

November 10, 2015

## MEMORANDUM – draft for review

To: Tom Moore, WESTAR  
From: John Grant, Sue Kemball-Cook  
Subject: Permian Basin Oil and Gas Emissions for the Ozone Modeling Study for Southern New Mexico – Dona Ana County

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As part of the Ozone Modeling Study for Southern New Mexico – Dona Ana County, Ramboll Environ is tasked with developing an emission inventory for Permian Basin oil and gas (O&G) sources for a 2011 base year and 2020 future year. Available O&G emission inventories are described below and a recommendation is provided for the development of base and future year Permian Basin emission inventories.

### Available O&G Emission Inventories for the Permian Basin

#### BLM NMSO Study

Ramboll Environ is currently conducting an emission inventory analysis for the Permian Basin in New Mexico with the Western States Air Resources Council (WESTAR) with sponsorship from the US Bureau of Land Management (BLM) New Mexico State Office (NMSO)<sup>1</sup> to develop a base year 2014 Permian Basin emission inventory for the portion of the basin in New Mexico. The product of this work will be a comprehensive set of emission inventory inputs based upon which an area and point source O&G emission inventory for the Permian Basin in New Mexico will be developed. A future year inventory is expected to be developed as part of this study, but the future year has not yet been chosen. The base year for the BLM NMSO study (2014), the schedule (completion of the first project phase in late December 2014), and the 2011 baseline year selected for modeling in this Ozone Modeling Study for Southern New Mexico – Dona Ana County are obstacles to using BLM NMSO study data to develop a Permian Basin emission inventory for the Dona Ana County study.

#### TCEQ Emission Inventory

For the portion of the Permian Basin in Texas, the Texas Commission on Environmental Quality (TCEQ) has developed an O&G emission inventory for well site (or area) emission sources for base years 2011 and 2012 and a future year 2018.

The base year O&G emission inventory estimates are primarily based on ERG (2010a). ERG (2010a) includes emission estimation methodology for most well site sources and is based on a combination

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<sup>1</sup> <http://www.wrapair2.org/SanJuanPermian.aspx>

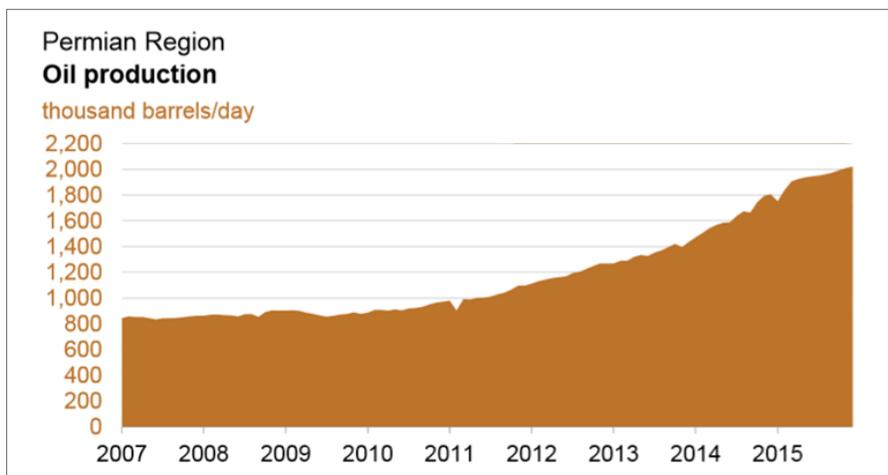
of data sources including Bar-Ilan et al. (2008) and other Texas specific studies. The TCEQ inventory methodology has been updated from ERG (2010a) for the following source categories:

- Condensate tanks (ERG, 2012)
- Heaters (ERG, 2013)
- Pneumatic Devices (TCEQ, 2014)
- Pneumatic Pumps (EPA, 2014)
- Drill rigs (ERG, 2011)

The TCEQ emission inventory forecast for the Permian Basin for 2018 is based on O&G activity growth factors from the Annual Energy Outlook (AEO) 2010 crude oil and natural gas forecasts for the Southwest oil and gas supply region which includes portions of Western Texas and Eastern New Mexico as shown in Figure 1. The ratio of 2018 to 2011 natural gas and crude oil production are 1.03 and 1.14, respectively; these growth factors are lower than more recent estimates presented below from the Environmental Protection Agency (EPA) 2011NEIv2-based Modeling Platform which are based on AEO 2014. AEO 2014 predicts sharper increases in oil and gas production for the Permian Basin consistent with accelerating O&G activity growth in the Permian Basin subsequent to the publishing of AEO 2010 in May 2010 (see Figure 2).



