

June 8, 2017

## MEMORANDUM

To: Tom Moore, WESTAR-WRAP  
 From: Rajashi Parikh, John Grant and Amnon Bar-Ilan; Ramboll Environ  
 Subject: 2014 Oil and Gas Intermountain West Criteria Pollutant Emission Inventories for Colorado, Montana, New Mexico, North Dakota, South Dakota, Utah, and Wyoming

### Introduction

Ramboll Environ compiled 2014 oil and gas (O&G) emissions for basins in the Intermountain West for inclusion in the Intermountain West Data Warehouse (IWDW)<sup>1</sup>. This memorandum outlines the data sources and calculation methodology used to develop the 2014 O&G point and nonpoint (area) source emissions for all basins in the Intermountain West with the exception of the San Juan Basin in Colorado and New Mexico and the Permian Basin in New Mexico. Emission inventories for the San Juan and Permian Basin are being developed in a separate effort<sup>2</sup>. 2014 O&G emissions were compiled from the most recent inventory development efforts undertaken by state and federal agencies and the Western States Air Resources Council-Western Regional Air Partnership (WESTAR-WRAP).

### Scope

#### Geographical

Emission inventories were developed for Intermountain West O&G basins as listed in Table 1. For each basin, emissions were compiled by county. For basins which include O&G activity on tribal land, emissions were classified as “tribal” or “non-tribal”.

**Table 1. Intermountain West O&G basins covered under this project.**

Basin	State
Denver-Julesburg	CO
Piceance	CO
Paradox	CO,UT
Uinta	UT
Raton	CO, NM
Big Horn	WY, MT
Powder River	WY, MT, SD
Green River Basin	WY, CO
Central Western Overthrust	WY
Wind River	WY

<sup>1</sup> <http://views.cira.colostate.edu/tsdw/>

<sup>2</sup> <https://www.wrapair2.org/SanJuanPermian.aspx>

Basin	State
Williston	MT, ND, SD
Sweetgrass Arch	MT
Central Montana Uplift	MT

O&G basin boundary definitions from the American Association of Petroleum Geologist (AAPG)<sup>3</sup> (see Figure 1) were adopted, consistent with basin boundaries used in the US Environmental Protection Agency (EPA) Greenhouse Gas Reporting Protocol (GHGRP) and 2014 National Emission Inventory (NEI). There are minor differences between American Association of Petroleum Geologist (AAPG) boundaries and modified US Geological Survey (USGS) boundaries developed in the WRAP Phase III<sup>4</sup> study for counties outside of core producing areas in several basins (see Figure 2).

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<sup>3</sup> <https://ngmdb.usgs.gov/Geolex/stratres/provinces>

<sup>4</sup> <https://www.wrapair2.org/PhaseIII.aspx>

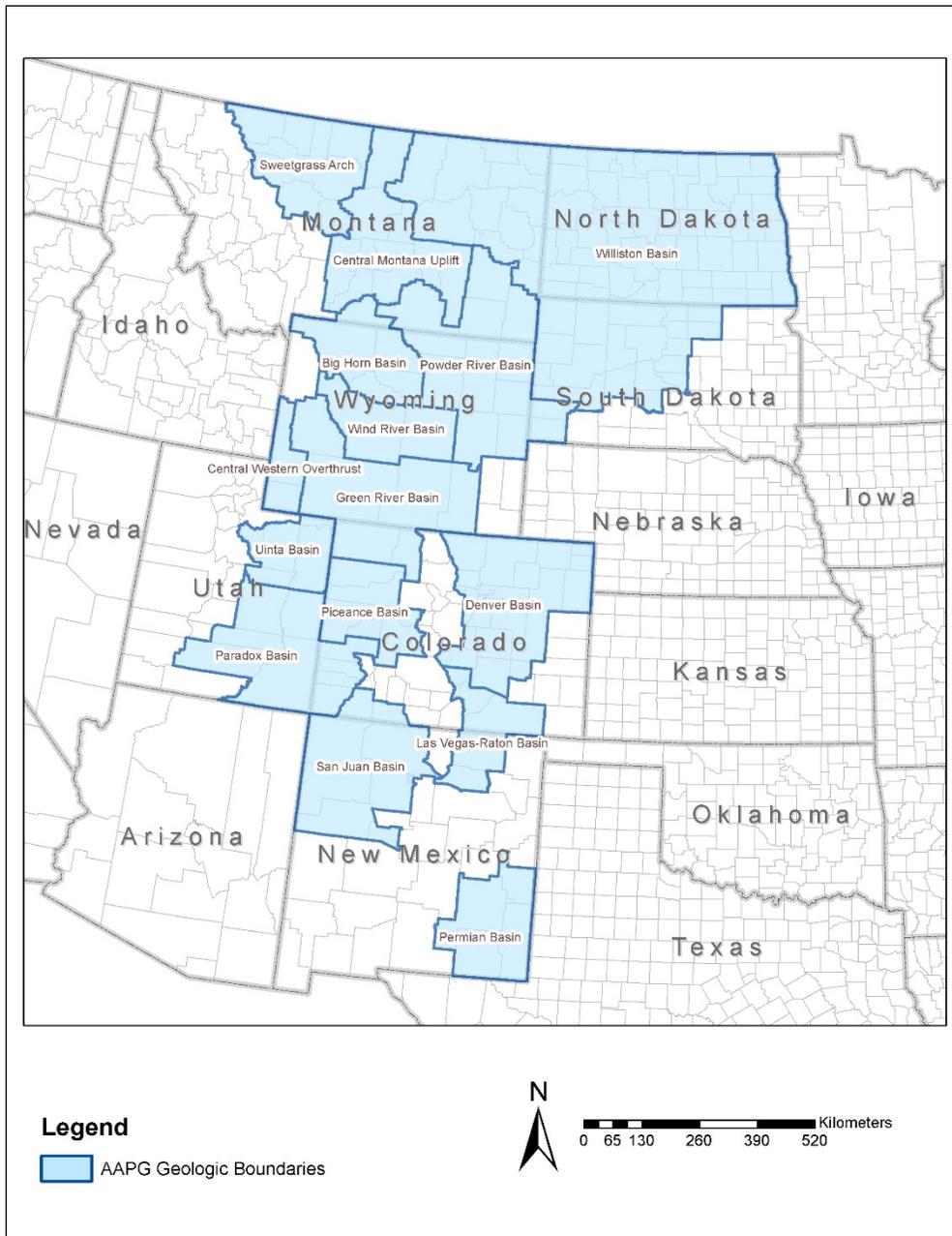
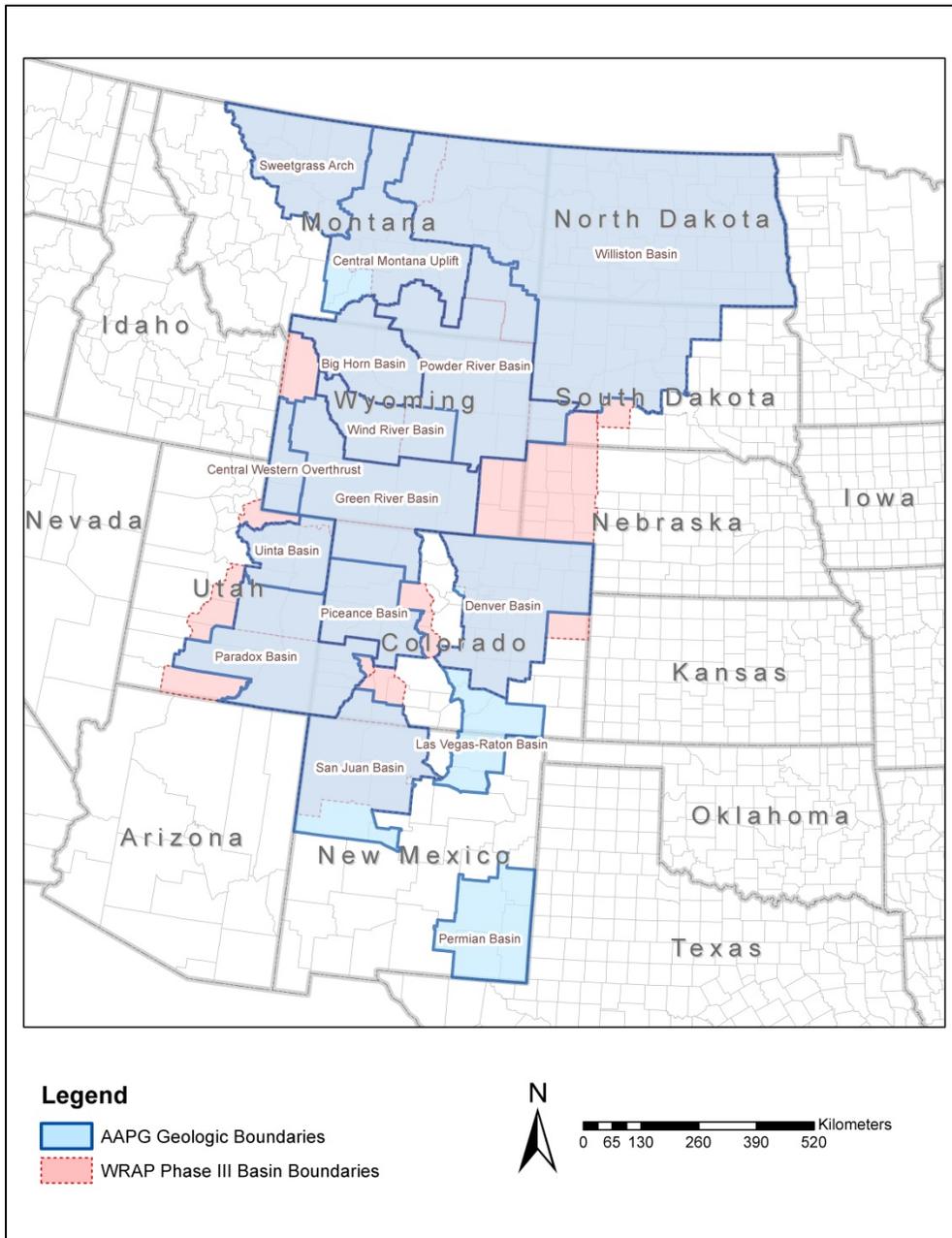


Figure 1. 2014 IWDW O&G basin boundaries<sup>5</sup>.

