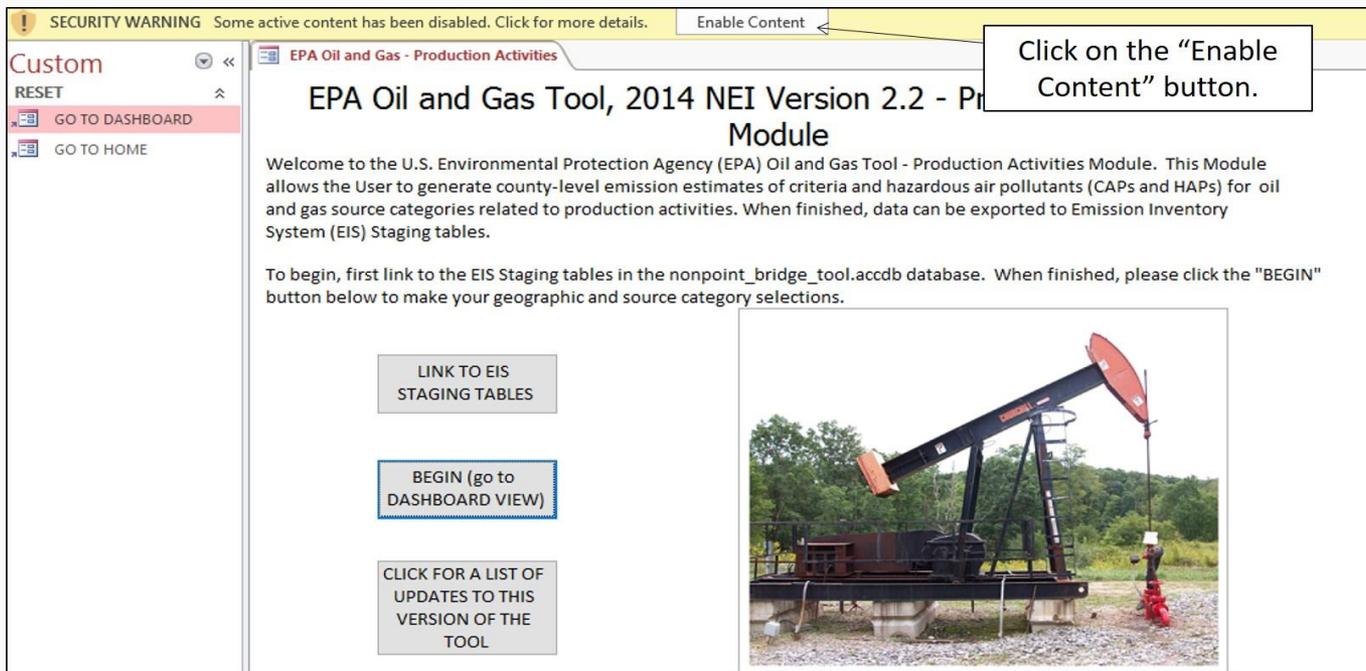


# Let's Walk Through the Tool...

- Tool Modules:
  - OIL\_GAS\_TOOL\_2014\_NEI\_PRODUCTION\_V2\_2.zip
  - OIL\_GAS\_TOOL\_2014\_NEI\_EXPLORATION\_V2\_2.zip
- Each Module contains:
  - Tool in MS-Access format
  - Blank Nonpoint Bridge Tool database
  - Instructions
- Production Module used as example

# Production Sources – Getting Started

- If using the Tool for the first time from unzipping, then you will need to “Enable Content”

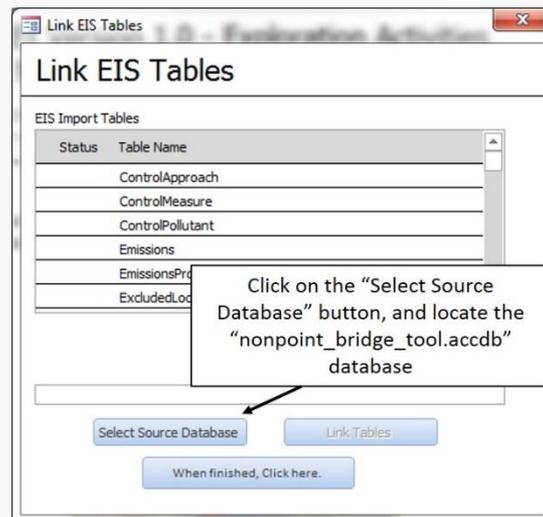


The screenshot shows a web browser window with a yellow security warning bar at the top that reads: "SECURITY WARNING Some active content has been disabled. Click for more details." and "Enable Content". The browser tab is titled "EPA Oil and Gas - Production Activities". The page title is "EPA Oil and Gas Tool, 2014 NEI Version 2.2 - Production Activities Module". The main content area contains a welcome message: "Welcome to the U.S. Environmental Protection Agency (EPA) Oil and Gas Tool - Production Activities Module. This Module allows the User to generate county-level emission estimates of criteria and hazardous air pollutants (CAPs and HAPs) for oil and gas source categories related to production activities. When finished, data can be exported to Emission Inventory System (EIS) Staging tables." Below this, it says: "To begin, first link to the EIS Staging tables in the nonpoint\_bridge\_tool.accdb database. When finished, please click the 'BEGIN' button below to make your geographic and source category selections." There are three buttons: "LINK TO EIS STAGING TABLES", "BEGIN (go to DASHBOARD VIEW)", and "CLICK FOR A LIST OF UPDATES TO THIS VERSION OF THE TOOL". A photograph of an oil pumpjack is shown on the right side of the page. A callout box points to the "Enable Content" button in the security warning bar with the text: "Click on the 'Enable Content' button."



# Production Sources – Linking to EIS Staging Tables

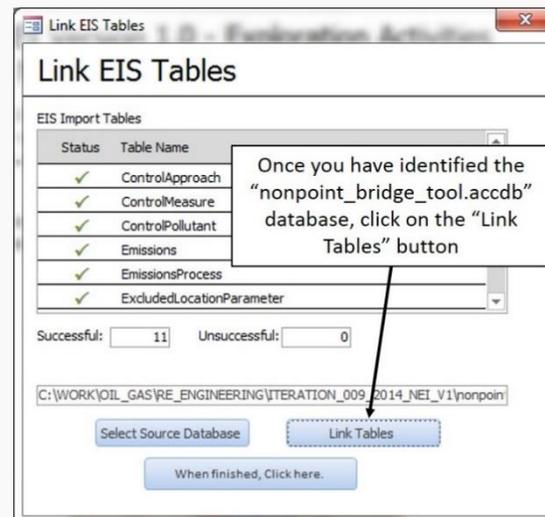
- Click on the “LINK TO EIS STAGING TABLES” button, and a pop-up box will appear. Follow the instructions to link in the EIS Staging tables in the “nonpoint\_bridge\_tool.accdb” database (see figure below). If successfully linked, 11 tables will be linked.





