STATE OF NEW MEXICO
ENVIRONMENTAL IMPROVEMENT BOARD

IN THE MATTER OF PROPOSED NEW REGULATION,
20.2.50 NMAC – *Oil and Gas Sector – Ozone Precursor Pollutants* **No. EIB 21-27 (R)**

REBUTTAL TESTIMONY OF RALPH MORRIS

I am providing this rebuttal testimony in this proceeding on behalf of the New Mexico Environment Department ("Department" or "NMED") to address the direct testimony of New Mexico Oil and Gas Association ("NMOGA") witness Dennis McNally, and Independent Petroleum Association of New Mexico ("IPANM") witness Doug Blewitt.

I. Summary of My Direct Testimony

I provided direct testimony in support of the NMED proposed new air quality regulations at 20.2.50 NMAC ("Part 50") to control ozone precursor emissions from oil and gas ("O&G") sources in New Mexico. *See* Morris Direct at NMED Exhibit 106. My direct testimony addressed the potential ozone air quality impacts from the implementation of the emissions controls for ozone precursor emissions on New Mexico O&G sources due to NMED's proposed new air quality regulations. I used the Comprehensive Air-quality Model with extensions ("CAMx") photochemical grid model ("PGM") to simulate 2028 base case emission conditions and 2028 emissions conditions with the proposed NMED O&G ozone precursor regulations and post-processed the CAMx results to estimate the ozone concentration impacts of the proposed O&G ozone precursor regulations.

My direct testimony was based on the CAMx results for a 2014 base case, 2028 base case, 2028 New Mexico ("NM") oil and gas ("O&G") control strategy case and two 2028 NM O&G control strategy ozone source apportionment simulations that I performed as part of the NMED Ozone Attainment Initiative ("OAI") PGM modeling study ("NM OAI Study"). The modeling

results from the NM OAI Study are documented on a webpage[1] and in the NM OAI Study Air Quality Technical Support Document ("AQTSD").[2] My direct testimony was based on the results in the NM OAI Study AQTSD.

II. Rebuttal Testimony to Direct Testimony of NMOGA Witness Mr. Dennis McNally

II.1 Overview of Mr. McNally's Conclusions Regarding the Impact of the Proposed Rule

In his Direct Testimony, Mr. McNally concludes as follows:

> The ozone air quality benefits of the proposed rule are quite modest, and what impacts the rule does have are primarily the result of the NOx control measures. Additional controls on oil and gas VOC emissions are not an effective means of controlling ambient ozone levels in New Mexico, except for possibly in a very limited area in northeastern San Juan County.

McNally Direct at p. 3. Yet on the same page Mr. McNally states: "Ozone is formed by the complex interactions of VOC with NOx in the presence of sun light." *Id*.

Both VOC and NO_X concentrations in the presence of sunlight are required to form ozone concentrations, thus it is logical for an ozone mitigation strategy to include both VOC and NO_X emission controls. In fact, it is standard practice to include both VOC and NO_X control measures in ozone State Implementation Plans ("SIPs") even if controlling one precursor more efficiently reduces ozone concentrations than controlling the other precursor, as controlling both ozone precursors provides greater ozone reduction benefits than controlling just one precursor. For example, Colorado 2020 Regulation Number 7,[3] which was implemented to control ozone precursors from O&G sources within the Denver Metro/North Front Range ("DM/NFR") ozone nonattainment area ("NAA"), controls both VOC and NO_X emissions from O&G sources even though ozone formation within the O&G production areas in the DM/NFR NAA (e.g., Weld

[1] http://wrapair2.org/NMOAI.aspx
[2] http://wrapair2.org/pdf/NM_OAI_2028_AQTSD_v8.pdf
[3] https://drive.google.com/file/d/1sCtcjhhaexdE0_K-fvrFudgO0vMuYis_/view

County) is believed to be more NO_X sensitive than VOC sensitive. The 2016 Air Quality Management Plan ("AQMP") for the South Coast (Los Angeles) Air Basin uses the concept of NO_X "carrying capacities" as the "maximum allowable NO_X emissions to meet ozone standards," since they estimate that VOC controls cannot achieve ozone attainment and only through NO_X controls can ozone attainment be achieved. Yet the 2016 AQMP still includes control measures for VOC emissions even though ultimate attainment of the ozone NAAQS is obtained by reducing NO_X emissions to the "carrying capacity" (see page 5-9 of Chapter 5 of 2016 AQMP)[4].

As discussed in more detail below, Mr. McNally's comment that the "ozone air quality benefits of the proposed rule are quite modest" is because the contributions of total anthropogenic emissions from New Mexico to ozone concentrations in New Mexico is also modest. That fact does not absolve the Board of its obligation under the New Mexico Air Quality Control Act ("AQCA") to address elevated ozone levels when ozone concentrations are exceeding 95% of the NAAQS.

Finally, Mr. McNally's conclusion that "[a]dditional controls on oil and gas VOC emissions are not an effective means of controlling ambient ozone levels in New Mexico, except for possibly in a very limited area in northeastern San Juan County" fails to note that San Juan County is within the San Juan Basin O&G production area that is one of the two largest O&G basins in New Mexico, so will see some of the most ozone benefits from the VOC emission reductions in the NMED O&G ozone precursor control regulations.