<sup>5</sup> Emission inventories for the San Juan and Permian Basin are being developed in a separate effort WESTAR-WRAP study (<https://www.wrapair2.org/SanJuanPermian.aspx>)



**Figure 2.** 2014 IWDW AAPG-based and previous 2011 IWDW USGS-based basin boundaries<sup>5</sup>.

**Temporal**

Annual O&G emissions were compiled for calendar year 2014.

**Source Category**

O&G emission inventories developed in this study include on-shore production and processing subsectors (items 1, 2a, 3, and 4 in Figure 3). Items 1) Drilling and Well Completion and 2a) Onshore Producing Wells are collectively referred to as “well-site” sources; emissions from well-site sources

are classified as nonpoint sources<sup>6</sup>. Items 3) Gathering and Boosting and 4) Gas Processing Plant are collectively referred to as “midstream” sources; emissions from midstream sources are classified as point sources. The classification of well-site emissions as nonpoint and midstream emissions as point sources is consistent with O&G emission inventory classifications used in the WRAP Phase III study<sup>4</sup>, West-wide Jumpstart Air Quality Modeling Study (WestJUMP AQMS)<sup>7</sup>, and 2011 IWDW<sup>8</sup>, and 2014 NEI methodology<sup>9</sup>. County-level emissions are estimated by source classification code<sup>10</sup> (SCC).

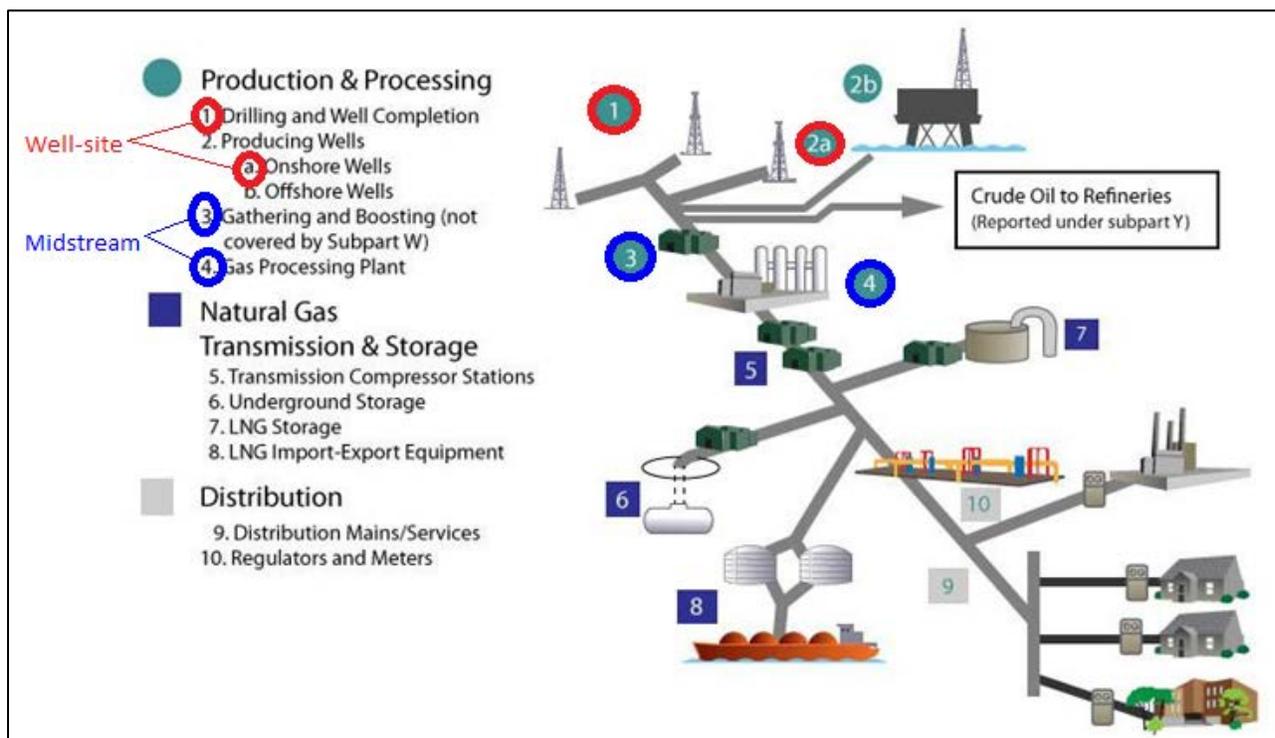


Figure 3. Example Petroleum and Natural Gas Industry schematic<sup>11,12</sup>.

## Methodology

Methodology used and data sources relied upon to estimate 2014 O&G emissions by county, tribal designation, and source category for Intermountain West O&G basins is summarized below.

<sup>6</sup> There are a small number of exceptions; for example, well-site tank emissions in the Piceance basin are included as point source emissions.

<sup>7</sup> <https://www.wrapair2.org/WestJumpAQMS.aspx>

<sup>8</sup> <http://vibe.cira.colostate.edu/wiki/wiki/1018/3saqs-2011a-modeling-platform>

<sup>9</sup> <https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-technical-support-document-tsd>

<sup>10</sup> <https://ofmpub.epa.gov/scsearch/>

<sup>11</sup> Source: <https://www.epa.gov/ghgreporting/subpart-w-basic-information>

<sup>12</sup> This figure shows O&G subsectors for which emissions have been developed in this study. It is not a comprehensive representation of the Petroleum and Natural Gas Industry. Petroleum and Natural Gas Industry equipment is typically tailored to meet field, basin, and/or region specific infrastructure requirements. Tank batteries and other types of facilities associated with oil fields are not represented in this figure.

Nonpoint and point source emissions were sourced from state and federal permitting databases and the 2014 National Emission Inventory (NEI) (v1)<sup>13</sup>.

### Nonpoint Source Emissions

Outreach was performed to state and federal agencies to obtain the most recent O&G nonpoint source emissions for inclusion in the IWDW 2014 O&G emission inventories. Nonpoint emissions were either obtained from state databases or from the 2014 NEI (v1)<sup>13</sup>. The Colorado Department of Public Health and Environment (CDPHE)<sup>14</sup> and Wyoming Department of Environmental Quality (WYDEQ)<sup>15</sup> provided by county and by SCC nonpoint emissions for Colorado and Wyoming counties, respectively. For other states, nonpoint source O&G emissions were extracted from the 2014 NEI (v1) by state, by county and by SCCs for O&G SCC codes (SCC codes beginning with 2310). Table 2 shows data sources used to develop 2014 nonpoint emissions by basin.

**Table 2. Basis of nonpoint O&G emissions by basin.**

Basin	State	Data Source
Denver-Julesburg	CO	2014 NEI
Piceance	CO	
Paradox	CO,UT	
Uinta <sup>A</sup>	UT	
Raton	CO, NM	
Big Horn	WY, MT	WYDEQ, 2014 NEI
Powder River	WY, MT, SD	WYDEQ, 2014 NEI
Green River Basin	WY, CO	WYDEQ, 2014 NEI
Central Western Overthrust	WY	WYDEQ
Wind River	WY	WYDEQ
Williston	MT, ND, SD	2014 NEI
Sweetgrass Arch	MT	2014 NEI
Central Montana Uplift	MT	2014 NEI

<sup>A</sup> EPA is developing an updated O&G emission inventory for Uinta and Duchesne counties. Since the status of the EPA inventory is still “in-development”, it was not possible to include the new inventory in this study.

Emissions were designated as tribal or non-tribal based on well location. Oil and gas activity were obtained from the IHS Enerdeq<sup>16</sup> database queried via online interface. Tribal or non-tribal designation were assigned based on latitude and longitude coordinates for each well and spud location in IHS Enerdeq data using the Geographical Information System (GIS). For all basins with oil and gas activity on tribal lands except the Uinta Basin, a well was designated as tribal if it was located on tribal land and non-tribal if it was not located on tribal land. For the Uinta Basin, a well was defined as tribal if it was located within the tribal airshed, but not on state jurisdiction land or non-tribal if it was located either outside of the tribal airshed or within the tribal airshed but on state jurisdiction land.

<sup>13</sup> NEI 2014 v1 published September 2016. Available online at <https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-data>

<sup>14</sup> Personal communication from Dale Wells, CDPHE, via email dated 03 October, 2016.

<sup>15</sup> Personal communication from Benjamin Way, WYDEQ, via email dated 14 October, 2016.

<sup>16</sup> Includes data supplied by IHS Inc., its subsidiary and affiliated companies; Copyright (2011) all rights reserved.

Activity on tribal lands was limited to the following basins, Paradox Basin, Powder River Basin, Sweet Grass Arch Basin, Uinta Basin and Wind River Basin. There was no oil and gas activity on tribal lands in 2014 for any other basin. Nonpoint source emissions were assigned a tribal or non-tribal designation by disaggregating county and SCC-level emissions by the fraction of oil and gas activity surrogate (i.e. oil production, gas production, well counts and spud counts) occurring on tribal and non-tribal land. Each source category was assigned the oil and gas activity category surrogate to which its emissions are most closely associated. For example, drill rig emissions activity would be most closely associated with and therefore assigned based on spuds activity. Appendix A shows surrogate assignments by source category.

For basins with O&G emissions on tribal lands, Figure 4 shows the fraction of O&G activity by tribal and non-tribal designation for active well counts, gas production, and liquid hydrocarbon production.