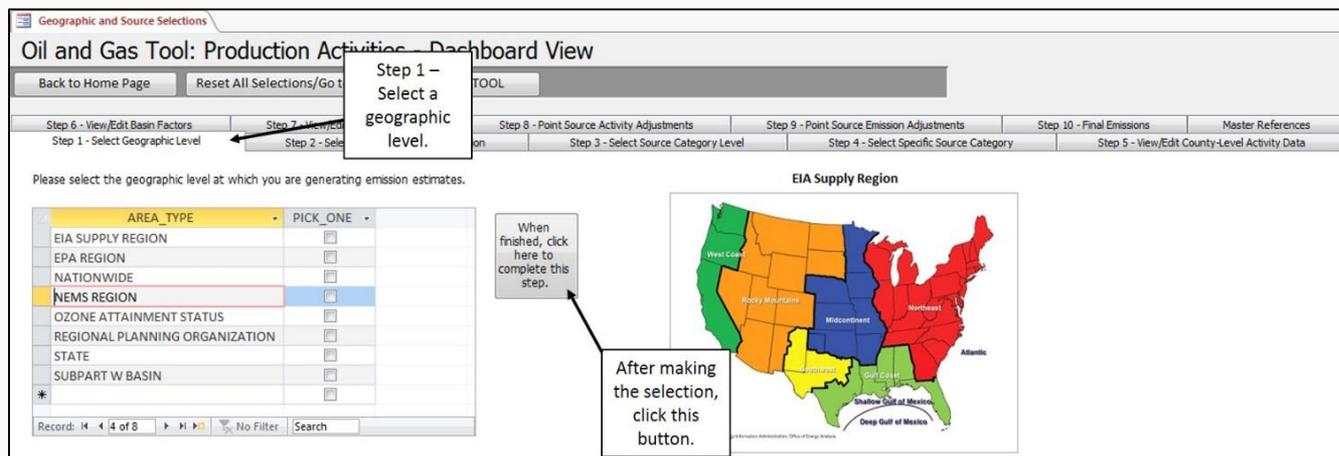
# Production Sources – Linking to EIS Staging Tables

- Once you have identified the location of the “nonpoint\_bridge\_tool.accdb” database to link, click on the “Link Tables” button. If successful, 11 tables will be linked. When finished click on the “When finished, Click here.” button.



# Production Sources – Step 1

- Select the geographic-level of the emissions inventory based on interest. Most Users will select the “STATE” view. When finished, click the “When finished, click here to complete this step.” button. A message box will appear instructing the User to proceed to Step 2.



**Oil and Gas Tool: Production Activities – Dashboard View**

Back to Home Page    Reset All Selections/Go to TOOL

Step 6 - View/Edit Basin Factors    Step 7 - View/Edit Basin Factors  
 Step 1 - Select Geographic Level    Step 2 - Select Source Category Level

Step 8 - Point Source Activity Adjustments    Step 9 - Point Source Emission Adjustments    Step 10 - Final Emissions    Master References  
 Step 3 - Select Source Category Level    Step 4 - Select Specific Source Category    Step 5 - View/Edit County-Level Activity Data

Please select the geographic level at which you are generating emission estimates.

AREA_TYPE	PICK_ONE
EIA SUPPLY REGION	<input type="checkbox"/>
EPA REGION	<input type="checkbox"/>
NATIONWIDE	<input type="checkbox"/>
NEMS REGION	<input type="checkbox"/>
OZONE ATTAINMENT STATUS	<input type="checkbox"/>
REGIONAL PLANNING ORGANIZATION	<input type="checkbox"/>
STATE	<input type="checkbox"/>
SUBPART W BASIN	<input type="checkbox"/>
*	<input type="checkbox"/>

Record: 4 of 8    No Filter    Search

**EIA Supply Region**

When finished, click here to complete this step.

After making the selection, click this button.



# Production Sources – Step 2

- Select the specific geographic location of interest. The User may select more than one specific location. When finished, click the “When finished, click here to complete this step.” button. A message box will appear instructing the User to proceed to Step 3.

Oil and Gas Tool: Production Activities - Dashboard

Back to Home Page    Reset All Selections/Go to Step 1    EXIT

Step 6 - View/Edit Basin Factors    Step 7 - View/Edit Emission Factors    Step 8 - Point Source Emission Adjustments    Step 9 - Select Specific Geographic Location    Step 10 - Final Emissions    Master References

Please select the specific geographic location at which you are generating emissions.

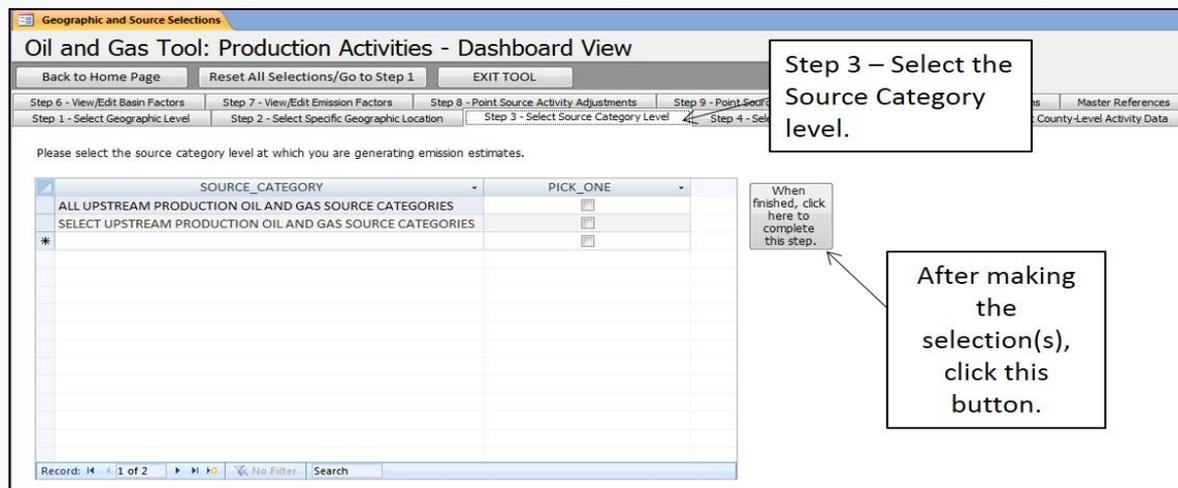
AREA_TYPE	AREA_DESCRIPTION	PICK_AT_LEAST_ONE
<input checked="" type="checkbox"/>	AK	<input type="checkbox"/>
<input type="checkbox"/>	AL	<input type="checkbox"/>
<input type="checkbox"/>	AR	<input type="checkbox"/>
<input type="checkbox"/>	AZ	<input type="checkbox"/>
<input type="checkbox"/>	CA	<input type="checkbox"/>
<input type="checkbox"/>	CO	<input type="checkbox"/>
<input type="checkbox"/>	CT	<input type="checkbox"/>
<input type="checkbox"/>	DC	<input type="checkbox"/>
<input type="checkbox"/>	DE	<input type="checkbox"/>
<input type="checkbox"/>	FL	<input type="checkbox"/>
<input type="checkbox"/>	GA	<input type="checkbox"/>
<input type="checkbox"/>	HI	<input type="checkbox"/>
<input type="checkbox"/>	IA	<input type="checkbox"/>
<input type="checkbox"/>	ID	<input type="checkbox"/>
<input type="checkbox"/>	IL	<input type="checkbox"/>
<input type="checkbox"/>	IN	<input type="checkbox"/>
<input type="checkbox"/>	KS	<input type="checkbox"/>

When finished, click here to complete this step.

After making the selection(s), click this button.

# Production Sources – Step 3

- The User may generate emission estimates for all oil and gas production source categories or individually select source categories. When finished, click the “When finished, click here to complete this step.” button. A message box will appear instructing the User to proceed to Step 4.