II.2 Ozone Contributions due to Sources in New Mexico are Modest

Mr. McNally is correct in his observation that the modeling shows that implementation of Part 50 is likely to result in "modest" reductions in ozone concentrations, and that "[t]he vast

[4] https://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2016-air-quality-management-plan/final-2016-aqmp/chapter5.pdf?sfvrsn=4

majority of the ozone in NM is from emission sources outside of NM or from biogenic emissions within NM." McNally Direct at p. 11. Mr. McNally presents the 2014 New Mexico VOC emissions by source sector in Figure C of his direct testimony and notes that "71% of the VOC emissions are from biogenic emissions, 19% are from oil and gas, with the balance as fires and other manmade emissions." McNally, Direct, at p. 8. According to Mr. McNally, in 2014 New Mexico anthropogenic emissions represent 25% of the total VOC emissions with O&G VOC emissions contributing 19% of the total (anthropogenic and natural) New Mexico VOC emissions. Given that New Mexico anthropogenic emissions are the only emissions that the Board's regulations can address, according to Mr. McNally's analysis of the 2014 base case New Mexico emissions, O&G sources in New Mexico constitute approximately 76% (i.e., 19% of 25%) of the New Mexico anthropogenic VOC emissions. McNally Direct at p. 8, Figure B. Similarly, when just looking at New Mexico anthropogenic NO_X emissions that make up 73% of the total New Mexico NO_X emissions (i.e., eliminating NO_X emissions from biogenic, fires and lightning NO_X sources), New Mexico O&G NO_X emissions make up 33% of the total New Mexico 2014 anthropogenic emissions (i.e., 24% of 73%). McNally Direct at p. 9 Figure C. Thus, New Mexico O&G emissions represent significant portions of the New Mexico 2014 anthropogenic VOC and NO_X emissions that are the only emissions the Board has authority to control to reduce ozone concentrations. Furthermore, the NM O&G emissions are relatively unregulated compared to some of the other major source sectors. For example, emissions from on-road mobile sources, which also represent approximately 33% of the New Mexico 2014 anthropogenic NO_X emissions, are regulated by EPA and are projected to be greatly reduced (-72%) between 2014 and 2028. *See* Morris Direct at p. 19 Figure 3. Likewise, Electrical Generating Units ("EGUs") represent 19% of the New Mexico 2014 anthropogenic NO_X

emissions and they are also being reduced over time (-69% reduction between 2014 and 2028). *See id.*

Mr. McNally also examined my CAMx 2028 APCA source sector ozone source apportionment ("SA") modeling results for the 2028 NM O&G control strategy emissions scenario and summarized the contributions of emissions to the projected 2028 ozone design values ("DVs") at the monitoring sites in Table C and Figures D-F on pages 11-13 of his testimony. Mr. McNally separates the ozone contributions from New Mexico O&G emissions, other New Mexico manmade (i.e., anthropogenic) emissions, and non-New Mexico anthropogenic emissions plus natural emissions and concludes, correctly, that "[t]he vast majority of the ozone in NM is from emissions sources outside NM or from biogenic emissions within NM." McNally Direct at p. 11. Mr. McNally also correctly notes that:

> [t]he SA simulation was conducted using the controlled oil and gas emissions, so the contributions presented are after the proposed controls are applied. Due to the non-linearities in ozone formation it is not possible to directly estimate the ozone contributions before the controls are applied using the NMED supplied SA simulation.

McNally Direct at p. 11.

However, as confirmed in Mr. McNally's Table B, the ozone contributions due to 2028 base case New Mexico O&G emissions before the NMED O&G controls were applied were greater than after they were controlled, which indicates that Mr. McNally's Table C understates the NM O&G emissions contributions to ozone concentrations in the 2028 base case emissions scenario. Mr. McNally's Table C confirms that O&G sources are a significant component of New Mexico's anthropogenic emissions ozone contribution at sites in or near the San Juan Basin, contributing 50%, 48%, 55% and 33% of the total New Mexico anthropogenic emissions contribution at the four sites in San Juan and Rio Arriba Counties (e.g., at Navajo Lake 3.0 ppb due to O&G out of 5.5 ppb total anthropogenic, or 55%). McNally Direct at p. 11 Table C. For

the Permian Basin, New Mexico O&G sources contribute 50% and 71% of the total New Mexico anthropogenic emissions contribution at the Carlsbad (Eddy County) and Hobbs (Lea County) monitoring sites, respectively. McNally Direct at p. 12 Table C. Even at the Desert View monitor in the Doña Ana (Sunland Park) ozone nonattainment area, which is further away from the two O&G Basins in New Mexico, New Mexico O&G emissions comprise approximately 20% of the total New Mexico anthropogenic emissions contribution. McNally Direct at p. 12 Table C. This is ***after*** the proposed NMED O&G controls have been applied, so the New Mexico O&G ozone contributions would be even greater in the 2028 base case before the controls were applied.