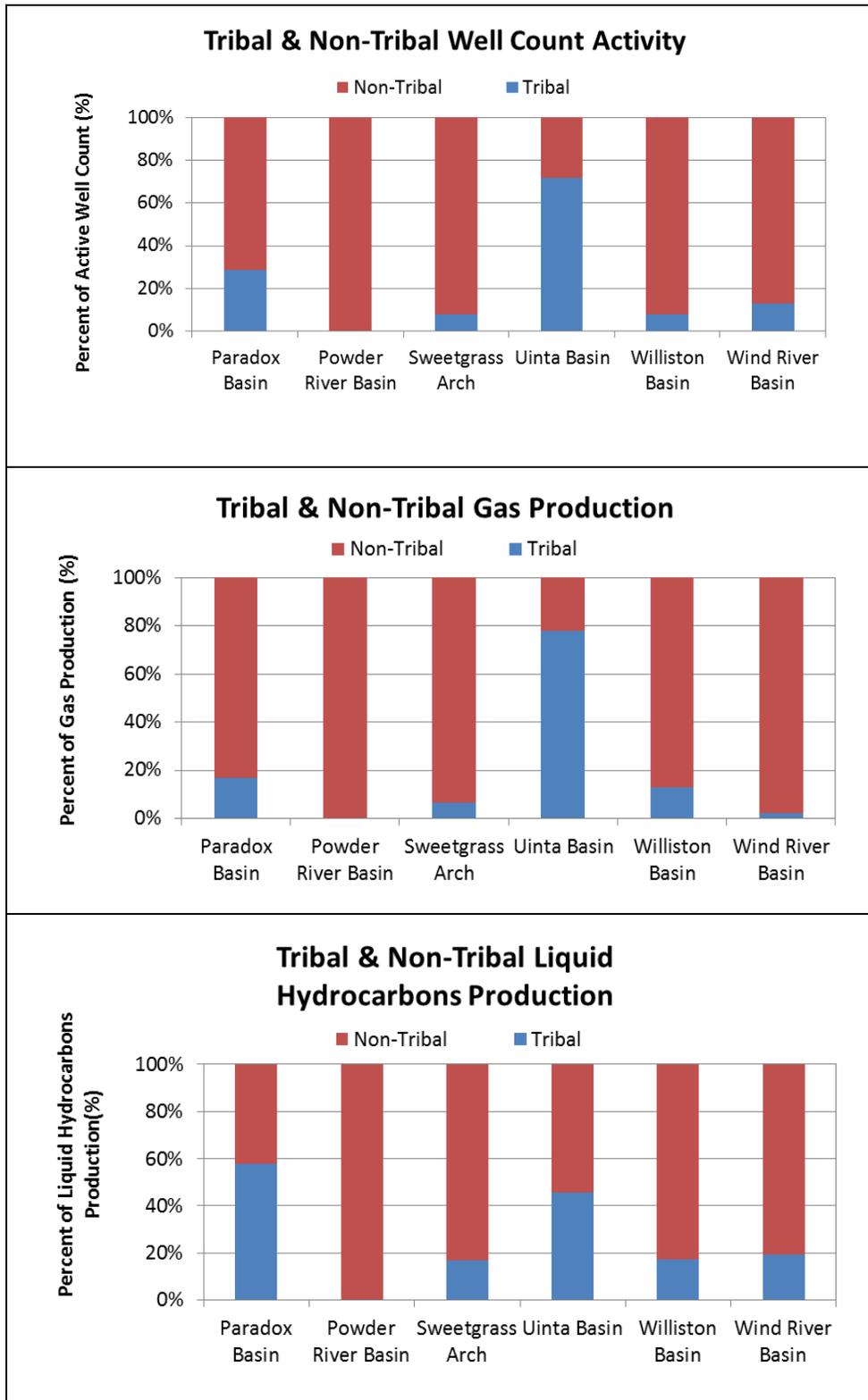
### **Completeness and Consistency**

For Wyoming and Colorado, O&G emission inventories were provided by WYDEQ and CDPHE, respectively, with a high degree of detail and completeness. The discussion below focuses on assumptions that were made for specific Wyoming and Colorado O&G basins in order to make use of the highly detailed emissions data provided by WYDEQ and CDPHE.

There was a double counting issue noted in 2014 NEI (v1) Colorado nonpoint O&G emissions. Based on input from CDPHE, only emissions submitted to the NEI by the CDPHE were used; 2014 NEI (v1) emissions estimated with EPA's O&G Tool were omitted. The emissions submitted by CDPHE to the 2014 NEI (v1) do not include SO<sub>x</sub> emissions estimates. SO<sub>x</sub> emissions were estimated by scaling NO<sub>x</sub> or VOC emissions by the ratio of source category specific emission factors (i.e. SO<sub>x</sub>:VOC or SO<sub>x</sub>:NO<sub>x</sub>).

For Montezuma County in the Paradox basin, non-tribal emissions were from the CDPHE 2014 NEI submittal; tribal emissions were estimated by apportioning 2014 NEI (v1) emissions based on the oil and gas surrogate method described above.

WYDEQ provided Fremont County nonpoint emissions by well-site and by SCC along with latitude and longitude coordinates. Based on the WYDEQ latitude and longitude coordinates, each well on tribal or non-tribal land was identified. The summation of emissions not occurring on tribal land were designated Fremont County non-tribal emissions. WYDEQ nonpoint source emissions on tribal lands are not expected to be complete for the Wind River Basin. Therefore, tribal emissions in Fremont County were estimated by disaggregating 2014 NEI (v1) emissions for Fremont County based on the oil and gas surrogate method described above.



**Figure 4. Tribal and non-tribal activity contributions for basins with O&G activity on tribal lands: active well count (top panel), gas production (middle panel), and liquids hydrocarbon production (i.e. condensate and oil; bottom panel).**

## Point Source Emissions

Outreach was performed to state and federal agencies to obtain the most recent O&G point source emissions for inclusion in the IWDW 2014 O&G emission inventories. Point source emissions were obtained from state and federal permit databases and the 2014 NEI (v1). As described above, point source emissions consist primarily of midstream facilities which are not included in the nonpoint source emission inventory. Table 5 shows data sources used to compile point source emissions for each basin.

**Table 3. Basis of point source O&G emissions by basin.**

Basin	State	Data Source
Denver-Julesburg	CO	CDPHE
Piceance	CO	CDPHE
Paradox	CO,UT	CDPHE, 2014 NEI
Uinta <sup>B</sup>	UT	2014 NEI, EPA Region 8
Raton	CO, NM	CDPHE, 2014 NEI
Big Horn	WY, MT	WYDEQ, 2014 NEI
Powder River	WY, MT, SD	WYDEQ, 2014 NEI, EPA Region 8
Green River Basin	WY, CO	WYDEQ, CDPHE
Central Western Overthrust	WY	WYDEQ
Wind River	WY	WYDEQ, EPA Region 8
Williston	MT, ND, SD	2014 NEI, EPA Region 8 <sup>A</sup>
Sweetgrass Arch	MT	2014 NEI, EPA Region 8
Central Montana Uplift	MT	2014 NEI

<sup>A</sup> South Dakota Department of Department of Environment & Natural Resources (SDDENR) provided emissions for a single additional source<sup>17</sup> not included in the 2014 NEI (v1).

<sup>B</sup> EPA is developing an updated O&G emission inventory for Uinta and Duchesne counties. Since the status of the EPA inventory is still “in-development”, it was not possible to include the new inventory in this study.

### Point Source Data from State Agencies

Colorado<sup>14</sup> and Wyoming<sup>15</sup> provided detailed process level emissions by facility from state permit databases. Per direction from Montana, New Mexico, North Dakota, South Dakota, and Utah representatives, point source emissions were obtained from the 2014 NEI (v1).

### Permit Data from EPA Region 8

Title V permits and tribal minor source registration<sup>18</sup> emissions on tribal lands were requested from EPA Region 8. EPA<sup>19</sup> provided a facility level database of 2014 Title V emissions on Region 8 tribal lands. Title V O&G facilities were identified based on the list of North American Industry Classification System (NAICS) codes shown in Table 4 for inclusion in the emission inventory. EPA also

<sup>17</sup> Personal communication from Kyrik Rombough, SDDENR, via email dated 18 November, 2016.

<sup>18</sup> Applicable minor sources on tribal lands are registered as part of the Tribal Minor New Source Review Program (<https://www.epa.gov/tribal-air/tribal-minor-new-source-review>). In May 2016, EPA finalized a federal implementation plan for oil and gas production and processing segments of the oil and gas sector (<https://www.epa.gov/tribal-air/final-federal-implementation-plan-oil-and-natural-gas-true-minor-sources-and-amendments>).

<sup>19</sup> Personal communication from Claudia Smith, EPA, via email dated 14 November, 2016 and 17 November, 2016.

provided emissions for sources included in the Tribal Minor New Source Review program. Well-site sources included in the Tribal Minor New Source Review emissions database were identified based on facility name and excluded from the analysis to avoid double counting with nonpoint source emissions. Sources registered after 2014 were assumed non-operational in 2014; all other applicable Tribal Minor New Source Review program sources were included in the 2014 emission inventory.

**Table 4. O&G sector NAICS codes.**

NAICS description	NAICS code
Oil and Gas Extraction	2111
Oil and Gas Extraction	21111
Crude Petroleum and Natural Gas Extraction	211111
Natural Gas Liquid Extraction	211112
Drilling Oil and Gas Wells	213111
Support Activities for Oil and Gas Operations	213112
Pipeline Transportation of Natural Gas	4862
Pipeline Transportation of Crude Oil	48611

### Point Source Emissions from 2014 NEI (v1)

For applicable states, point source O&G emissions were extracted from the 2014 NEI (v1) for O&G NAICS codes shown in Table 4. The database provides process level emissions for each midstream facility.

### **Base Year 2014 Emission Results**

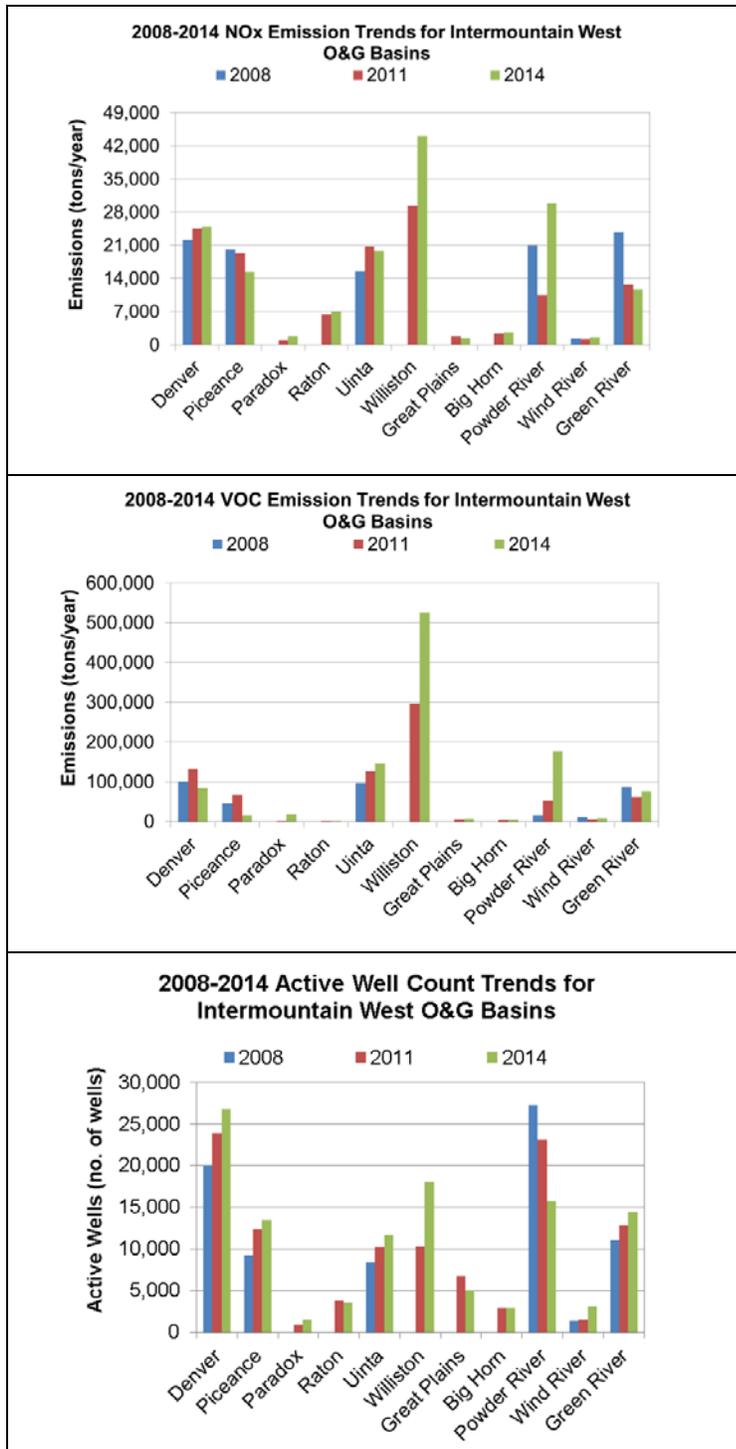
O&G emission inventory results are presented below for Intermountain West O&G basins as a series of tables, bar graphs, and pie charts. Emissions totals by basin are presented in Table 5. Basin-level 2014 NO<sub>x</sub>, VOC, and well counts are compared to previous IWDW 2011<sup>8</sup> and WestJUMP AQMS 2008<sup>7</sup> estimates in Figure 5.