Oil and Gas Tool: Production Activities - Dashboard View

Back to Home Page    Reset All Selections/Go to Step 1    EXIT TOOL

Step 6 - View/Edit Basin Factors    Step 7 - View/Edit Emission Factors    Step 8 - Point Source Activity Adjustments    Step 9 - Point Source Activity Data

Step 1 - Select Geographic Level    Step 2 - Select Specific Geographic Location    Step 3 - Select Source Category Level    Step 4 - Select Source Category Level

Please select the source category level at which you are generating emission estimates.

SOURCE_CATEGORY	PICK_ONE
ALL UPSTREAM PRODUCTION OIL AND GAS SOURCE CATEGORIES	<input type="checkbox"/>
SELECT UPSTREAM PRODUCTION OIL AND GAS SOURCE CATEGORIES	<input type="checkbox"/>
*	<input type="checkbox"/>

Record: 1 of 2    No Filter    Search

Step 3 – Select the Source Category level.

When finished, click here to complete this step.

After making the selection(s), click this button.



# Production Sources – Step 4

- Select the specific Source Categories to generate emission estimates. A message box will appear instructing the User to proceed to Steps 5, 6, and 7 to review/edit the activity data, basin factors, and emission factors; or to proceed directly to Step 8 for Point Source Activity Adjustments.

Oil and Gas Tool: Production Activities - Dashboard View

Back to Home Page    Reset All Selections/Go to Step 1    EXIT TOOL

Step 6 - View/Edit Basin Factors    Step 7 - View/Edit Emission Factors    Step 8 - Point Source Activity Adjustments

Step 1 - Select Geographic Level    Step 2 - Select Specific Geographic Location    Step 3 - Select Source Category    Step 4 - Final Emissions    Master References

Step 5 - View/Edit County-Level Activity Data

Please select the specific source categor(ies) for which you are generating emission estimates for.

SOURCE_CATEGORY	SCC	SCC_DESCRIPTION	PICK_AT_LEAST_ONE
ARTIFICIAL LIFTS	2310000330	Oil & Gas Expl & Prod /All Processes /Artificial Lift	<input checked="" type="checkbox"/>
ASSOCIATED GAS	2310011000	On Shore Crude Oil Production All Processes	<input checked="" type="checkbox"/>
CONDENSATE TANKS	2310021010	On-Shore Gas Production /Storage Tanks: Condensate	<input checked="" type="checkbox"/>
CONDENSATE TANKS	2310023010	On-Shore CBM Production /Storage Tanks: Condensate	<input checked="" type="checkbox"/>
CRUDE OIL TANKS	2310010200	Oil & Gas Expl & Prod /Crude Petroleum /Oil Well Tanks - Flashing & Sta	<input checked="" type="checkbox"/>
DEHYDRATORS	2310021400	On-Shore Gas Production Dehydrators	<input checked="" type="checkbox"/>
DEHYDRATORS	2310023400	Coal Bed Methane NG / Dehydrators	<input checked="" type="checkbox"/>
FUGITIVES	2310011501	On-Shore Oil Production /Fugitives: Connectors	<input checked="" type="checkbox"/>
FUGITIVES	2310011502	On-Shore Oil Production /Fugitives: Flanges	<input checked="" type="checkbox"/>
FUGITIVES	2310011503	On-Shore Oil Production /Fugitives: Open Ended Lines	<input checked="" type="checkbox"/>
FUGITIVES	2310011505	On-Shore Oil Production /Fugitives: Valves	<input checked="" type="checkbox"/>
FUGITIVES	2310021501	On-Shore Gas Production /Fugitives: Connectors	<input checked="" type="checkbox"/>
FUGITIVES	2310021502	On-Shore Gas Production /Fugitives: Flanges	<input checked="" type="checkbox"/>
FUGITIVES	2310021503	On-Shore Gas Production /Fugitives: Open Ended Lines	<input checked="" type="checkbox"/>
FUGITIVES	2310021505	On-Shore Gas Production /Fugitives: Valves	<input checked="" type="checkbox"/>

When finished, press here

After making the selection(s), click this button.



# Production Sources – Step 5

- The User can view and edit the activity data that EPA has compiled for the geographic area and source categories selected

Geographic and Source Selections

### Oil and Gas Tool: Production Activities - Dashboard View

Back to Home Page    Reset All Selections/Go to Step 1    EXIT TOOL

Step 6 - View/Edit Basin Factors    Step 7 - View/Edit Emission Factors    Step 8 - Point Source Activity Adjustments    Step 9 - Point Source Emission Adjustments    Step 10 - Final Emissions

Step 1 - Select Geographic Level    Step 2 - Select Specific Geographic Location    Step 3 - Select Source Category Level    Step 4 - Select Specific Source Category    Step 5 - View/E

Please click on the source category below to view/edit county-level activity data

Click here to review the Oil Production Data.    Click here to review the Natural Gas Production Data.    Click here to review the Coalbed Methane Production Data.    Click here to review the Produced Water Data.

Pick a type of production dataset

When finished, please continue to Step 6 to View/Edit Basin Factors





# Production Sources – Step 5 (cont.)

- The User may also edit activity data in MS-Excel by using the “Import/Export Data...” button.

Geographic and Source Selections | Activity Data: Natural Gas

### Natural Gas Production Activity Data

State Abbreviation:

State and County FIPs Code:

County Name:

Basin Name:

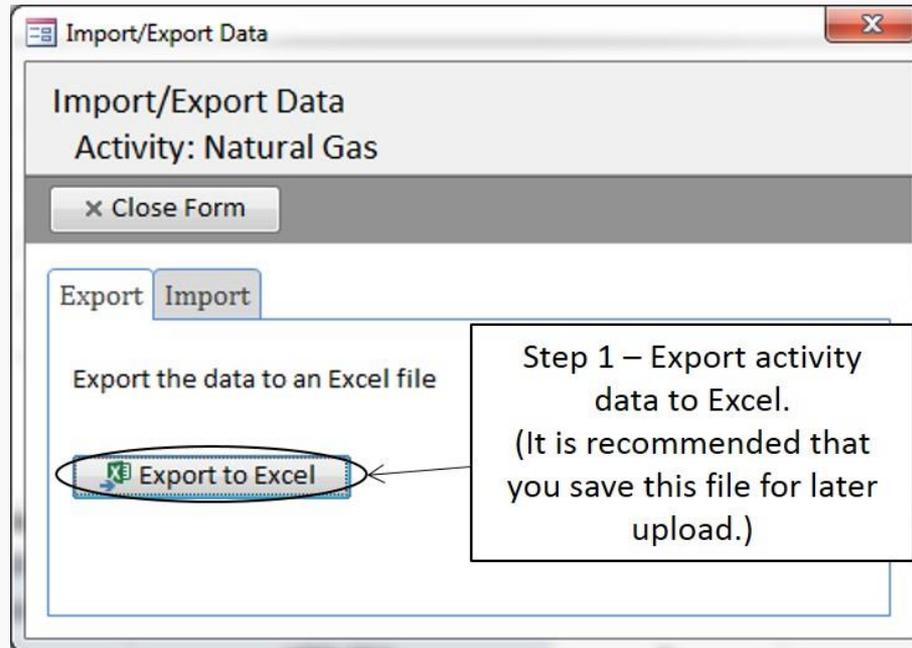
Year:

← Values here can be edited.