II.3 Uncertainties in Mr. McNally's Separation of O&G Ozone Impacts due to O&G VOC and NO_X Emissions

In Table D on pages 14-15 of his direct testimony, Mr. McNally uses my CAMx 2028 APCA source sector ozone source apportionment modeling results to separate the contributions of O&G emissions for the 2028 O&G Control Strategy scenario into ozone contributions due to O&G VOC and NO_X emissions. There are several issues with this analysis that produce uncertainties in Mr. McNally's calculations of the O&G ozone contributions due to VOC emissions versus such contributions due to NO_X emissions. These uncertainties are difficult to quantify due to the following issues:

- The CAMx APCA source sector ozone source apportionment was performed after the 2028 base case O&G emissions were controlled. The 2028 base case O&G VOC emissions were reduced by over 100,000 tons per year (TPY) (~45%) and the 2028 O&G NO_X emissions were reduced by slightly less than 50,000 TPY (50%) in the 2028 O&G control strategy. This results in the ratio of New Mexico O&G VOC to NO_X emissions in the 2028 base case (approximately 2.1) being greater than the ratio of New Mexico O&G VOC to NO_X emissions in the 2028 O&G control strategy

(approximately 1.9). Consequently, the ratio of ozone due New Mexico O&G VOC emissions to ozone due to New Mexico O&G NO_X emissions is likely greater in the 2028 base case than 2028 O&G control case. Although ozone formation is nonlinear so this is not guaranteed.

- Mr. McNally claims he is able to separate the O&G ozone impacts into those impacts attributable to O&G VOC emissions and those attributable to NO_X emissions by post-processing my CAMx APCA source sector ozone source apportionment results. He claims that this is possible because "the CAMx source apportionment separately tracks ozone formed under NOx limited (sensitive to NOx emissions) and VOC limited (sensitive to VOC emissions) conditions." McNally Direct at p. 13-14. If the Ozone Source Apportionment Technology ("OSAT") version of the CAMx ozone source apportionment tool had been used in the ozone source apportionment modelling Mr. McNally analyzed, Mr. McNally's statement would be correct. However, the CAMx APCA source sector ozone source apportionment simulation used the Anthropogenic Precursor Culpability Assessment ("APCA") version of the CAMx source apportionment tool that overrides some of the NO_X and VOC sensitive conditions in allocating ozone formed to the source group VOC sensitive and NO_X sensitive ozone tracers, making Mr. McNally's O&G VOC and NO_X ozone assignments unreliable.
- Finally, Mr. McNally's projections of 2028 ozone design values at each site only analyzes the effects of the O&G VOC and NO_X emissions using the relative changes in the modeling results averaged over 10 days. This dilutes the effects of VOC sensitive ozone formation that is highest on a few days with many more days of

higher NO_X sensitive ozone formation conditions. In my Direct Testimony, and the Air Quality Technical Support Document ("AQTSD") for the NM OAI Study, in addition to analyzing the 2028 NM O&G control strategy results on projected 2028 ozone design values using the relative changes in ozone modelling results averaged over 10 days as McNally did, I also analyzed the 2028 NM O&G control strategy simulation effects on maximum daily average 8-hour ("MDA8") ozone concentrations using daily absolute modeling results. The absolute MDA8 ozone modeling results identified some days with higher VOC sensitive ozone formation conditions, especially within San Juan County in the San Juan O&G Basin. Morris Direct at . pp. 56-61. I conducted a CAMx 2028 O&G Control Strategy OSAT ozone source apportionment simulation that more accurately apportions ozone among VOC sensitive and NO_X sensitive conditions than the APCA ozone source apportionment modeling results that Mr. McNally analyzed in his Table D that identified days with higher VOC sensitive ozone conditions, especially in the San Juan O&G basin.

There is no question that the modeling indicates that ozone formation in New Mexico is more NO_X sensitive than VOC sensitive and it is likely true that a majority of the ozone benefits of Part 50 shown in the modeling are due to the NO_X emission reductions. But that does not mean there will be no ozone reduction benefits from VOC emission reductions, especially in the San Juan Basin where the OSAT modeling results indicate that ozone formation appears to be more sensitive to VOC emissions. The quantitative breakdown of ozone between O&G VOC and NO_X emissions provided in Mr. McNally's Table D has significant uncertainties as listed above.

II.4 Effects of Not Including NO_X Emission Increases due to O&G VOC Controls

As I discussed in my direct testimony, the effects of proposed Part 50 on the 2028 base case New Mexico O&G emissions were estimated in a control scenario developed by ERG under

separate contract with NMED. That control scenario was posted to NMED's website and should have been included with my direct testimony but was inadvertently left out. It is included here as NMED Rebuttal Exhibit 12. I offer no opinion on the accuracy of ERG's estimated emissions reductions from implementation of proposed Part 50 that were used as inputs in the modeling.

Mr. McNally offered the following opinion on the potential effects on the modeling results of NO_X emission increases due to VOC controls that may not have been included in the 2028 O&G control strategy emissions scenario:

> Not including the excess NOx emissions from the VOC controls would influence the impact of the proposed rule. The NMED SA simulation showed that 56,015 tpy of oil and gas NOx emissions had much more influence on ozone concentrations than 105,172 tpy of oil and gas VOC emissions. NOx emissions increases would reduce any ozone benefit from the VOC controls, and could worsen the ozone air quality.

McNally, Direct at p. 16.

Whether NO_X emission increases due to O&G VOC controls had any effect on the modeling results would depend on the magnitude of the NO_X emission increases. ERG compiled a spreadsheet estimating that the NO_X emissions increase due to some of the VOC controls (e.g., combustion of VOC emissions in flares) would result in increases in NO_X emissions of 67 TPY. This spreadsheet is attached as NMED Rebuttal Exhibit 13, and is a revised version of the control scenario, as discussed previously. I express no opinion regarding the accuracy of the 67 TPY NO_X emission increase ERG estimated due to certain VOC controls in the 2028 NM O&G control strategy.