**Table 5. 2014 O&G emissions (tons/yr) by basin.**

Basin	2014 Emissions (tons/year)				
	NO <sub>x</sub>	VOC	CO	SO <sub>x</sub>	PM
Denver	24,902	83,223	24,878	181	978
Piceance	15,395	14,734	10,096	448	553
Paradox	1,808	17,758	1,724	538	108
Raton	6,967	1,189	6,822	3	18
Uinta	19,753	146,684	14,926	484	826
Williston	44,090	524,913	36,900	4,133	1,514
Great Plains <sup>20</sup>	1,397	6,522	711	1	24
Big Horn	2,595	4,300	1,342	2,066	47
Powder River	29,832	177,568	10,624	612	526
Wind River	1,569	8,025	1,556	3,222	67
Green River <sup>21</sup>	11,676	74,968	8,284	911	538

<sup>20</sup> Great Plains Basin includes the Sweetgrass Arch and Central Montana Uplift basins.

<sup>21</sup> Green River Basin includes the entire Green River Basin and the portion of the Central Western Overthrust Basin in Wyoming.



**Figure 5. 2008, 2011 and 2014 emissions and active well count trends by basin: NOx emissions (top panel), VOC emissions (middle panel), and active well counts (bottom panel).**<sup>20,21,22,23</sup>

<sup>22</sup> 2008 emission inventories were not developed for Paradox, Raton, Williston, Great Plains, or Big Horn basins.

<sup>23</sup> 2011 Paradox Basin and Raton Basin emission inventories did not include nonpoint sources.

Figure 6 and Figure 7 show the percentage of emissions in each basin from point and nonpoint sources. A majority of NO<sub>x</sub> emissions are from nonpoint sources for the Denver, Paradox, Uinta, Williston, and Powder River basins; for the remaining basins, point sources contribute a greater amount of NO<sub>x</sub> than nonpoint sources. A majority of VOC emissions are from nonpoint sources for all basins except the Piceance Basin for which point sources contribute a majority of VOC emissions. Well-site condensate tank emissions in the Piceance Basin were included in the permitted sources database provided by CDPHE.

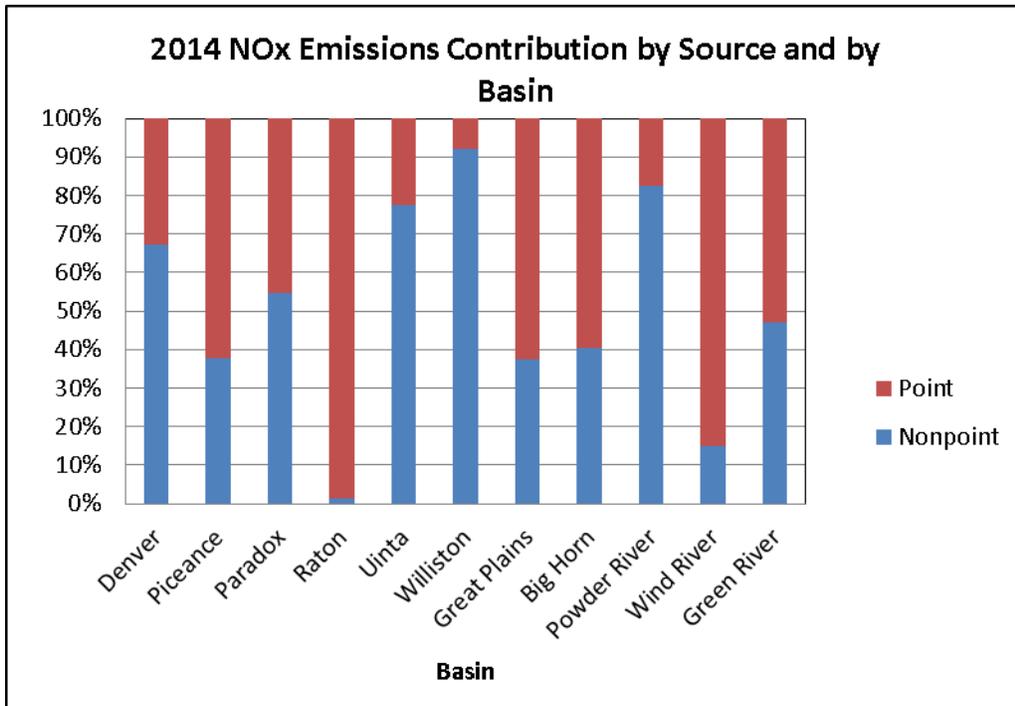


Figure 6. Basin-level 2014 O&G NOx emissions contribution by source type. <sup>20,21</sup>

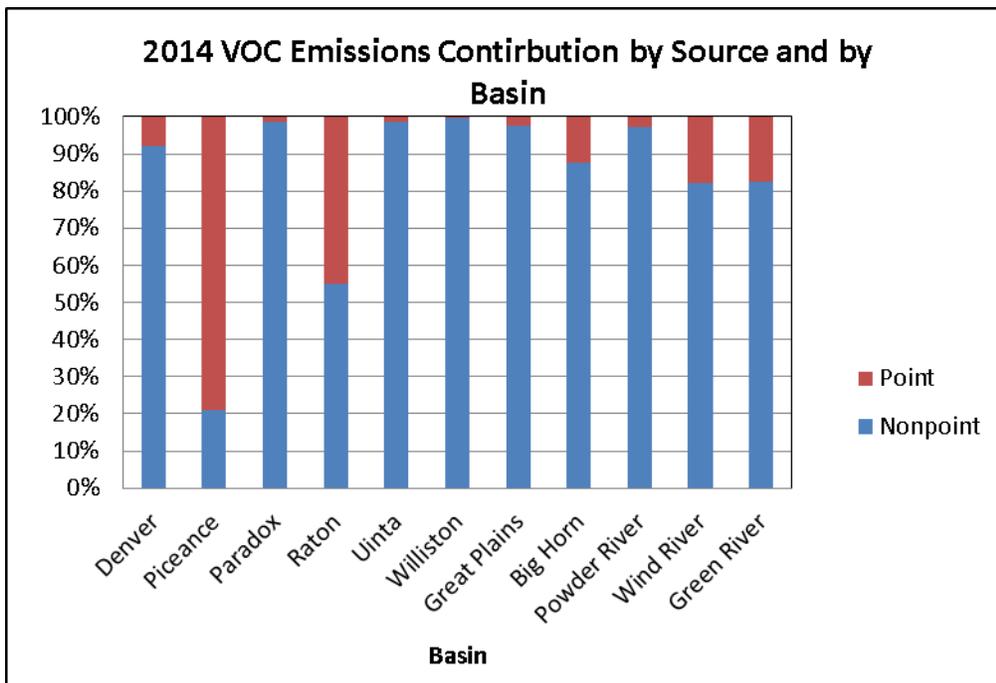


Figure 7. Basin-level 2014 O&G VOC emissions contribution by source type. <sup>20,21</sup>

Figures 8 through 19 show the distribution of NOx emissions within each basin by source category. NOx emissions are primarily from combustion sources such as midstream compressor engines, wellhead production engines (e.g. compressor engines, artificial lift engines), wellhead heaters and flares, and drill rigs. The exception is the Powder River Basin, in which 66% of NOx emissions are from well completion sources. Figures 20 through 31 show the distribution of VOC emissions within each basin by source category. Venting and fugitive sources such as tanks, pneumatic devices, pneumatic pumps, completion venting, associated gas venting and fugitives represent the largest contributors to basin-wide VOC emissions in most basins. Exceptions include the Uinta Basin (dehydrators are second largest source of VOC emissions) and Raton and Piceance basins (compressor engines are the largest source in VOC emissions in Piceance and Raton basins).

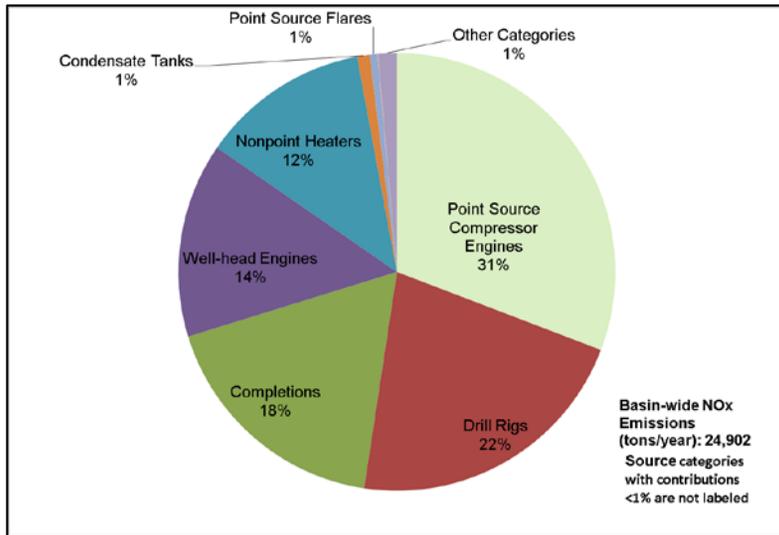


Figure 8. 2014 Denver Basin NOx emissions contributions by source category.