	Current Value	Current Value Reference	2011 Value	2011 Value Reference
County-Level Natural Gas Production (MSCF)	226,113,000.00	HPDI_2016	138,938,400.00	HPDI_2013
County-Level Condensate Production from natural gas wells (BBL)	0.00	HPDI_2016	0.00	HPDI_2013
County-Level Natural Gas Well Counts	889	HPDI_2016	407	HPDI_2013
Fraction of natural gas wells in the county needing compression	0.085	CENSARA_STUDY_2012	0.085	CENSARA_STUDY_2012

# Production Sources – Step 5 (cont.)

- If the user elects to edit activity data in MS-Excel, after clicking the button, the data is then exported into MS-Excel as shown below.





# Production Sources – Step 5 (cont.)

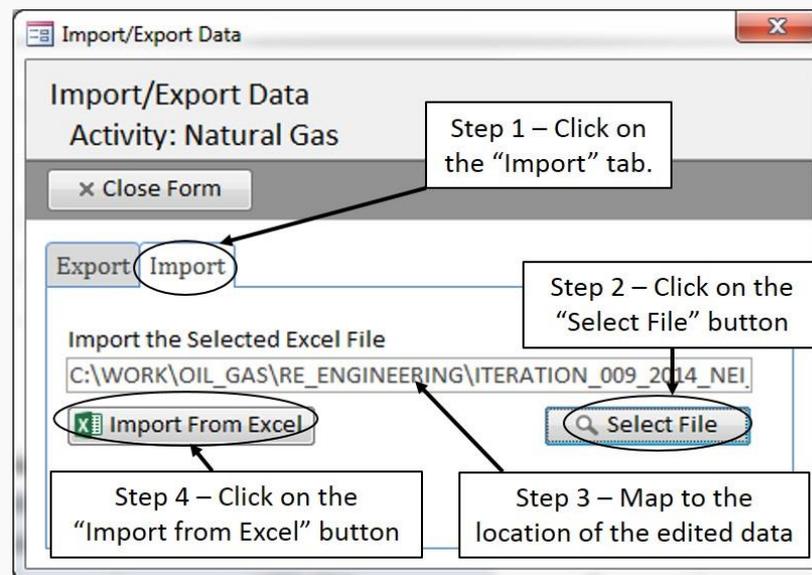
- A MS-Excel workbook will open when finished exporting. It is required that the User save this file to the hard drive for later upload. In the Excel file, the User can only edit the yellow shaded cells. When completed, simply save the file.

A	B	C	D	E	F	G	H	I	J
STATE_ABBR	STATE_COUNTY_FIPS	COUNTY_NAME	BASIN	YEAR	DATA_CATEGORY	PREVIOUS_VALUE	PREVIOUS_REFERENCE	CURRENT_VALUE	CURRENT_REFERENCE
AR	05001	Arkansas	Louisiana-Mississippi Salt Basins	2014	County-Level Natural Gas Production (MSCF)	0	HPDI_2013	0	HPDI_2015
AR	05001	Arkansas	Louisiana-Mississippi Salt Basins	2014	County-Level Condensate Production from natural gas wells (BBL)	0	HPDI_2013	0	HPDI_2015
AR	05001	Arkansas	Louisiana-Mississippi Salt Basins	2014	County-Level Natural Gas Well Counts	0	HPDI_2013	0	HPDI_2015
AR	05001	Arkansas	Louisiana-Mississippi Salt Basins	2014	Fraction of natural gas wells in the county needing compression	9.090909E-02	CENSARA_STUDY_2012	9.090909E-02	CENSARA_STUDY_2012
AR	05003	Ashley	Louisiana-Mississippi Salt Basins	2014	County-Level Natural Gas Production (MSCF)	0	HPDI_2013	0	HPDI_2015
AR	05003	Ashley	Louisiana-Mississippi Salt Basins	2014	County-Level Condensate Production from natural gas wells (BBL)	0	HPDI_2013	0	HPDI_2015
AR	05003	Ashley	Louisiana-Mississippi Salt Basins	2014	County-Level Natural Gas Well Counts	0	HPDI_2013	0	HPDI_2015
AR	05003	Ashley	Louisiana-Mississippi Salt Basins	2014	Fraction of natural gas wells in the county needing compression	9.090909E-02	CENSARA_STUDY_2012	9.090909E-02	CENSARA_STUDY_2012
AR	05005	Baxter	Ozark Uplift	2014	County-Level Natural Gas Production (MSCF)	0	HPDI_2013	0	HPDI_2015
AR	05005	Baxter	Ozark Uplift	2014	County-Level Condensate Production from natural gas wells (BBL)	0	HPDI_2013	0	HPDI_2015
AR	05005	Baxter	Ozark Uplift	2014	County-Level Natural Gas Well Counts	0	HPDI_2013	0	HPDI_2015
AR	05005	Baxter	Ozark Uplift	2014	Fraction of natural gas wells in the county needing compression	0.2082511	CENSARA_STUDY_2012	0.2082511	CENSARA_STUDY_2012
AR	05007	Benton	Ozark Uplift	2014	County-Level Natural Gas Production (MSCF)	0	HPDI_2013	0	HPDI_2015
AR	05007	Benton	Ozark Uplift	2014	County-Level Condensate Production from natural gas wells (BBL)	0	HPDI_2013	0	HPDI_2015
AR	05007	Benton	Ozark Uplift	2014	County-Level Natural Gas Well Counts	0	HPDI_2013	0	HPDI_2015
AR	05007	Benton	Ozark Uplift	2014	Fraction of natural gas wells in the county needing compression	0.2082511	CENSARA_STUDY_2012	0.2082511	CENSARA_STUDY_2012
AR	05009	Boone	Ozark Uplift	2014	County-Level Natural Gas Production (MSCF)	0	HPDI_2013	0	HPDI_2015
AR	05009	Boone	Ozark Uplift	2014	County-Level Condensate Production from natural gas wells (BBL)	0	HPDI_2013	0	HPDI_2015
AR	05009	Boone	Ozark Uplift	2014	County-Level Natural Gas Well Counts	0	HPDI_2013	0	HPDI_2015
AR	05009	Boone	Ozark Uplift	2014	Fraction of natural gas wells in the county needing compression	0.2082511	CENSARA_STUDY_2012	0.2082511	CENSARA_STUDY_2012
AR	05011	Bradley	Louisiana-Mississippi Salt Basins	2014	County-Level Natural Gas Production (MSCF)	0	HPDI_2013	0	HPDI_2015
AR	05011	Bradley	Louisiana-Mississippi Salt Basins	2014	County-Level Condensate Production from natural gas wells (BBL)	0	HPDI_2013	0	HPDI_2015
AR	05011	Bradley	Louisiana-Mississippi Salt Basins	2014	County-Level Natural Gas Well Counts	0	HPDI_2013	0	HPDI_2015
AR	05011	Bradley	Louisiana-Mississippi Salt Basins	2014	Fraction of natural gas wells in the county needing compression	9.090909E-02	CENSARA_STUDY_2012	9.090909E-02	CENSARA_STUDY_2012
AR	05013	Calhoun	Louisiana-Mississippi Salt Basins	2014	County-Level Natural Gas Production (MSCF)	0	HPDI_2013	0	HPDI_2015
AR	05013	Calhoun	Louisiana-Mississippi Salt Basins	2014	County-Level Condensate Production from natural gas wells (BBL)	0	HPDI_2013	0	HPDI_2015
AR	05013	Calhoun	Louisiana-Mississippi Salt Basins	2014	County-Level Natural Gas Well Counts	0	HPDI_2013	0	HPDI_2015
AR	05013	Calhoun	Louisiana-Mississippi Salt Basins	2014	Fraction of natural gas wells in the county needing compression	9.090909E-02	CENSARA_STUDY_2012	9.090909E-02	CENSARA_STUDY_2012
AR	05015	Carroll	Ozark Uplift	2014	County-Level Natural Gas Production (MSCF)	0	HPDI_2013	0	HPDI_2015
AR	05015	Carroll	Ozark Uplift	2014	County-Level Condensate Production from natural gas wells (BBL)	0	HPDI_2013	0	HPDI_2015
AR	05015	Carroll	Ozark Uplift	2014	County-Level Natural Gas Well Counts	0	HPDI_2013	0	HPDI_2015
AR	05015	Carroll	Ozark Uplift	2014	Fraction of natural gas wells in the county needing compression	0.2082511	CENSARA_STUDY_2012	0.2082511	CENSARA_STUDY_2012
AR	05017	Chicot	Louisiana-Mississippi Salt Basins	2014	County-Level Natural Gas Production (MSCF)	0	HPDI_2013	0	HPDI_2015
AR	05017	Chicot	Louisiana-Mississippi Salt Basins	2014	County-Level Condensate Production from natural gas wells (BBL)	0	HPDI_2013	0	HPDI_2015
AR	05017	Chicot	Louisiana-Mississippi Salt Basins	2014	County-Level Natural Gas Well Counts	0	HPDI_2013	0	HPDI_2015
AR	05017	Chicot	Louisiana-Mississippi Salt Basins	2014	Fraction of natural gas wells in the county needing compression	9.090909E-02	CENSARA_STUDY_2012	9.090909E-02	CENSARA_STUDY_2012
AR	05019	Clark	Louisiana-Mississippi Salt Basins	2014	County-Level Natural Gas Production (MSCF)	0	HPDI_2013	0	HPDI_2015