Although ozone formation is nonlinear, to obtain a ballpark order of magnitude estimate of the ozone impacts of a 67 TPY increase in NO_X emissions, I compared it with the CAMx 2028 modeling results for the 2028 base case and 2028 New Mexico O&G control strategy and assumed a linear change of ozone as a function of NO_X emissions. This should be a conservative

estimate since it does not include the ozone reduction effects of the VOC emission reductions. Mr. McNally noted that there was a 46,296 TPY reduction in NO_X emissions between the 2028 base case and the 2028 NM O&G control case that produced a maximum -1.5 ppb reduction in the ozone design value at the Navajo Lake monitor. McNally Direct at p. 9-10. Thus, a 67 TPY increase in NO_X emissions would likely produce an order of 0.002 ppb increase in ozone [0.00217 = 1.5 x (67/46,296)]. Since both Mr. McNally and I have reported the ozone modeling results of the proposed O&G rule to the nearest tenth (0.1) of a ppb, and a 67 TPY increase in NO_X emissions is estimated to increase ozone by an order of a thousandth (0.001) of a ppb, a 67 TPY increase in NO_X emissions due to the VOC controls would have no material effect on the ozone modeling results. Even if the NO_X emissions increase was an order of magnitude higher than estimated by ERG (i.e., 670 TPY) the ozone increase would be on the order of a hundredth (0.01) of a ppb, and so would still have no material effect on the ozone modeling results.

III. Rebuttal Testimony to IPANM's Witness Mr. Doug Blewitt

III.1 Overview of Mr. Blewitt's Conclusions of the Impact of the Proposed Rule

Mr. Blewitt states his position on NMED's Proposal of 20.2.50.2 NMAC as follows:

> I believe it is premature to regulate NOx and VOC emissions from oil and gas facilities until NMED addresses the many technical issues and uncertainties associated with the modeling, baseline emission inventories associated with base case, and providing documentation regarding future year inventories that were used to predict future year impacts. Further, the way that the modeling was conducted, it is not possible to identify ozone benefits from NOx control compared to VOC controls. Combining results for NOx and VOC emissions precludes identification control benefits for NOx and VOCs resulting from non-linear ozone chemistry. If reductions in ozone are deemed necessary, control strategies should be developed on a regional basis (by county) to ensure that focused regional emissions will produce meaningful ozone reductions. Many of the ozone monitors have design values below the threshold level specified in the draft regulation and should be exempt from the installation of new controls.

Blewitt Direct at p. 5.

As discussed in more detail below, all photochemical modeling has uncertainties because the emissions, meteorological conditions, and transported pollutants used as inputs to the models have uncertainties. As noted by EPA in its ozone modeling guidance, "[b]y definition, models are simplistic approximations of complex phenomena." *See* NMED Exhibit 108 at p. 169. EPA goes on to list many of the uncertainties and explains how using the procedures in EPA's modeling guidance, which was followed in the NM OAI Study CAMx modeling of the proposed O&G rule, will reduce those uncertainties. NMOGA's modeling expert, Mr. McNally, stated that he "agree[s] with the general approach taken to examine the air quality impacts of the proposed rule." McNally Direct at p. 4. Mr. McNally also agreed with the NM OAI Study AQTSD conclusion that the model performance was as good or better than most recent photochemical modeling studies and "appears to be a reliable [photochemical grid model] modeling platform for evaluating emission reduction strategies for reducing ozone concentrations in New Mexico*." Id.* at p. 5.

Regarding Mr. Blewitt's assertion that the NM OAI Study AQTSD failed to document the 2028 future year emissions used, the AQTSD noted that the 2028 emissions were based on the WRAP-WAQS 2028OTBa2 emissions inventory used in the western states Regional Haze SIPs, whose derivation and documentation are contained in numerous reports/studies/webpages cited in the NM OAI Study AQTSD that Mr. Blewitt could have accessed and reviewed for details on how the 2028 future year emissions were developed, as discussed below.

Regarding Mr. Blewit's comment that "the way that the modeling was conducted, it is not possible to identify ozone benefits from NOx control compared to VOC controls" that is typically not done when analyzing emission control strategies for ozone. Many control measures obtain both VOC and NO_X emission reductions (e.g., reducing hours of operation), so obtaining

separate ozone reductions for the VOC versus NO_X emission reductions does not make sense since the reduction of just one of the ozone precursors in isolation is not possible for some control measures.

Regarding Mr. Blewitt's claims that it is premature to control O&G sources, controls should be developed on a regional (county) basis, and monitors with ozone design values below the threshold level should be exempt from the new controls, my understanding is that the AQCA requires the Board to adopt regulations to address elevated ozone levels when air quality is exceeding 95% of the ozone NAAQS. *See* NMSA 1978, § 74-3-5(C). In Slides 4 and 6 of IPANM Exhibit 8, Mr. Blewitt shows that observed ozone design values at the three San Juan County monitoring sites exceed 95% of the 70 ppb 2015 NAAQS and the most recent ozone design values at the monitoring sites in Eddy and Lea Counties in the Permian Basin exceed the 2015 ozone NAAQS, and the Carlsbad (Eddy County) 2017-2019 ozone design values even exceed the 75 ppb 2008 ozone NAAQS. Thus, the O&G sources in the San Juan and Permian Basins are in areas that would not be exempted from Part 50 even if monitoring sites below 95% of the NAAQS threshold were exempted.