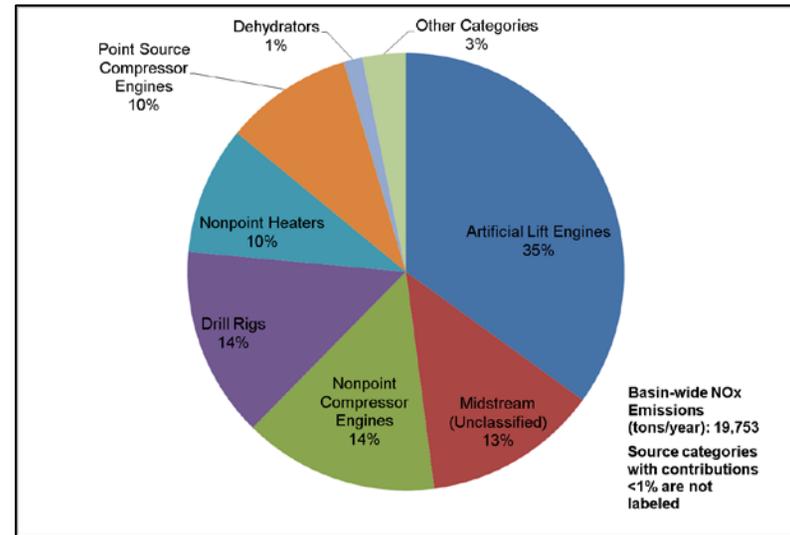


Figure 9. 2014 Uinta Basin NOx emissions contributions by source category.

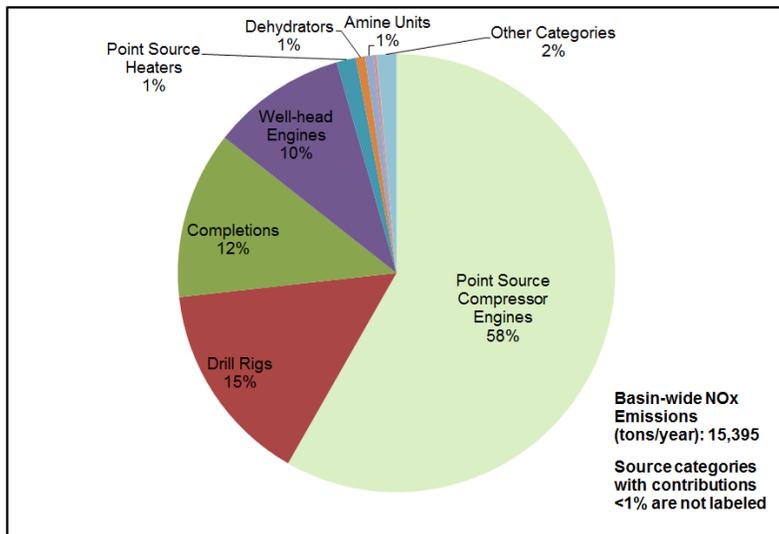


Figure 10. 2014 Piceance Basin NOx emissions contributions by source category.

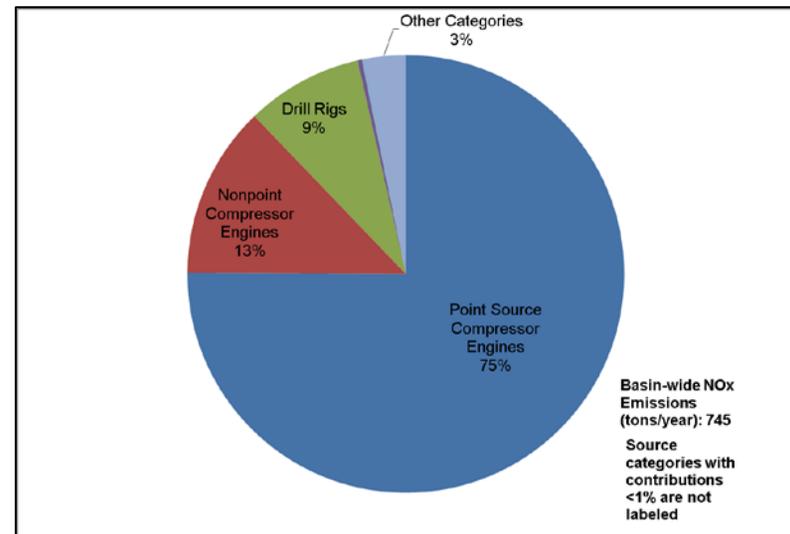


Figure 11. 2014 Central Montana Uplift Basin NOx emissions contributions by source category<sup>20</sup>.

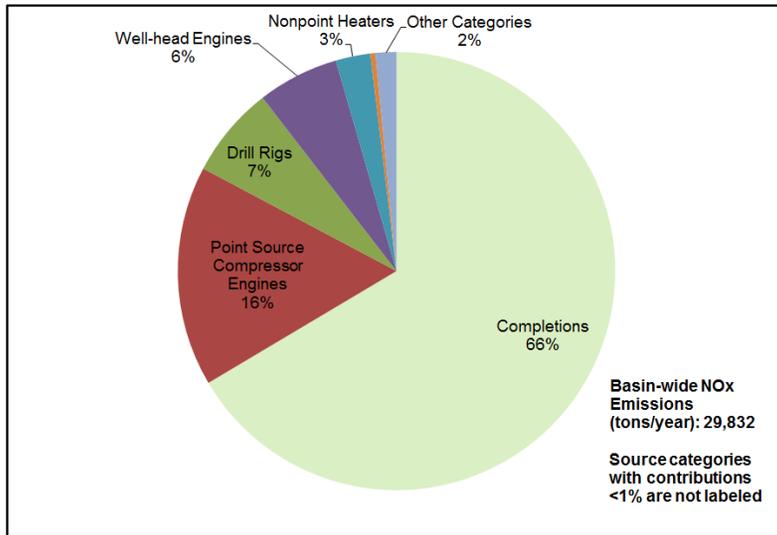


Figure 12. 2014 Powder River Basin NOx emissions contributions by source category.

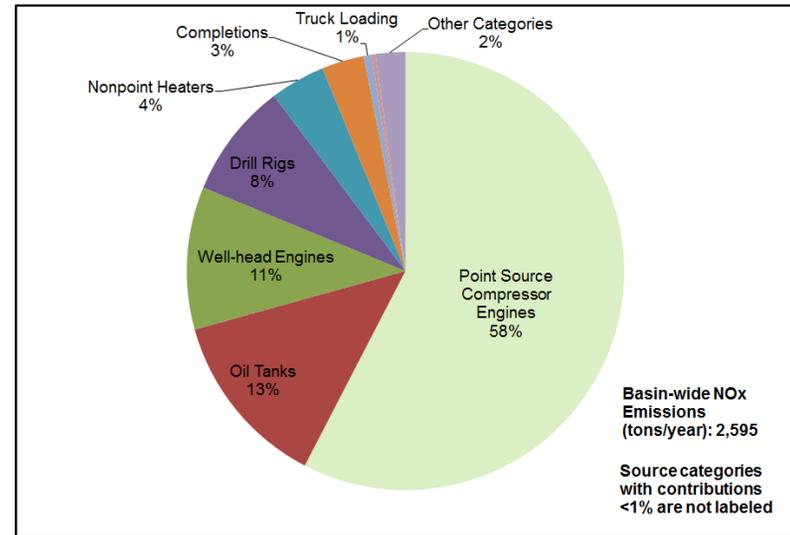


Figure 13. 2014 Big Horn Basin NOx emissions contributions by source category.

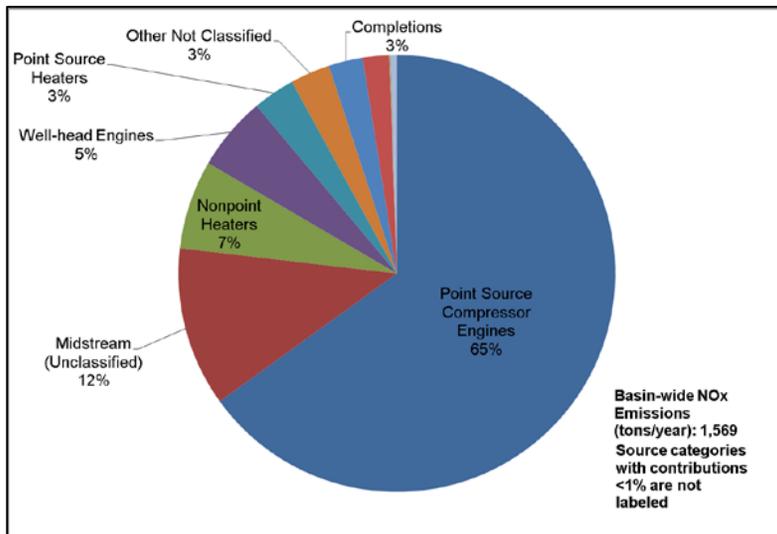


Figure 14. 2014 Wind River Basin NOx emissions contributions by source category.

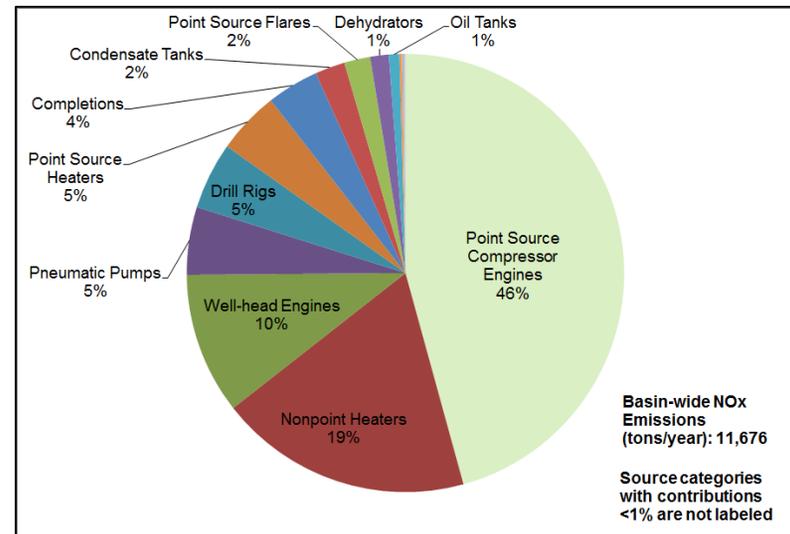


Figure 15. 2014 Green River Basin NOx emissions contributions by source category<sup>21</sup>.