Step 2 – The User can edit the yellow-shaded cells.

# Production Sources – Step 5 (cont.)

- The User will need to go back to the Tool and click on the “Import/Export Data...” button to initiate importing the edited data file. After clicking, the Import/Export form will appear.





# Production Sources – Step 6

- In Step 6, the User can view and edit the basin factor data that EPA has compiled for the geographic area and source categories selected.

Geographic and Source Selections

### Oil and Gas Tool: Production Activities - Dashboard View

Back to Home Page | Reset All Selections/Go to Step 1 | EXIT TOOL

Step 1 - Select Geographic Level | Step 2 - Select Specific Geographic Location | Step 3 - Select Source Category Level | Step 4 - View/Edit Emission Factors | Step 5 - View/Edit Emission Factors | Step 6 - View/Edit Basin Factors | Step 7 - View/Edit Emission Factors | Step 8 - Point Source Activity Adjustments | Step 9 - View/Edit Emission Factors | Step 10 - Final Review

#### Oil and Gas Production Sources - Basin Factors

Please click on the source category below to view/edit the basin factors.

Artificial Lifts	Heaters	Associated Gas	Gas-Actuated Pumps
Associated Gas	Lateral/Gathering Compressors	Condensate Tank	Liquids Unloading
Condensate Tank	Liquids Unloading	Crude Oil Tank	Loading Operations
Crude Oil Tank	Loading Operations	Dehydrators	Pneumatic Devices
Dehydrators	Pneumatic Devices	Fugitives	Produced Water
Fugitives	Produced Water		
Gas-Actuated Pumps	Wellhead Compressors		

Please click on the source category below to view/edit the gas composition factors.

When finished, please continue to Step 7 to View/Edit Emission Factors

Step 6 – Pick a source category basin factor or gas composition dataset to view/edit.

# Production Sources – Step 6 (cont.)

- In Step 6, the User can view/edit the basin factor data. If the User updates values for one county in a basin, then all other counties in the basin and state can be updated by clicking on the “Click to apply these values to all other counties in the same basin for the state.” button.

Geographic and Source Selections | Basin Factors: Crude Oil Tanks

### Crude Oil Tanks Basin Factors Form

State Abbreviation: AR  
 State and County FIPs Code: 05023  
 County Name: Cleburne  
 Basin Name: Arkoma Basin

Import/Export Data...

Filter for this Basin only | Remove Basin Filter

EPA Default Values cannot be edited.

The User can filter for specific basins.

Click to apply these values to all other counties in the same basin for this state.

Values from the 2011 Tool. Values here cannot be edited.

If new values are entered, please enter a reference.

When finished, click here

When finished, click here

	Current Value	Current Value Reference	EPA Default Value	EPA Default Value Reference	2011 Value	2011 Value Reference
Crude Oil Fraction directed to Tanks	1	CENSARA_STUDY_2012	1	CENSARA_STUDY_2012_AVERAGE	1	CENSARA_STUDY_2012
Fraction of Oil Tanks with Flares	0	EPA_2015d	0	EPA_2015d	0	CENSARA_STUDY_2012
Average VOCs Loss (lb VOCs/BBL Crude Oil)	2.244627	CENSARA_STUDY_2012	1.01541	CENSARA_STUDY_2012_AVERAGE	2.244627	CENSARA_STUDY_2012
Flaring	100	CENSARA_STUDY_2012	100	CENSARA_STUDY_2012_AVERAGE	100	CENSARA_STUDY_2012
Flaring	98	CENSARA_STUDY_2012	98	CENSARA_STUDY_2012_AVERAGE	98	CENSARA_STUDY_2012
Gas Vent	2.973009E-02	CENSARA_STUDY_2012	0.0148	CENSARA_STUDY_2012_AVERAGE	2.973009E-02	CENSARA_STUDY_2012



# Production Sources – Step 7

- In Step 7, the User can view or edit the emission factors that are used to generate the emission estimates for the source categories selected.

Geographic and Source Selections

## Oil and Gas Tool: Production Activities - Dashboard View

Back to Home Page    Reset All Selections/Go to Step 1    EXIT TOOL

Step 0 - VIEW/EDIT EMISSION FACTORS    Step 1 - VIEW/EDIT EMISSION FACTORS    Step 2 - POINT SOURCE ACTIVITY ADJUSTMENTS    Step 3 - POINT SOURCE EMISSION ADJUSTMENTS

Please select the emission factor source category you would like to view/edit.

### Oil and Gas Production Sources - Emission Factors

Please click on a Source Category below to view/edit emission factors.

Artificial Lifts	Fugitives
Associated Gas	Heaters
Condensate Tanks	Lateral/Gathering Compressors
Crude Oil Tanks	Liquids Unloading
Dehydrators	Wellhead Compressors

Note: there are no emission factors to review for Gas-Actuated Pumps, Loading Operations, Pneumatic Devices, and Produced Water

Step 7 – Pick a source category emission factor dataset to view/edit.



# Production Sources – Step 7 (cont.)

- Once a Source Category has been selected, the User can view or edit the emission factors. The User should update the reference field (EMISSION\_FACTOR\_SOURCE) for any updated emission factors.