III.2 A Majority of the Ozone in New Mexico Comes from Sources Outside of New Mexico

As discussed in my Section III.2 above regarding Mr. McNally's Direct Testimony, Mr. Blewitt also observes that most of the ozone in New Mexico is due to sources from outside of New Mexico:

> I have concluded that the majority of ozone detected within New Mexico is transported from sources located outside of the boundaries of the state. The State of New Mexico has no regulatory authority to regulate ozone reductions beyond its borders. New Mexico is not the only state facing this issue, as other states have similar ozone-compliance issues with the NAAQS. As control strategies for those areas and regions are developed, ozone transport into New Mexico will be reduced.

Blewitt Direct at p. 7; *see also* IPANM Exhibit 8, Slide 7.

As Mr. Blewitt notes, New Mexico has no regulatory authority to control emissions outside of New Mexico; the Board only has authority to regulate anthropogenic emissions within New Mexico.

Given that the contribution of New Mexico anthropogenic emissions is a small component of ozone in New Mexico, it is not surprising that the New Mexico O&G control strategy results in small reductions in ozone concentrations. But ozone attainment control plans tend to be made up of numerous control measures, any one of which may only result in a small reduction in ozone concentrations. Mr. Blewitt discusses this, and notes that:

> [F]or the 2028 base case, all monitors are below the 70 ppb ozone NAAQS except Carlsbad. The 2028 control base case reduces the design value from 73.7 ppb to 71.2 ppb (reduction of 2.5 ppb). The implementation of the Oil and Gas control strategy (NOx and VOC combined) reduces the design value to 70.9 ppb (a reduction of 0.3 ppb). The modeling demonstrates that the Oil and Gas control strategy is ineffective in reducing ozone at this monitor.

Blewitt Direct at p. 9.

In this case, the emission reductions from Part 50 are sufficient to reduce the projected 2028 ozone design value at the Carlsbad monitor from above (71.2 ppb) to below (70.9 ppb) the 2015 ozone NAAQS. Mr. Blewitt's conclusion that the control strategy is "ineffective" does not align with the modeling showing that the O&G control strategy is sufficient to demonstrate attainment the 2015 ozone NAAQS under this scenario.

III.3 Emission Inventory Uncertainties

In his direct testimony, Mr. Blewitt claims that the NM OAI Study AQTSD lacks sufficient supporting data and documentation, stating as follows:

> The NMED TSD does not contain data regarding the derivation of the base case emissions inventory and results in insufficient data to verify the base case modeling. The 2028 future year base case provides no documentation for

> emissions calculations, emission growth (by source category), as well as assumptions regarding emission reductions that will be implemented as a result of new control requirements that are required by the proposed promulgated regulation of other programs, including regional haze.

Blewitt Direct at p. 9-10.

These criticisms of the NM OAI Study AQTSD are entirely unfounded. Chapter 4 of the NM OAI Study AQTSD, which Mr. Blewitt bases some of his Direct Testimony on, describes very clearly that the 2014 base case emissions were based on the WRAP 2014v2 inventory and the 2028 base case emissions were based on the WRAP 2028OTBa2 emissions inventory with updated 2028 New Mexico O&G emissions; the development of the 2028 NM O&G emissions is described in Section 4.3.1 of the AQTSD. The NM OAI Study AQTSD provides numerous links to documents and webpages that thoroughly document the development of the WRAP 2014v2 and 2028OTBa2 emission inventories. *See,* e.g., NM OAI Study AQTSD at p. 35.

Mr. Blewitt could have simply followed the links to the WRAP 2014v2 and 2028OTBa2 emissions documentation to locate the data and documentation necessary to understand the derivation of the 2014 and 2028 emission inventories. Mr. Blewitt's criticisms that controls from the new Regional Haze SIPs were not included is likewise entirely without basis, given that the 2021 Regional Haze SIPs for the western states are still under development, so the controls in them are not yet known.

Regarding the 2028 NM O&G emissions growth assumptions, Mr. Blewitt provides a review of the U.S. Bureau of Land Management's ("BLM") Farmington Mancos Resource Management Plan and Environmental Impact Statement ("Mancos RMP/EIS"). *See* IPANM Exhibit 9. Based on these documents, Mr. Blewitt states, without any explanation or justification, that "[t]he Mancos analysis is directly related to the New Mexico O3 Attainment Initiative Photochemical Modeling Study." Blewitt Direct at p. 10. The Mancos RMP/EIS O&G emissions

and air quality modeling was performed in the circa 2016 time frame and used 2025 O&G projections that were developed at that time. The NM OAI Study AQTSD clearly states that circa 2028 O&G growth assumptions were used that were provided by BLM in September 2020. *See* NM OAI Study AQTSD at p. 36. O&G growth forecasts undergo continuous updates and, given the fluctuation in the price of oil between 2016 and 2020, the forecasts also fluctuate. Thus, the Mancos review of circa 2016 O&G growth factors for 2025 is not relevant to the emissions used in the NM OAI study modeling using more recent 2028 O&G growth factors for 2028.