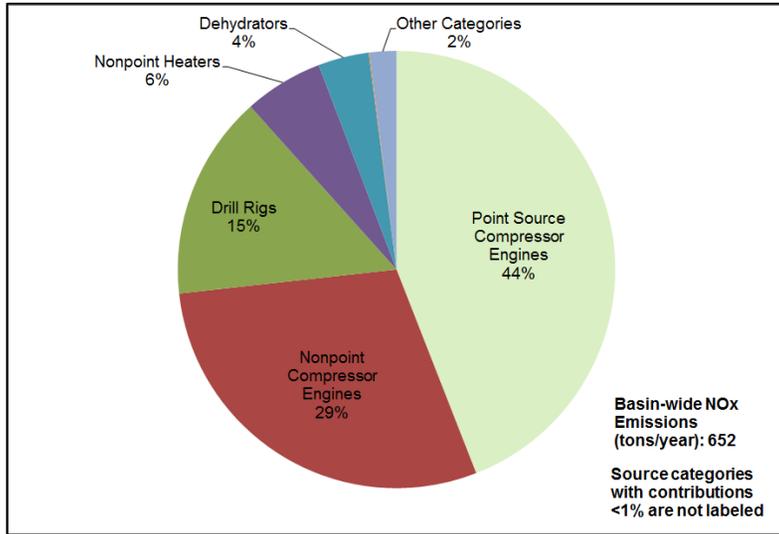


Figure 16. 2014 Sweet grass Arch Basin NOx emissions contributions by source category<sup>20</sup>.

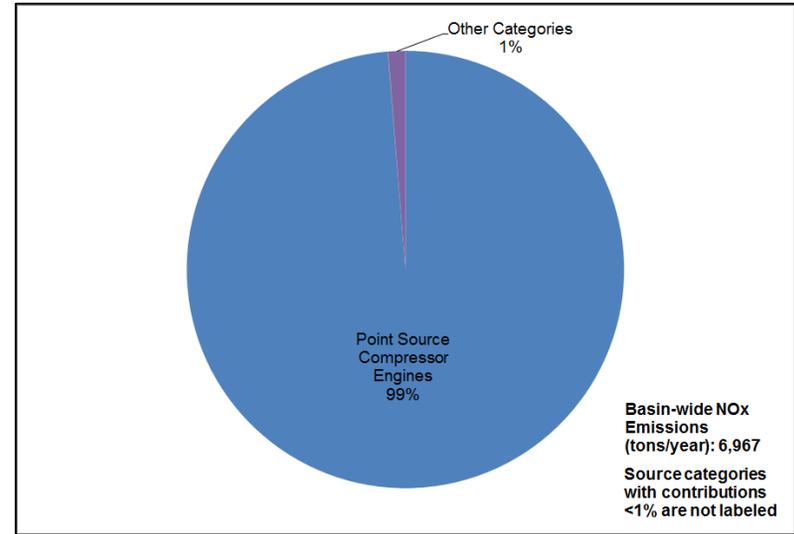


Figure 17. 2014 Raton Basin NOx emissions contributions by source category.

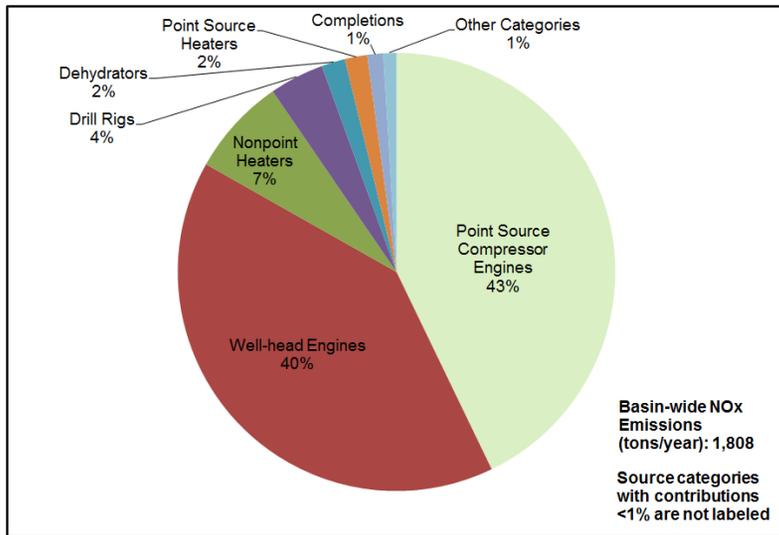


Figure 18. 2014 Paradox Basin NOx emissions contributions by source category.

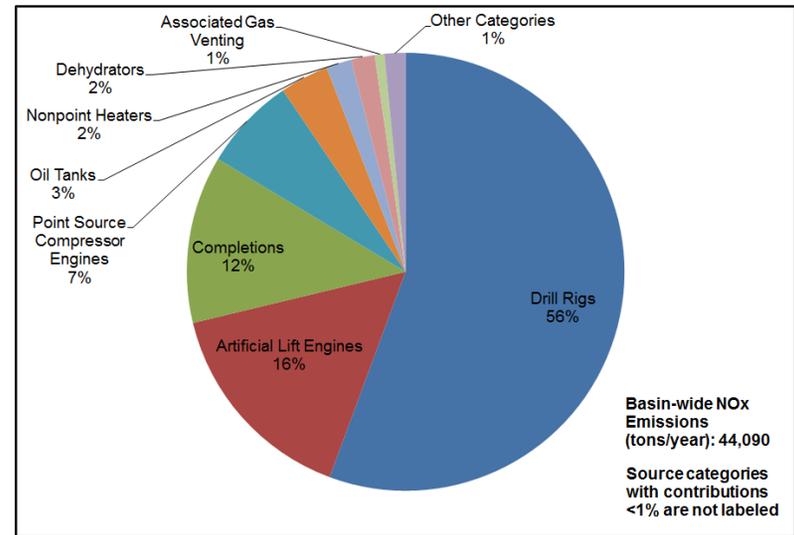


Figure 19. 2014 Williston Basin NOx emissions contributions by source category.

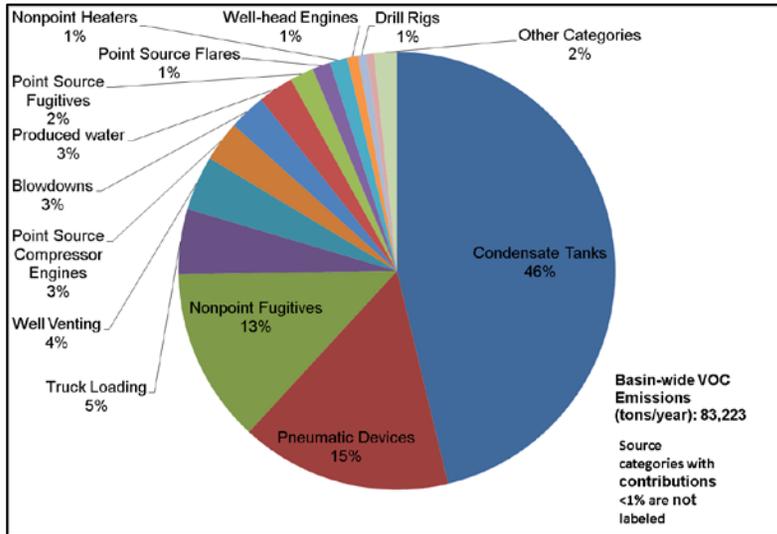


Figure 20. 2014 Denver Basin VOC emissions contributions by source category.

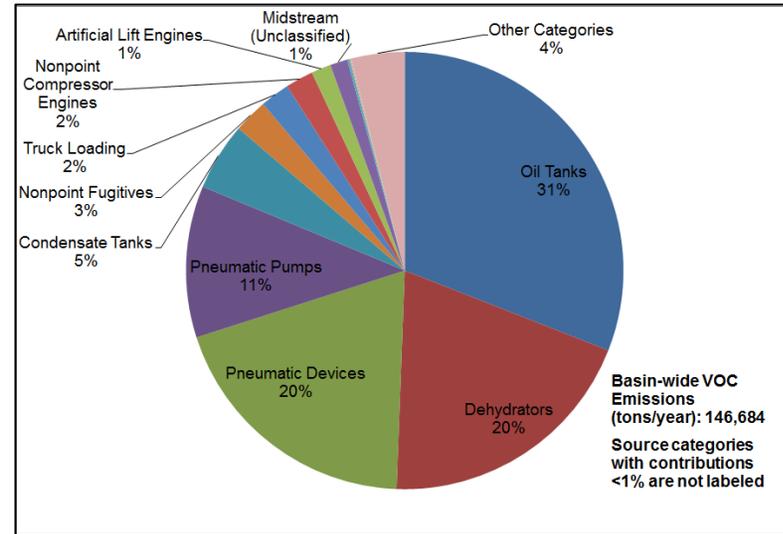


Figure 21. 2014 Uinta Basin VOC emissions contributions by source category.

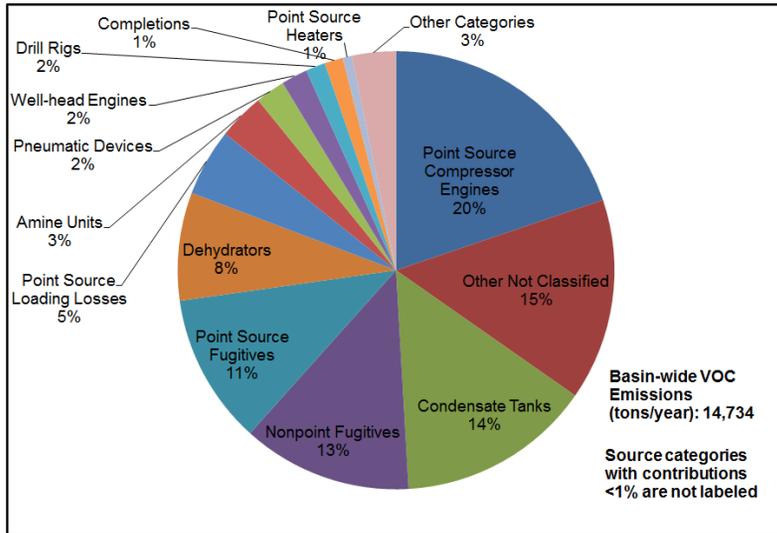


Figure 22. 2014 Piceance Basin VOC emissions contributions by source category.