**Figure 1. Energy Information Administration (EIA) oil and gas supply module regions (source: EIA, 2010).**



**Figure 2. Permian Region 2007-2015 historical oil production (source: EIA, 2015).**

2011NEIv2-based Platform (2011v6.2)

The EPA’s 2011NEIv2-based Platform (EPA, 2015) was developed to support rulemaking analyses. Base year 2011 O&G emissions in the 2011NEIv2-based Platform are based on the 2011 National Emission Inventory (NEI). The 2011 NEI includes well site (area source) emissions provided by TCEQ for the portion of the Permian Basin in Texas; for the portion of the Permian Basin in New Mexico, the 2011 NEI well site emissions are based on EPA’s O&G Tool (EPA, 2014). The TCEQ well site emission inventory basis is described above. The O&G Tool emission inventory for New Mexico is based primarily on well site equipment and configurations from Bar-Ilan et al. (2008). O&G sector point source emissions in the 2011 NEI are based on state provided emissions.

The 2011NEIv2-based Platform includes forecast year emissions for 2017 and 2025. O&G activity growth estimates to future years are based on either play specific growth factors developed by EPA based on more highly resolved AEO 2014 forecasts of O&G activity or region-level growth factors based on region-level AEO 2014 forecasts. Figure 3 shows Permian Basin active O&G well locations circa-2014 in New Mexico and Texas. Figure 4 shows Permian Basin plays for which play specific growth factors have been developed by EPA; for Permian Basin counties outside of these plays region-level growth factors are used.