Geographic and Source Selections FORM\_EF\_WELLHEAD\_COMPRESSORS

### WELLHEAD COMPRESSORS EMISSION FACTORS FORM

ST	BASIN	ATTAINMENT	SOURCE_CATEGORY	SCC	SCC_SHORTENED	POLLUTANT_DESCRIPTOR	POLLUTANT_CODE	EMISSION_FACTOR	EMISS_UNITS	EMISS_CODE	EMISS_CODE
AR	Illinois Basin	ATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Polycyclic Aromatic Hydroca	250	4.862483E-04	G	HP-HR	EPA_20
AR	Illinois Basin	ATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Perchloroethylene	78875	1.618409E-04	G	HP-HR	EPA_20
AR	Illinois Basin	ATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Perchloroethylene	100425	1.988539E-04	G	HP-HR	EPA_20
AR	Illinois Basin	ATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	SO2	50	2.133687E-03	G	HP-HR	EPA_20
AR	Illinois Basin	ATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	1,2,2-Trichloroethane, 1,1,2-	79345	2.405841E-04	G	HP-HR	EPA_20
AR	Illinois Basin	ATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Toluene	108883	3.494457E-03	G	HP-HR	EPA_20
AR	Illinois Basin	ATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Trichloroethane, 1,1,2-	79065	3.069897E-03	G	HP-HR	EPA_20
AR	Illinois Basin	ATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Trimethylpentane, 2,2,4-	540841	3.494457E-03	G	HP-HR	EPA_20
AR	Illinois Basin	ATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Vinyl chloride	75014	8.962939E-05	G	HP-HR	EPA_20
AR	Illinois Basin	ATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Volatile Organic Compound	VOC	0.4354464	G	HP-HR	EPA_20
AR	Illinois Basin	ATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Xylenes (Mixed Isomers)	1330207	9.72497E-04	G	HP-HR	EPA_20
AR	Illinois Basin	NONATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Acetaldehyde	75070	2.815887E-02	G	HP-HR	EPA_20
AR	Illinois Basin	NONATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Acrolein	107028	2.823144E-02	G	HP-HR	EPA_20
AR	Illinois Basin	NONATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Benzene	71432	7.039717E-03	G	HP-HR	EPA_20
AR	Illinois Basin	NONATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Biphenyl	92524	1.433344E-05	G	HP-HR	EPA_20
AR	Illinois Basin	NONATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Butadiene, 1,3-	106990	2.97555E-03	G	HP-HR	EPA_20
AR	Illinois Basin	NONATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Carbon Dioxide	CO2	399.1592	G	HP-HR	EPA_20
AR	Illinois Basin	NONATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Carbon Monoxide	CO	1.280988	G	HP-HR	EPA_20
AR	Illinois Basin	NONATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Carbon tetrachloride	56235	2.202633E-04	G	HP-HR	EPA_20
AR	Illinois Basin	NONATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Chlorobenzene	108907	1.611157E-04	G	HP-HR	EPA_20
AR	Illinois Basin	NONATTAINMENT	WELLHEAD COMPRESSORS	2310021102	On-Shore Gas Productic	Chloroform	67663	1.280988E-04	G	HP-HR	EPA_20

These emission factors can be edited. If changes are made, please update the reference.

Emission Factors are presented at the state, basin, and attainment status level.

When finished, click here

When finished, click here

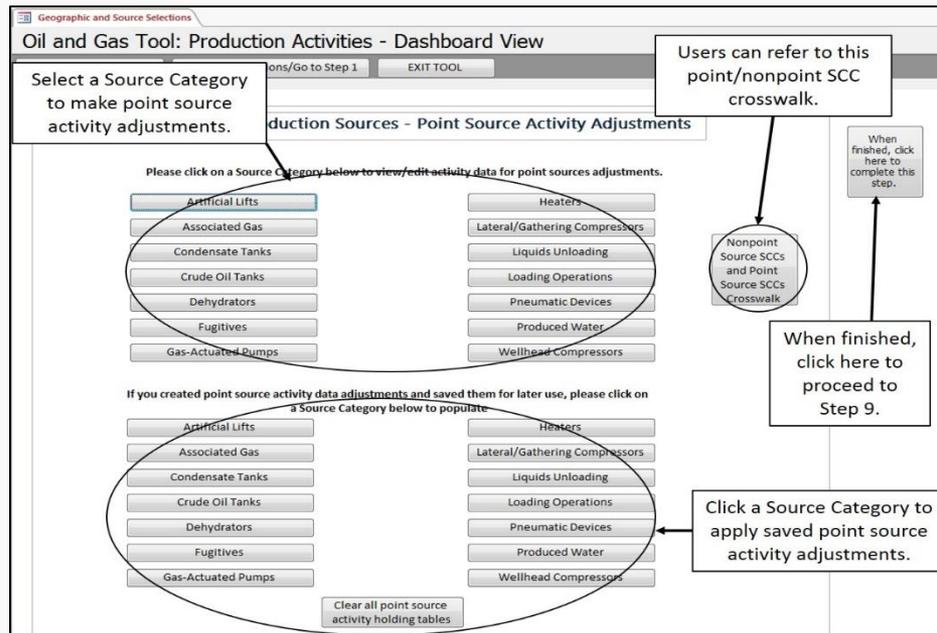


# Production Sources – Step 8

- In Step 8, the User may account for emissions that are to be reported to the point sources emissions inventory.
- Activity adjustments are preferred
  - Well counts
  - Liquids production
  - Etc.
- Emissions adjustments are also an option
  - NO<sub>x</sub>
  - VOC
  - Etc.

# Production Sources – Step 8 (cont.)

- If the User does not have any point source activity adjustments, then they will need to click the “When finished, click here to complete this step.” button.



Geographic and Source Selections

Oil and Gas Tool: Production Activities - Dashboard View

Select a Source Category to make point source activity adjustments.

Production Sources - Point Source Activity Adjustments

Please click on a Source Category below to view/edit activity data for point sources adjustments.

Artificial Lifts	Heaters
Associated Gas	Lateral/Gathering Compressors
Condensate Tanks	Liquids Unloading
Crude Oil Tanks	Loading Operations
Dehydrators	Pneumatic Devices
Fugitives	Produced Water
Gas-Actuated Pumps	Wellhead Compressors

If you created point source activity data adjustments and saved them for later use, please click on a Source Category below to populate

Artificial Lifts	Heaters
Associated Gas	Lateral/Gathering Compressors
Condensate Tanks	Liquids Unloading
Crude Oil Tanks	Loading Operations
Dehydrators	Pneumatic Devices
Fugitives	Produced Water
Gas-Actuated Pumps	Wellhead Compressors

Clear all point source activity holding tables

When finished, click here to complete this step.

Nonpoint Source SCCs and Point Source SCCs Crosswalk

When finished, click here to proceed to Step 9.

Click a Source Category to apply saved point source activity adjustments.



# Production Sources – Step 8 (cont.)

- Point source activity adjustments are preferred over point source emission adjustments. Additionally, Users should pay careful attention to ensure that the point source activity data is entered in the same units as the nonpoint activity data (e.g., MMBBL vs. MBBL).

The screenshot shows a web-based form titled "HEATERS POINT SOURCE ACTIVITY ADJUSTMENT FORM". The form includes the following fields and sections:

- Geographic and Source Selections** (tab)
- FORM\_PS\_ACTIVITY\_HEATERS** (tab)
- State abbreviation:** AR
- State and County FIPs Code:** 05001
- County name:** Arkansas
- Year:** 2014
- Point Source Well Counts:** A table with three columns: Oil Wells, Gas Wells, and CBM Wells. Each column contains the number 0.