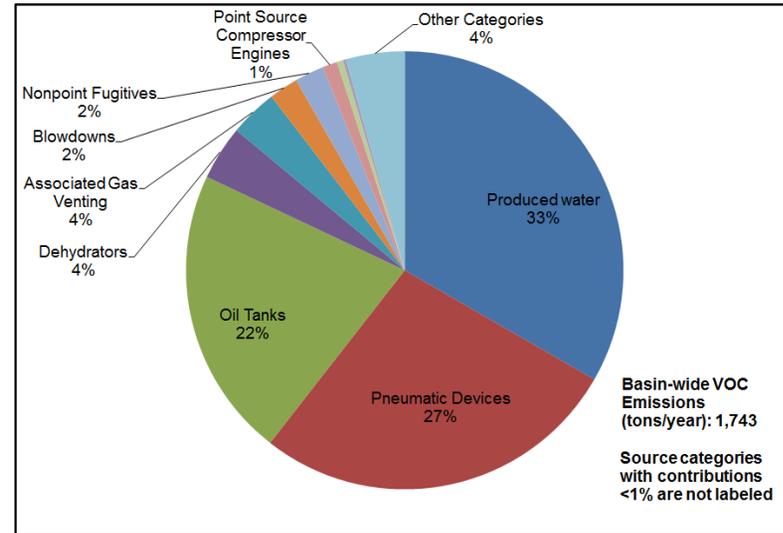


Figure 23. 2014 Central Montana Uplift Basin VOC emissions contributions by source category<sup>20</sup>.

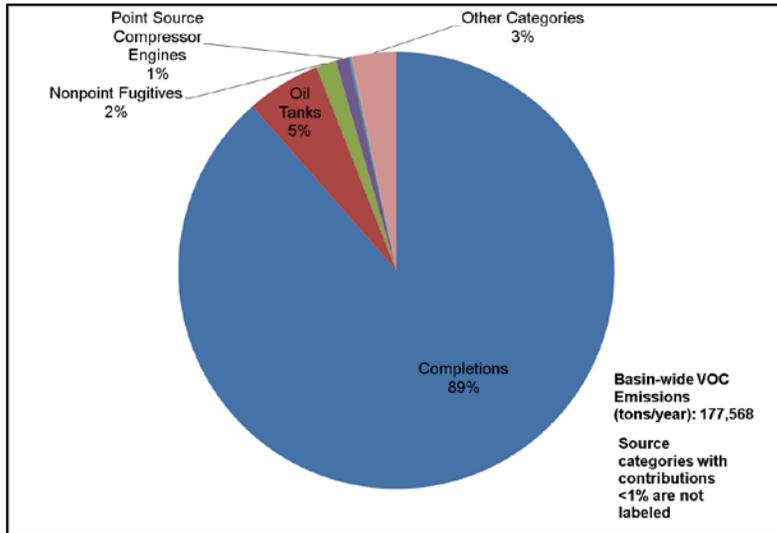


Figure 24. 2014 Powder River Basin VOC emissions contributions by source category.

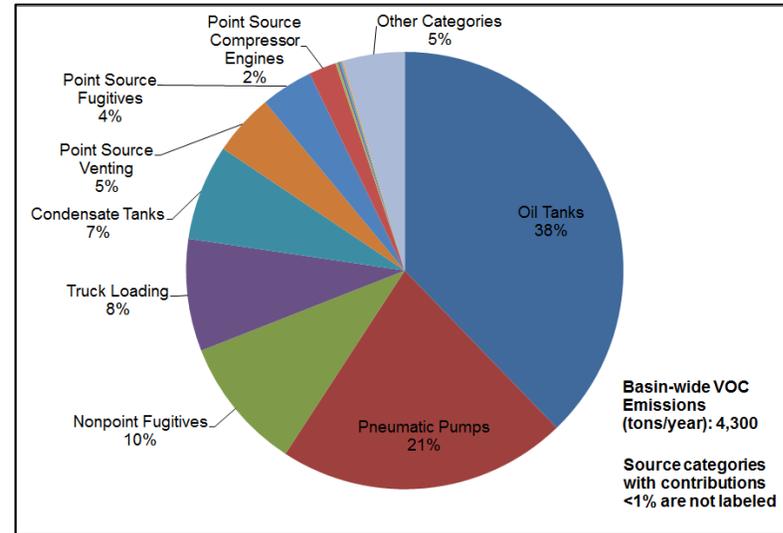


Figure 25. 2014 Big Horn Basin VOC emissions contributions by source category.

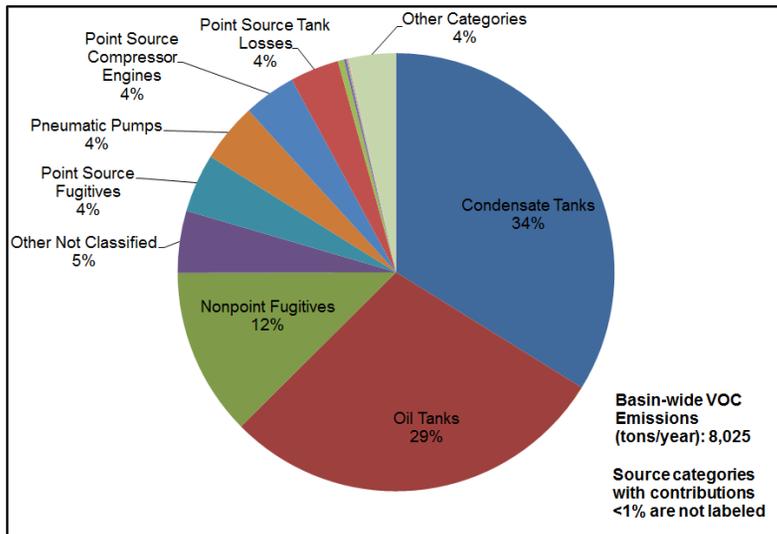


Figure 26. 2014 Wind River Basin VOC emissions contributions by category.

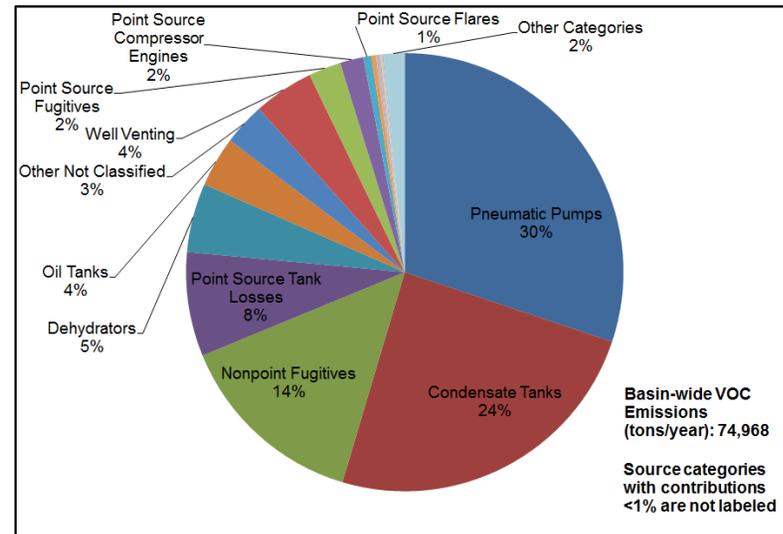


Figure 27. 2014 Green River Basin VOC emissions contributions by source category<sup>21</sup>.

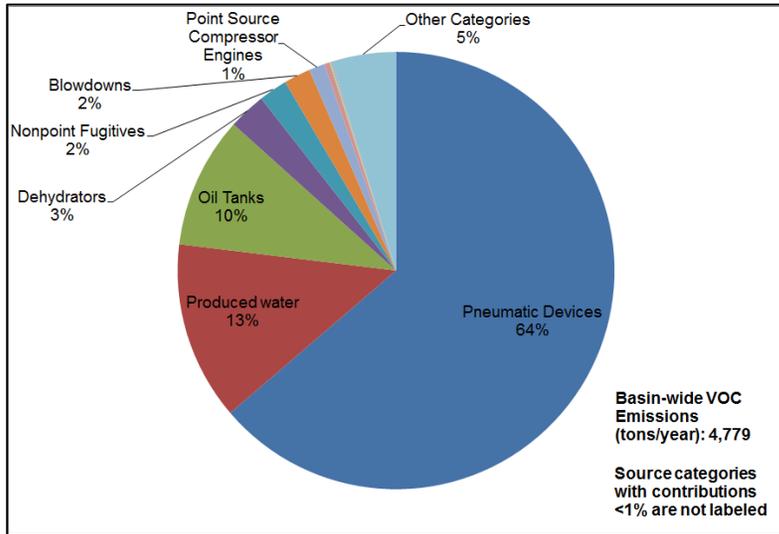


Figure 28. 2014 Sweet grass Arch Basin VOC emissions contributions by source category<sup>20</sup>.

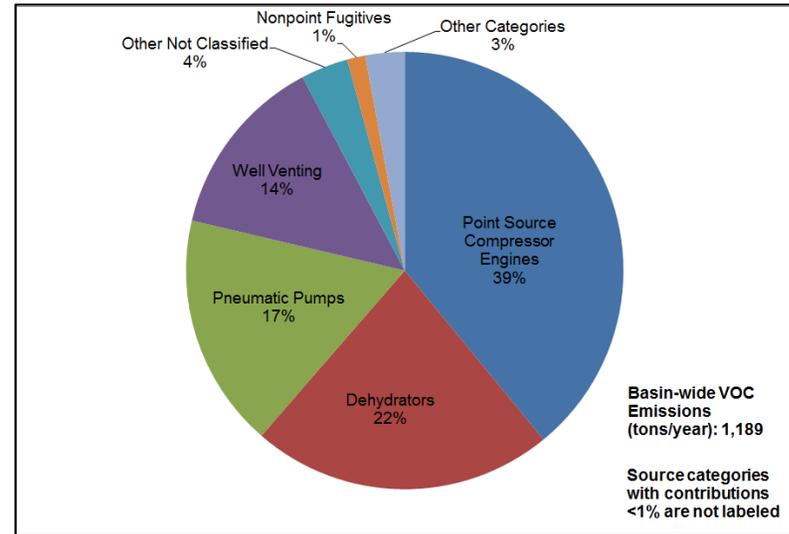


Figure 29. 2014 Raton Basin VOC emissions contributions by source category.