Citing discrepancies between the NM OAI Study AQTSD EGU NO_X emissions for 2014 and 2028 (NM OAI Study AQTSD, Tables 4-6 and 4-7), and what he reports as 2014 and 2028 EGU EIA NO_X emissions, Mr. Blewitt argues as follows:

> The TSD developed provides limited documentation on EGU sources included in the inventory, as well as information supporting the 2028 emission reductions. The Technical Support Document presents the following NOx emission data for EGUs: (a) EGU 2014 base case NOx emissions 43,071 t/yr; (b) EGU 2028 future year case NOx emissions 13,389 t/yr; (c) Difference -29,682 t/yr; (d) EGU 2014 EIA NOx emissions are listed as 60,158 t/yr; (e) difference between NOx modeling and EIA inventories is approximately 17,000 t/yr; (f) no documentation is provided regarding how the 2014 EGU inventory was developed and why it is vastly different than the 2014 EIA data, and (g) several EGU facilities have announced closure of coal-fired plants and the only statement made in the TSD is that Units 4 and 5 will continue to operate at the Four Corners Power Plant in 2028.

Blewitt Direct at p. 10.

As clearly stated in the NM OAI Study AQTSD, the 2014 and 2028 base case emissions were based on the WRAP 2014v2 and 2028OTBa2 emissions inventory. The WRAP 2014v2 emissions were based on the 2014NEIv2 that used 2014 Continuous Emissions Monitor ("CEM") measured NO_X emissions for major EGUs (> 25 MW). Mr. Blewitt does not provide a reference or link to the U.S. Energy Information Administration ("EIA") data he purports to use to compare with the NM OAI Study 2014 EGU emissions. Ramboll staff visited the EIA website

(https://www.eia.gov/electricity/data/emissions/) and found a spreadsheet ("emissions2014.xlsx") that includes a NOx tab with 5 columns of different 2014 EGU NO_X emissions by facility. We summed up the total EGU NO_X emissions for facilities in New Mexico for each of the 5 columns and the total New Mexico 2014 EGU NO_X emissions ranged from 41,655 TPY to 117,900 TPY, with Column P ["EIA Model Estimates of NOx Emissions (Tons)"] totaling 60,158 TPY, the same value as quoted by Mr. Blewitt. Thus, I suspect that Mr. Blewitt's reported discrepancies between the NM OAI Study reported 2014 EGU NO_X emissions and his EIA 2014 EGU emissions are primarily because the NM OAI Study used actual 2014 measured EGU NO_X emissions from CEM observations, while Mr. Blewitt used 2014 EIA modeled NO_X emissions data that is based on fuel consumption and an EIA model.

The same spreadsheet found on the EIA website contains NO_X emissions in Column S ["Selected NOx Emissions (tons)"] that are based on the observed hourly CEM NOx emissions, with a total for New Mexico EGUs of 45,916 TPY. This is very close (6.6% higher) to the 2014 EGU NO_X emissions in the NM OAI Study AQTSD (43,071 TPY). These differences are likely due to the fact that the EIA used raw CEM hourly NO_X emissions where maximum hourly NO_X emissions are included for hours with missing data to show compliance with emissions limits. For modeling purposes, Ramboll processed the hourly CEM emissions and replaced the maximum hourly emissions with typical average values for those hours for which the CEM data are missing. Thus, the small (6.6%) discrepancy between the EIA NM CEM and the AQTSD reported NM EGU NO_X emissions is likely due to the processing of the hourly CEM NO_X emissions for the missing hours.

The NM OAI Study 2028 EGU NO_X emissions for the western states, including New Mexico, were based on the WRAP EGU Analysis Project,[5] as clearly stated in the AQTSD. *See* NM OAI Study AQTSD at p. 35, note 31. If Mr. Blewitt had looked at the WRAP EGU Analysis Study webpage, he would have found all the documentation on the derivation of the 2028 EGU emissions and which EGUs were assumed to be closed in 2028.

Mr. Blewitt claims that:

> [f]or Oil and Gas emission inventories, documentation is lacking on the underlying assumptions used to formulate Oil and Gas emissions for the 2014 base, 2028 growth, and 2028 Oil and Gas control cases.

Blewitt Direct at p. 10-11.

This statement is untrue. As discussed previously and clearly stated in the AQTSD, Ramboll did not develop the estimated control strategy emissions reductions from the proposed Part 50 in the 2028 NM O&G emissions, so those estimates are not discussed in the AQTSD. The control strategy emissions reductions were developed by ERG so are addressed in the direct testimony of NMED witnesses Elizabeth Bisbey-Kuehn and Brian Palmer at NMED Exhibit 32. Mr. Blewitt also apparently failed to follow the citations to the WRAP 2014 emissions where the documentation for the WRAP 2014v2 O&G emissions are located on the WRAP Oil and Gas Working Group ("OGWG") webpage.[6] The OGWG webpage contains a final report on the 2014 baseline O&G emissions inventory for the WRAP region (including New Mexico).[7] Also on the WRAP OGWG webpage is a final report for the 2028 future year O&G emissions for the WRAP region that was used in the WRAP 2028OTBa2 emissions scenario.[8] The WRAP 2028OTBa2 O&G emissions were used in the NM OAI Study 2028 base case emissions scenario for all

[5] http://wrapair2.org/EGU.aspx
[6] http://wrapair2.org/OGWG.aspx
[7] http://wrapair2.org/pdf/WRAP_OGWG_Report_Baseline_17Sep2019.pdf
[8] http://wrapair2.org/pdf/WRAP_OGWG_2028_OTB_RevFinalReport_05March2020.pdf

WRAP states except New Mexico. The NM OAI Study developed the 2028 base case New Mexico O&G emissions with the growth factors by O&G activity provided in Table 4-4 of the NM OAI Study AQTSD. NM OAI Study AQTSD, at p. 38. These data were also repeated as Table 1 in my Direct Testimony. Morris Direct at p. 16.