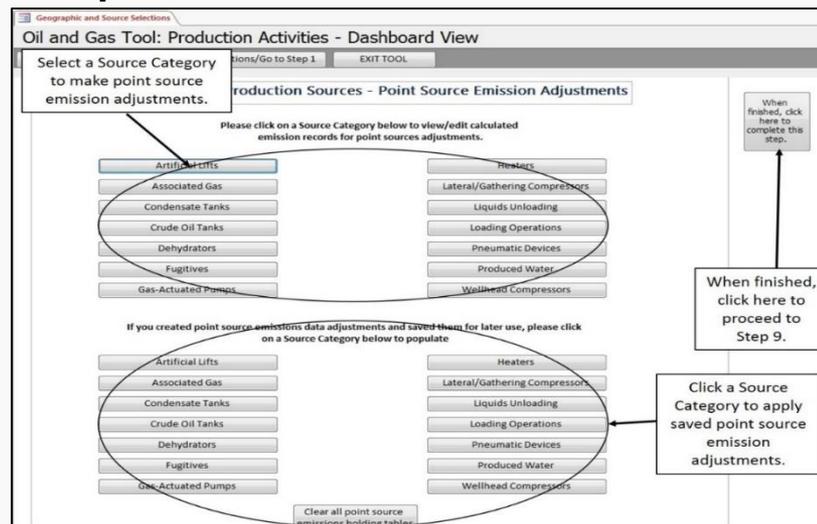
Annotations on the form include:

- A box pointing to the "County name" field: "When finished, click here."
- A box pointing to the "Point Source Well Counts" table: "Enter the point sources activity data."
- A box pointing to the "Point Source Well Counts" table: "When finished, click here"



# Production Sources – Step 9

- In Step 9, the User can make point source emission adjustments directly in the emission tables. Select a Source Category to open. If a User has no point source emissions adjustments, they may click on the “When finished, click here to complete this step” button.





# Production Sources – Step 9 (cont.)

- Point source emission estimates are to be entered in the “POINT\_EMISSIONS\_TPY” field.

Geographic and Source Selections | FORM\_EMISSIONS\_WELLHEAD\_COMPRESSORS

### WELLHEAD COMPRESSORS POINT SOURCE EMISSIONS REPORT FORM

STATE	STATE_A	COUNTY_NA	SCC	SOURCE_CATEGORY	POLLUTANT	CONCENTRATION	POINT_EMISSIONS_TPY
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	75003 Ethyl	0.84556E-04	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	75014 Vinyl	0.63363E-03	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	75070 Aceta	0.05966251	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	75092 Methy	0.27333E-03	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	75343 Ethyl	0.84253E-03	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	78875 Propylene Dichloride	1.919763E-03	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	79005 1,1,2-Trichloroethane	2.269459E-03	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	79345 1,1,2,2-Tetrachloroethane	2.854666E-03	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	91203 Naphthalene	5.309679E-03	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES		1.512973E-02	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES		115.5124	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES		35.00402	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	Monoxide	10165.09	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	Dioxide	1.935393E-02	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	Oxide	78.27121	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	n Oxides	0.9229071	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	Primary (Filt + Cond)	0.9229071	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	Primary (Filt + Cond)	0.9229071	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	oxide	5.433702E-02	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	VOC	8.417548	0
05023	AR	Cleburne	2310021202	WELLHEAD COMPRESSOR ENGINES	Volatile Organic Compounds	8.417548	0

When finished, click here to finalize the emissions.

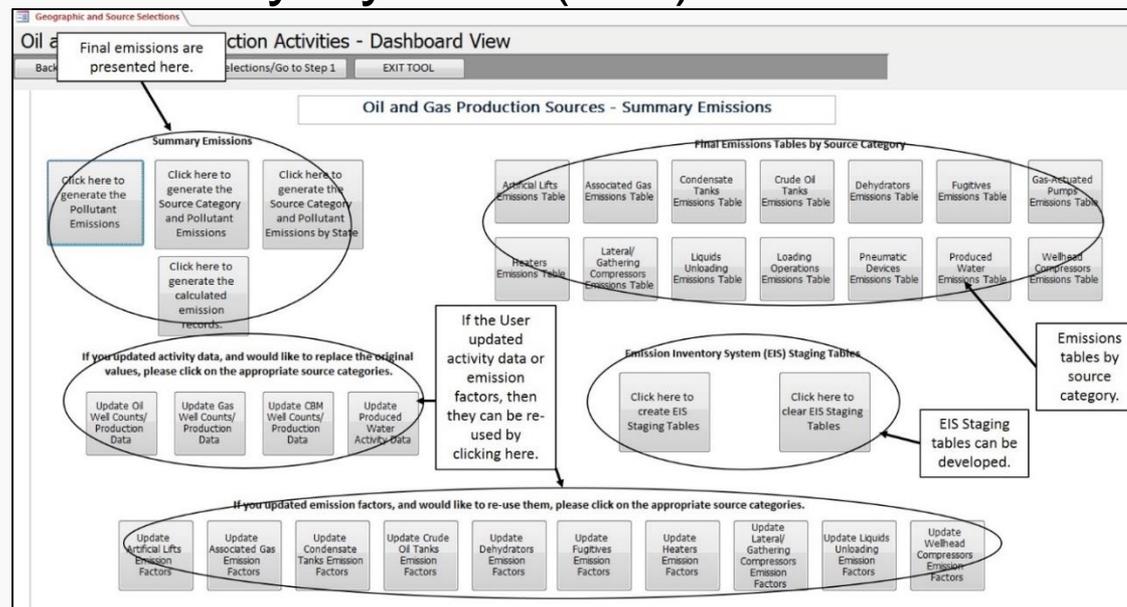
When finished, click here

Users can enter point source emissions adjustments



# Production Sources – Step 10

- In Step 10, the User can review the final emissions; update county-level activity data, emission factors, and/or basin factors they provided in Steps 5 through 7; or generate the Emission Inventory System (EIS) data tables.



# Production Sources – Step 10 (cont.)

- Point source activity and/or emissions adjustments can also be saved within the Tool for future use.

**Oil and Gas Production Sources - Summary Emissions**

If you updated gas composition data basin factors, and would like to re-use them, please click on the appropriate source categories.

Update Associated Gas Composition Data Basin Factors	Update Condensate Tanks Gas Composition Data Basin Factors	Update Crude Oil Tanks Gas Composition Data Basin Factors	Update Dehydrators Gas Composition Data Basin Factors	Update Fugitives Gas Composition Data Basin Factors	Update Artificial Lifts Basin Factors	Update Associated Gas Basin Factors	Update Condensate Tanks Basin Factors	Update Crude Oil Tanks Basin Factors	Update Dehydrators Basin Factors	Update Fugitives Basin Factors	Update Gas-Actuated Pumps Basin Factors
Update Gas-Actuated Pumps Gas Composition Data Basin Factors	Update Liquids Unloading Gas Composition Data Basin Factors	Update Loading Operations Gas Composition Data Basin Factors	Update Pneumatic Devices Gas Composition Data Basin Factors	Update Produced Water Gas Composition Data Basin Factors	Update Heaters Basin Factors	Update Lateral/Gathering Compressors Basin Factors	Update Liquids Unloading Basin Factors	Update Loading Operations Basin Factors	Update Pneumatic Devices Basin Factors	Update Produced Water Basin Factors	Update Wellhead Compressors Basin Factors

If you updated basin factors, and would like to re-use them, please click on the appropriate source categories.

If you made point source activity adjustments, and would like to re-use them, please click on the appropriate source categories.