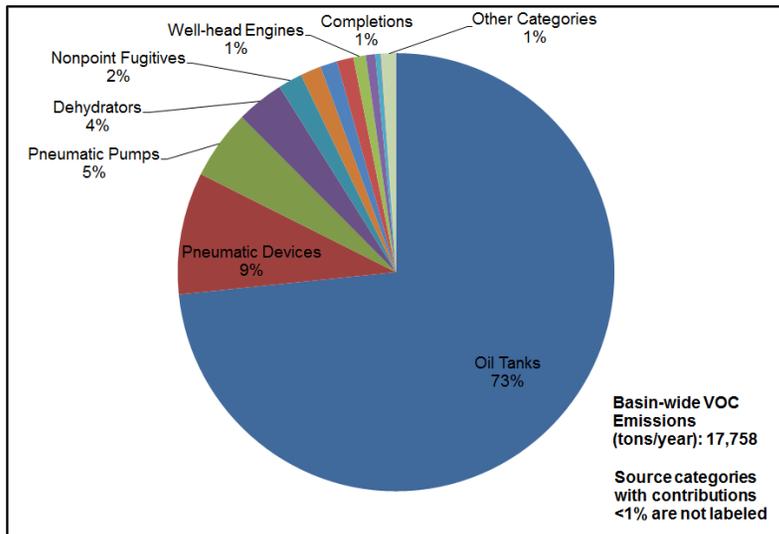


Figure 30. 2014 Paradox Basin VOC emissions contributions by source category.

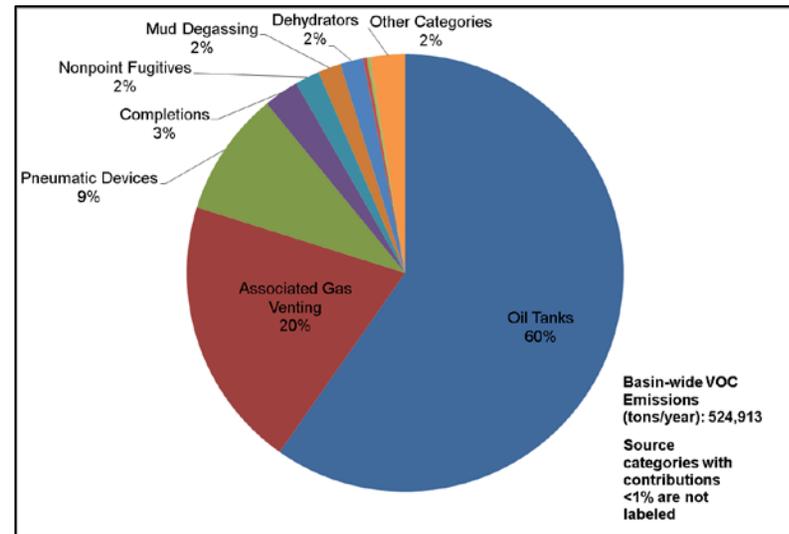


Figure 31. 2014 Williston Basin VOC emissions contributions by source category.

**APPENDIX A**

**O&G Activity Surrogate Used for Tribal Emissions**

**Table A-1. Summary of surrogates used to develop tribal emissions.**

SCC	Source	Surrogate
2310000220	Oil And Gas Exploration Drill Rigs	Total Spud Counts
2310000230	Oil & Gas Expl & Prod /All Processes /Workover Rigs	Total Well Counts
2310000330	Oil & Gas Expl & Prod /All Processes /Artificial Lift	Oil Well Liquid Production
2310000550	Produced Water	Total Gas Production
2310000660	Oil & Gas Expl & Prod /All Processes /Hydraulic Fracturing Engines	Total Spud Counts
2310010100	On-Shore Oil Production /Heater Treater	Oil Well Well Counts
2310010200	Oil & Gas Expl & Prod /Crude Petroleum /Oil Well Tanks - Flashing & Standing/Working/Breathing	Oil Well Liquid Production
2310010300	Oil Production Pneumatic Devices	Oil Well Well Counts
2310010800	Oil & Gas Expl & Prod /Crude Petroleum /Oil Well Truck Loading	Oil Well Liquid Production
2310011000	On Shore Crude Oil Production All Processes	Oil Well Gas Production
2310011020	On-Shore Oil Production /Storage Tanks: Crude Oil	Oil Well Liquid Production
2310011201	On-Shore Oil Production /Tank Truck/Railcar Loading: Crude Oil	Oil Well Liquid Production
2310011501	On-Shore Oil Production /Fugitives: Connectors	Oil Well Well Counts
2310011502	On-Shore Oil Production /Fugitives: Flanges	Oil Well Well Counts
2310011503	On-Shore Oil Production /Fugitives: Open Ended Lines	Oil Well Well Counts
2310011505	On-Shore Oil Production /Fugitives: Valves	Oil Well Well Counts
2310011506	On-Shore Oil Production /Fugitives: Other	Oil Well Well Counts
2310020600	Oil & Gas Expl & Prod /Natural Gas /Compressor Engines	Total Gas Production
2310021010	On-Shore Gas Production /Storage Tanks: Condensate	Gas Well Liquid Production
2310021011	On-Shore Gas Production / Condensate Tank Flaring	Gas Well Liquid Production
2310021030	On-Shore Gas Production /Tank Truck/Railcar Loading: Condensate	Gas Well Liquid Production
2310021100	On-Shore Gas Production /Gas Well Heaters	Gas Well Well Counts
2310021102	On-Shore Gas Production /Natural Gas Fired 2Cycle Lean Burn Compressor Engines 50 To 499 Hp	Gas Well Gas Production
2310021202	On-Shore Gas Production /Natural Gas Fired 4Cycle Lean Burn Compressor Engines 50 To 499 Hp	Gas Well Gas Production
2310021251	On-Shore Gas Production/Lateral Compressors 4 Cycle Lean Burn	Gas Well Gas Production
2310021300	On-Shore Gas Production Pneumatic Devices	Gas Well Well Counts
2310021302	On-Shore Gas Production /Natural Gas Fired 4Cycle Rich Burn Compressor Engines 50 To 499 Hp	Gas Well Gas Production

SCC	Source	Surrogate
2310021351	On-Shore Gas Production/Lateral Compressors 4 Cycle Rich Burn	Gas Well Gas Production
2310021400	On-Shore Gas Production Dehydrators	Gas Well Gas Production
2310021411	On-Shore Gas Production / Gas Well Dehydrators - Flaring	Gas Well Gas Production
2310021500	On-Shore Gas Production /Gas Well Completion - Flaring	Gas Well Spud Counts
2310021501	On-Shore Gas Production /Fugitives: Connectors	Gas Well Well Counts
2310021502	On-Shore Gas Production /Fugitives: Flanges	Gas Well Well Counts
2310021503	On-Shore Gas Production /Fugitives: Open Ended Lines	Gas Well Well Counts
2310021505	On-Shore Gas Production /Fugitives: Valves	Gas Well Well Counts
2310021506	On-Shore Gas Production /Fugitives: Other	Gas Well Well Counts
2310021601	On-Shore Gas Production / Gas Well Venting - Initial Completions	Gas Well Spud Counts
2310021602	On-Shore Gas Production / Gas Well Venting - Recompletions	Gas Well Well Counts
2310021603	On-Shore Gas Production / Gas Well Venting - Blowdowns	Gas Well Gas Production
2310021604	On-Shore Gas Production / Gas Well Venting - Compressor Startups	Gas Well Gas Production
2310021605	On-Shore Gas Production / Gas Well Venting - Compressor Shutdowns	Gas Well Gas Production
2310021700	On-Shore Gas Production / Miscellaneous Engines	Total Well Counts
2310023010	On-Shore Cbm Production /Storage Tanks: Condensate	CBM Well Liquid Production
2310023030	On-Shore Cbm Production /Tank Truck/Railcar Loading: Condensate	CBM Well Liquid Production
2310023100	On-Shore Cbm Production /Cbm Well Heaters	CBM Well Well Counts
2310023102	On-Shore Cbm Production /Cbm Fired 2Cycle Lean Burn Compressor Engines 50 To 499 Hp	CBM Well Gas Production
2310023202	On-Shore Cbm Production /Cbm Fired 4Cycle Lean Burn Compressor Engines 50 To 499 Hp	CBM Well Gas Production
2310023251	On-Shore Cbm Production/Lateral Compressors 4 Cycle Lean Burn	CBM Well Gas Production
2310023300	On-Shore Cbm Production Pneumatic Devices	CBM Well Well Counts
2310023302	On-Shore Cbm Production /Cbm Fired 4Cycle Rich Burn Compressor Engines 50 To 499 Hp	CBM Well Gas Production
2310023310	Coal Bed Methane Ng / Pneumatic Pumps	CBM Well Well Counts
2310023351	On-Shore Cbm Production/Lateral Compressors 4 Cycle Rich Burn	CBM Well Gas Production
2310023400	Coal Bed Methane Ng / Dehydrators	CBM Well Gas Production
2310023511	On-Shore Cbm Production /Fugitives: Connectors	CBM Well Well Counts
2310023512	On-Shore Cbm Production /Fugitives: Flanges	CBM Well Well Counts
2310023513	On-Shore Cbm Production /Fugitives: Open Ended Lines	CBM Well Well Counts

SCC	Source	Surrogate
2310023515	On-Shore Cbm Production /Fugitives: Valves	CBM Well Well Counts
2310023516	On-Shore Cbm Production /Fugitives: Other	CBM Well Well Counts
2310023600	On-Shore Cbm Exploration: Cbm Well Completion: All Processes	CBM Well Spud Counts
2310023603	On-Shore Cbm Production / Cbm Well Venting - Blowdowns	CBM Well Gas Production
2310023606	On-Shore Cbm Exploration /Mud Degassing	CBM Well Gas Production
2310030401	Natural Gas Liquids / Gas Plant Truck Loading	Gas Well Liquid Production
2310111100	On-Shore Oil Exploration /Mud Degassing	Oil Well Gas Production
2310111401	On-Shore Oil Exploration /Oil Well Pneumatic Pumps	Oil Well Well Counts
2310111700	On-Shore Oil Exploration: Oil Well Completion: All Processes	Oil Well Spud Counts
2310121100	On-Shore Gas Exploration /Mud Degassing	Gas Well Gas Production
2310121401	On-Shore Gas Exploration: Gas Well Pneumatic Pumps	Gas Well Well Counts
2310121700	On-Shore Gas Exploration: Gas Well Completion: All Processes	Gas Well Spud Counts