Regarding the changes in NM O&G emissions between 2014 and 2028, Mr. Blewitt states as follows:

> For NOx emissions, there is approximately 34% increase in emissions between the 2014 base case and the 2028 growth case, while for VOCs, the difference between 2014 base case and the 2028 growth base case indicates a 42% decrease. It does not seem reasonable that there is a substantial growth in NOx sources while there is a simultaneous reduction in VOC emission from the same sources.

Blewitt Direct at p. 11.

It is unclear how Mr. Blewitt calculated the 34% increase and 42% decrease in NM O&G NO_X and VOC emissions, respectively, between the 2014 and 2028 base case emissions scenarios. The NM OAI Study AQTSD compares the 2014 and 2028 NM O&G NO_X and VOC emissions in Table 4-5, which occurs ***before*** the NM O&G emissions are processed by the SMOKE emissions model, and in Tables 4-6 and 4-7, which was derived from the CAMx-ready emission inputs ***after*** the NM O&G emissions are processed by SMOKE. *See* NM OAI Study AQTSD at p. 39-41. In Table 4-5 of the NM OAI Study AQTSD the NM O&G VOC and NO_X emissions are estimated to increase between 2014 and 2028 by, respectively, 29% and 15%. In Tables 4-6 and 4-7 the NM O&G VOC emissions are estimated to be -1% lower in 2028 than 2014, while the NM O&G NO_X emissions are estimated to increase by 38%. These differences are due to Table 4-5 being annual emissions before being processed by SMOKE and Tables 4-6 and 4-7 being summer episode average emissions after being processed by SMOKE. The SMOKE emission model performs temporal adjustments, spatial disaggregation, and chemical speciation that can result in alterations of the annual emissions. Because some O&G sources

don't have flat seasonal temporal profiles, the annualized episode average emissions in Tables 4-6 and 4-7 will not match the annual emissions in Table 4-5. The chemical speciation step in SMOKE will also alter the emissions and O&G ethane emissions are included in the O&G VOC emissions in Tables 4-6 and 4-7 after the chemical speciation step but not in Table 4-4 that occur before SMOKE processing.

III.4 Mr. Blewitt's Concluding Remarks

On the last two pages of Mr. Blewitt's Direct Testimony he has several concluding remarks, which I address in order as follows:

> **1.** "Thus, I conclude that the monitoring and modeling analysis presented in the TSD do not support the need for additional controls on Oil and Gas sources." Blewitt Direct at p. 13.

The technical facts of the monitoring and modeling analysis that I performed and other facts are as follows:

- The observed 2017-2019 ozone Design Values exceed 95% of the 2015 ozone NAAQS at all monitoring sites in New Mexico except Santa Fe. They exceed the 70 ppb 2015 ozone NAAQS at sites in the Permian Basin and Doña Ana County. *See* NM OAI Study AQTSD at p. 3, Table 1.
- The AQCA requires the Board to develop a plan to address elevated ozone levels when air quality is within 95% of the ozone NAAQS. My understanding is that NMED in this proceeding has brought before the Board a proposed plan, as well as proposed Part 50, in response to this statutory requirement.
- Doña Ana County (Sunland Park Area) is designated as a Marginal ozone nonattainment area (NAA) for the 2015 ozone NAAQS, with an attainment year of 2020 that it failed to achieve. Thus, the area may be redesignated as a Moderate

ozone NAA with a 2023 attainment year and an ozone SIP, with an ozone attainment emissions control plan, due by January 2023.

- Even after the implementation of Part 50, if adopted by the Board, the 2028 APCA source sector ozone source apportionment modeling shows that O&G emissions still have a large fraction of the New Mexico anthropogenic emissions contribution to the 2028 ozone design values: New Mexico O&G emissions constitute 33-55% of the total New Mexico anthropogenic emissions ozone contribution at sites in the San Juan Basin (San Juan and Rio Arriba Counties) (McNally Direct at p. 11, Table C); New Mexico O&G emissions constitute approximately 71% (Hobbs) and 50% (Carlsbad) of the total New Mexico anthropogenic emissions ozone contribution at the two sites in the Permian Basin (McNally Direct at p.12 Table C); and at the Desert View monitor in the Doña Ana ozone nonattainment area, emissions from New Mexico O&G emissions constitute approximately 20% of the New Mexico anthropogenic emissions ozone contribution (McNally Direct at p. 12 Table C).

2. "The emission inventories used in the modeling lack documentation for verification." Blewitt Direct at p. 13.

As noted in Section IV.3 above, the NM OAI Study used the WRAP 2014v2 and 2028OTBa2 emissions with updated 2028 New Mexico O&G emissions that are summarized in Chapter 4 of the NM OAI Study AQTSD, with the development of the 2028 NM O&G emissions documented in Section 4.3.1 in the NM OAI Study AQTSD. *See* NM OAI Study AQTSD at p. 36-39. As described in the NM OAI Study AQTSD, with numerous links to the documentation, the WRAP 2014v2 emissions were based on the 2014NEI[9] and 2028OTBa2

[9] https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-data

emissions are documented on the WRAP regional haze website[10] that includes the Regional Haze Planning Work Group webpage, a 2014 current year emissions webpage[11], webpages devoted to O&G[12], EGU[13] and fire[14] emissions with the Regional Technical Operations Work Group website[15] including run specification sheets[16,17] of which emissions went into the 2028OTBa2 emissions scenario.