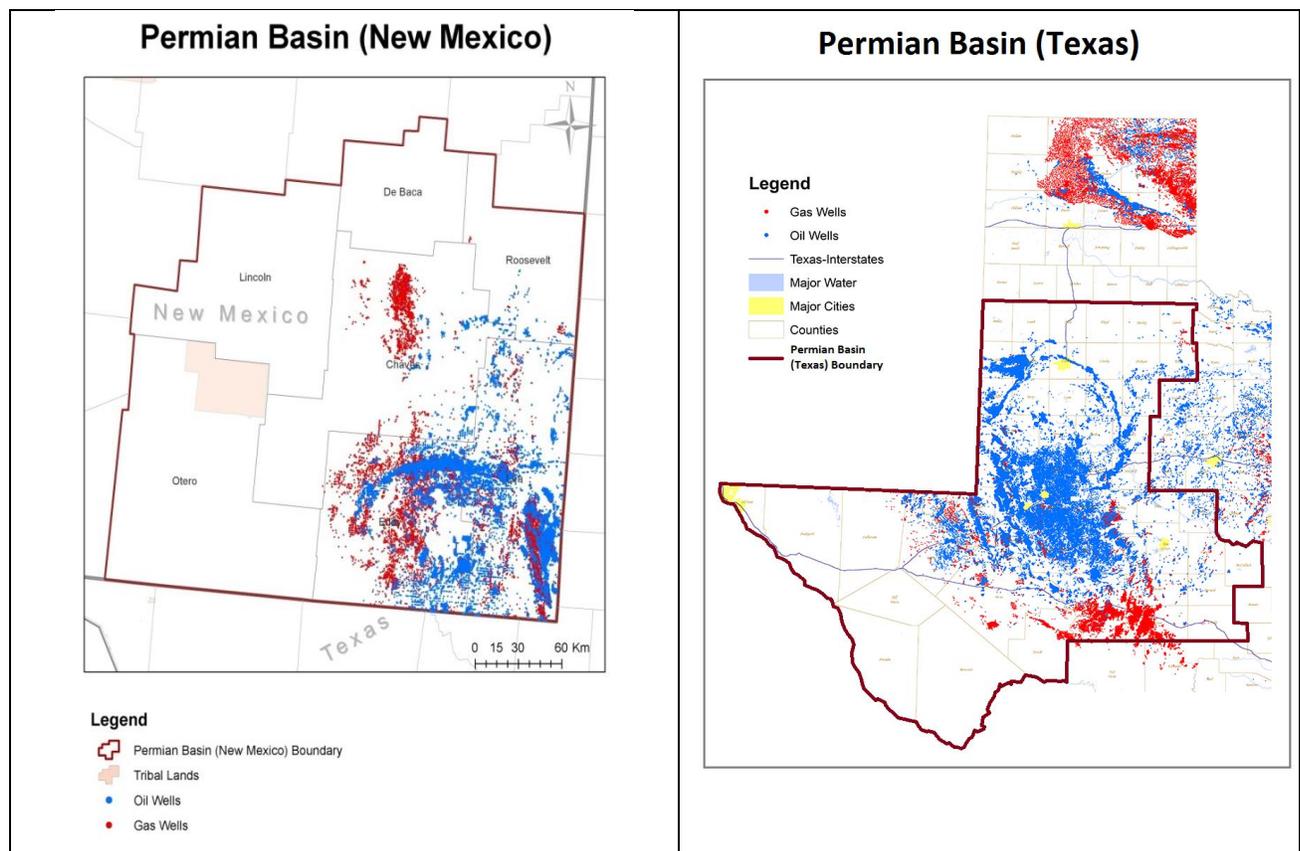
Table 1 shows growth factors applicable to the Permian Basin. The AEO 2014 forecasts were released in April 2014, when the Cushing, Oklahoma (OK) West Texas Intermediate (WTI) crude oil price was about \$100 per barrel. In August 2014, crude oil prices began to decline steeply and since November 2014 the Cushing, OK WTI crude oil price has remained between \$40 and \$60 per barrel<sup>2</sup>. The AEO 2015 forecast for the Cushing, OK WTI crude oil price for calendar year 2025 is 12% lower than the AEO 2014 estimate; AEO 2015 forecasts overall Southwest Region oil production to be 21% higher than the AEO 2014. While any oil and gas production forecasts are uncertain, the consistency

<sup>2</sup> Spot Prices for Crude Oil and Petroleum Products, [http://www.eia.gov/dnav/pet/PET\\_PRI\\_SPT\\_S1\\_M.htm](http://www.eia.gov/dnav/pet/PET_PRI_SPT_S1_M.htm)

in forecast crude oil production increases for the AEO 2014 and AEO 2015 indicate that the sharp increases in EPA’s forecasts based on the AEO 2014 are reasonable, even with marked decreases in crude oil prices since August 2014.

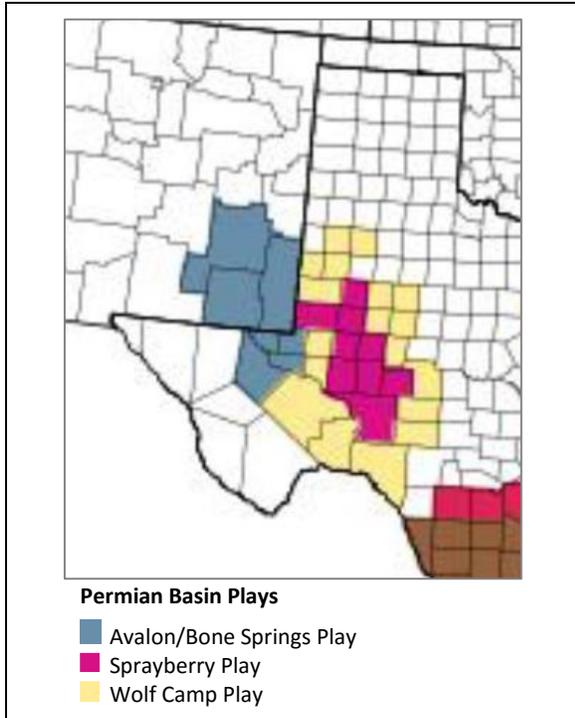
To develop forecast year emissions, EPA also considers the control effects of on-the-books regulations for the O&G sector (EPA, 2015). The control effects of the following rulemakings are considered in the 2011NEIv2-based Platform 2017 and 2018 forecasts:

- New Source Performance Standards (NSPS) Subpart OOOO (area and point sources)
- Reciprocating internal combustion engine (RICE) NSPS Subparts JJJJ and IIII and NESHAP Subpart ZZZZ (area and point sources)
- Industrial/Commercial/Institutional Boilers and Process Heaters Maximum Achievable Control Technology (MACT) Rule (point sources)
- Standards of Performance for Turbines 40 CFR Part 60 - Subpart KKKK (point sources)
- Process Heaters NSPS (point sources)



**Figure 3. Permian Basin (New Mexico) active O&G wells as of December 2014 (left panel, source: IHS Enerdeq) and Permian Basin (Texas) active O&G Wells as of January 2014 (right panel, adapted from TCEQ Texas Oil and Gas Wells Map<sup>3</sup>).**

<sup>3</sup> [http://www.tceq.state.tx.us/assets/public/implementation/barnett\\_shale/bs\\_images/txOilGasWells.png](http://www.tceq.state.tx.us/assets/public/implementation/barnett_shale/bs_images/txOilGasWells.png)



**Figure 4. Permian Basin plays from the 2011NEIv2-based Platform (excerpt from EPA (2015): Figure 4-1).**

**Table 1. Permian Basin O&G activity growth factors from the 2011NEIv2-based Platform (2011v6.2)<sup>a</sup>.**

Play / US Region	Oil Well Sources	Gas Well Sources	Oil and Gas Well Sources
<b>Ratio 2017:2011</b>			
<span style="color: pink;">■</span> Sprayberry Play	2.500	2.500	2.464
<span style="color: yellow;">■</span> Wolfcamp Play	2.500	2.500	2.500
<span style="color: blue;">■</span> Avalon/Bone Springs Play	1.886	1.908	1.525
<span style="color: gray;">■</span> Southwest Region	1.004	1.350	0.972
<b>Ratio 2025:2011</b>			
<span style="color: pink;">■</span> Sprayberry Play	2.500	2.500	2.500
<span style="color: yellow;">■</span> Wolfcamp Play	2.500	2.500	2.500
<span style="color: blue;">■</span> Avalon/Bone Springs Play	1.862	1.571	1.841
<span style="color: gray;">■</span> Southwest Region	1.448	1.384	1.006

<sup>a</sup> O&G sector growth factors were capped at 2.5 by EPA based on the concern that the uncertainty in O&G forecasts is too great to allow for growth over 150%.

## 2008 WestJumpAQMS

As part of the West-wide Jumpstart Air Quality Modeling Study (WestJumpAQMS), Ramboll Environ developed a Permian Basin O&G emission inventory for point and area sources for a base year 2008 (Bar-Ilan and Morris, 2013). The area source emission inventory relied exclusively on emission rate estimates from Bar-Ilan et al. (2008). The point source emission inventory was based on state agencies' permitted source emission estimates.

### **Recommendation**

We recommend that the Dona Ana study base and future year Permian Basin emission inventories be based on the 2011NElv2-based Platform (2011v6.2). The 2011NElv2-based Platform base year emission inventory is for 2011, consistent with the base year of the Dona Ana County study; it includes the 2011 TCEQ well site emission inventory for Texas, and is consistent with the latest available well site emission inventory inputs for the Permian Basin in New Mexico. 2011 base year emissions from the 2011NElv2-based Platform can be used as-is; 2020 future year emissions can be linearly interpolated between available 2017 and 2025 2011NElv2-based Platform emission inventories.

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