Save Artificial Lifts point source activity adjustments	Save Associated Gas point source activity adjustments	Save Condensate Tanks point source activity adjustments	Save Crude Oil Tanks point source activity adjustments	Save Dehydrators point source activity adjustments	Save Fugitives point source activity adjustments	Save Gas-Actuated Pumps point source activity adjustments
Save Heaters point source activity adjustments	Save Lateral/Gathering Compressors point source activity adjustments	Save Liquids Unloading point source activity adjustments	Save Loading Operations point source activity adjustments	Save Pneumatic Devices point source activity adjustments	Save Produced Water point source activity adjustments	Save Wellhead Compressors point source activity adjustments

If you made point source emission adjustments, and would like to re-use them, please click on the appropriate source categories.

Save Artificial Lifts point source emissions adjustments	Save Associated Gas point source emissions adjustments	Save Condensate Tanks point source emissions adjustments	Save Crude Oil Tanks point source emissions adjustments	Save Dehydrators point source emissions adjustments	Save Fugitives point source emissions adjustments	Save Gas-Actuated Pumps point source emissions adjustments
Save Heaters	Save Lateral/Gathering	Save Liquids Unloading	Save Loading	Save Pneumatic	Save Produced	Save Wellhead

If the User updated basin factors, then they can be re-used by clicking here.

If the User created point source activity data and/or emission adjustments, then they can be re-used by clicking here.



# Additional Notes

- In the EIS Staging Tables, the following tables are populated:
  - ControlApproach
  - ControlMeasure
  - ControlPollutant
  - Emissions
  - EmissionsProcess
  - Location
  - ReportingPeriod
- The Exploration Module runs the same way as the Production Module.



# Additional Notes (cont.)

- If the User wishes to reset the tool, and regenerate the emissions, the following steps are recommended:
  - Click on the “Reset All Selections/Go to Step 1” button at the top of the Dashboard.
  - Compact and Repair the database.

The screenshot shows the 'Oil and Gas Tool: Production Activities - Dashboard View'. At the top, there are three buttons: 'Back to Home Page', 'Reset All Selections/Go to Step 1', and 'EXIT TOOL'. Below these is the 'Oil and Gas Production Sources - Summary Emissions' section, which includes a 'Summary Emissions' table and a 'Final Emissions Tables by Source Category' grid. The grid contains 18 buttons for various emission sources: Artificial Lifts, Associated Gas, Condensate Tanks, Crude Oil Tanks, Dehydrators, Fugitives, Gas-Actuated Pumps, Heaters, Lateral/Gathering Compressors, Liquids Unloading, Loading Operations, Pneumatic Devices, Produced Water, and Wellhead Compressors. Below this is the 'Emission Inventory System (EIS) Staging Tables' section with two buttons: 'Click here to create EIS Staging Tables' and 'Click here to clear EIS Staging Tables'. At the bottom, there are two rows of buttons for updating data and factors for each of the 18 emission sources. Annotations with arrows point to the 'Reset All Selections/Go to Step 1' button, the 'EXIT TOOL' button, and the 'Summary Emissions' table.



# Additional Notes (cont.)

- References cited for the original data in the Tool are found in the "Master References" tab.

Oil and Gas Tool: Production Activities - Dashboard View

Back to Home Page    Reset All Selections/Go to Step 1    EXIT TOOL

Step 1 - Select Geographic Level    Step 2 - Select Specific Geographic Location    Step 4 - Select Specific Source Category    Step 5 - View/Edit County-Level Activity Data  
Step 6 - View/Edit Basin Factors    Step 7 - View/Edit Emission Factors    Step 8 - View/Edit Point Source Emission Adjustments    Step 10 - Final Emissions    Master References

References are compiled into a single table. These references pertain to the original data entered by the User.

FIELD_REFERENCE	DESCRIPTION
AK_OGC_2012	Alaska Oil and Gas Commission data
AK_OGC_2013_RIGDATA	Alaska Oil and Gas Commission data from RIGDATA
AL_OGC_2013_RIGDATA	Alabama Oil and Gas Commission data from RIGDATA
API_2009a	API Compendium (8/2009), Table 4-11
API_2009b	API Compendium (8/2009), Table 4-11
AR_DEQ_2013	Arkansas Oil and Gas Commission well completion reports
CA_OGC_2013	California Oil and Gas Commission data
CA_OGC_2013_RIGDATA	California Oil and Gas Commission drilling data scaled to California state totals from RIGDATA
CENRAP_2008	ENVIRON. Recommendations for Improvements to the CENRAP STATES' OIL AND GAS EMISSIONS INVENTORIES. November 2008
CENSARA_STUDY_2012	ENVIRON International Corporation. Oil and Gas Emission Inventory Enhancement Project for CenSARA States. December 21, 2012
CENSARA_STUDY_2012_AVERAGE	ENVIRON International Corporation. Oil and Gas Emission Inventory Enhancement Project for CenSARA States. December 21, 2012
CENSARA_STUDY_2012_EXTENSION	ENVIRON International Corporation. Oil and Gas Emission Inventory Enhancement Project for CenSARA States. December 21, 2012
CLIMATE_REGISTRY_2010	The Climate Registry Oil and Gas Production Annex II to the General Reporting Protocol, 2010 - Table 17.5
EIA_2012	Energy Information Administration (EIA). 2012. Accessed online at: <a href="http://www.eia.gov/">http://www.eia.gov/</a>

References cited in the Tool for the original data are here.



# Case Studies



# Case Studies.

*(please have both the Production and Exploration modules open)*



## Case Study #1

- The Permian Basin consists of 4 counties in New Mexico and 62 counties in Texas. In 2014, the basin produced:
  - 582,987,082 barrels of oil from 125,421 wells
  - 552,747,870 MSCF of natural gas from 24,606 wells
  - 121,407 MSCF coalbed methane from 12 wells

Use the Tool to calculate the nonpoint VOC emissions for crude oil tanks for each state, and the % of total production sources.



## Case Study #2

- Based on new permit applications, unconventional drilling activity is expected to begin in Wake County, NC (FIPS = 37183). Calculate NO<sub>x</sub> emissions from exploration sources.
  - 100 natural gas wells drilled horizontally; total estimated feet drilled is 425,000 ft.
  - 85 natural gas wells completed

NCDENR is also wanting to evaluate the impact of limiting hydraulic fracturing engines to 3.5 g/hp-hr for NO<sub>x</sub> from the current factor of 5.831 g/hp-hr for NO<sub>x</sub>. Calculate the NO<sub>x</sub> impact.



## Case Study #3

- EPA is considering reducing the NO<sub>x</sub> emission factor for 4-cycle lean-burn wellhead compressor engines at gas wells (SCC = 2310021202) to 0.5 g/hp-hr in nonattainment areas (current factor = 3.07359 g/hp-hr. Using the tool, assess:
  - Impact of total NO<sub>x</sub> emissions within nonattainment counties.
  - Impact of total NO<sub>x</sub> emissions within nonattainment counties for SCC 2310021202



## Case Study #4

- The state of Oklahoma provides point source emissions in the NEI for several upstream oil and gas wells. Using the Tool, calculate benzene emissions from Dehydrators in Alfalfa County, OK (FIPS = 40003), after making point source activity adjustments.
  - Alfalfa County, OK Gas Production = 5,017,381 MSCF from 170 gas wells (No CBM production in Alfalfa County, OK)
  - Alfalfa County, OK Associated Gas Production = 107,564,300 MSCF from 783 oil wells
  - Point sources activity = 1,706,326 MSCF from 12 gas wells; 92,718,640 MSCF from 613 oil wells