> **3.** "The emission inventories for Oil and Gas do not include production decline and likely overstate actual emissions (this will likely affect cost effective control evaluations)." Blewitt Direct at p. 13.

The 2014 and 2028 O&G emissions did account for production decline. When estimating emissions for an individual well, it is expected that production-related emissions are highest as a well's production peaks, typically shortly after the well begins production, and then decrease thereafter (in the absence of interventions [e.g., refracturing] to increase a well's production later in its life). Over a collection of wells, such as a basin, the combination of new wells being brought online and existing wells with declining production leads to overall oil and gas activity trends. The 2028 emission inventory estimates are based on overall basin-level O&G activity trends which implicitly account for additional production from new wells and production decline at existing wells.

> **4.** "The modeling strongly indicates ozone formation is NOx limited; however, modeling cannot separate the effectiveness of NOx versus VOC controls." Blewitt Direct at p. 13-14.

[10] http://wrapair2.org/RHPWG.aspx
[11] http://wrapair2.org/RHP_InvMod.aspx
[12] http://wrapair2.org/ogwg.aspx
[13] http://wrapair2.org/EGU.aspx
[14] http://wrapair2.org/fswg.aspx
[15] http://wrapair2.org/rtowg.aspx
[16] http://wrapair2.org/pdf/RepBase2%20and%202028OTBa2%20emission%20sector%20inputs.pdf
[17] https://views.cira.colostate.edu/docs/iwdw/platformdocs/WRAP_2014/EmissionsSpecifications_WRAP_RepBase2_and_2028OTBa2_RegionalHazeModelingScenarios_Sept30_2020.pdf

Mr. Blewitt is correct that the modeling indicates that ozone formation in New Mexico is more NO_X sensitive than VOC sensitive, which is not unexpected given the rural nature of most of New Mexico. This was addressed in the CAMx 2028 O&G control strategy OSAT ozone source apportionment modeling in Chapter 11 of the NM OAI Study AQTSD. *See* NM OAI Study AQTSD at p. 158-184. There is significant day-to-day variability in the level of NO_X sensitive versus VOC sensitive ozone, but on most days and locations there was more NO_X sensitive ozone formation than VOC sensitive ozone formation in New Mexico. The exception was in the northwest corner of New Mexico (e.g., San Juan County), where there was more VOC sensitive ozone formation than other areas of New Mexico, and on some days there was approximately equal amounts of NO_X and VOC sensitive ozone formation.

DRAFT MEMORANDUM

TO: Elizabeth Kuehn, NMED AQB
FROM: Mike Pring, Eastern Research Group, Inc. (ERG)
Brian Palmer, ERG
Stephen Treimel, ERG
DATE: June 4, 2021
SUBJECT: Emissions Inventory Reductions

The purpose of this memorandum is to document the emission reductions estimated to result from the requirements of the draft Ozone Precursor Rule for Oil and Natural Gas Sector under consideration by the New Mexico Environment Department (NMED).[1] This analysis was prepared for NMED by ERG under Professional Services Contract number 2066740400006.

Tables 1 and 2 show the estimated emission reductions as a result of the draft rule for NOx and VOC, respectively.

Table 1. Estimated NOx Emission Reductions

Source Type	Rule Section	Pre-Rule NOx (tons/year)	Post-Rule NOx (tons/year)	NOx Reduction (tons/year)	NOx Reduction (%)
Engines and Turbines	113	82,011	64,512	17,500	21.3%
Compressor Seals	114	22	22	-	-
Equipment Leaks	116	958	958	-	-
Gas Well Liquids Unloading	117	-	-	-	-
Glycol Dehydrators	118	10,699	10,699	-	-
Heaters	119	3,182	2,674	508	16.0%
Hydrocarbon Liquids Transfers	120	3	3	-	-
Pig Launching and Receiving	121	-	-	-	-
Pneumatic Controllers and Pumps	122	1.5	1.5	-	-
Storage Tanks	123	886	886	-	-
	Total	**97,763**	**79,755**	**18,008**	**18.4%**

[1] Stakeholder Review Draft: 20.2.50 NMAC Oil and Gas Sector-Ozone Precursor Pollutants, accessed online at https://www.env.nm.gov/air-quality/wp-content/uploads/sites/2/2021/03/Proposed-Part-20.2.50-May-6-2021-Version.pdf

Table 2. Estimated VOC Emission Reductions

Source Type	Rule Section	Pre-Rule VOC (tons/year)	Post-Rule VOC (tons/year)	VOC Reduction (tons/year)	VOC Reduction (%)
Engines and Turbines	113	32,061	29,886	2,175	6.8%
Compressor Seals	114	13	6	6	51.3%
Equipment Leaks	116	26,025	6,475	19,550	75.1%
Gas Well Liquids Unloading	117	13,020	6,510	6,510	50.0%
Glycol Dehydrators	118	15,337	8,778	6,559	42.8%
Heaters	119	619	619	-	-
Hydrocarbon Liquids Transfers	120	11,681	1,542	10,139	86.8%
Pig Launching and Receiving	121	0.2	0.2	-	-
Pneumatic Controllers and Pumps	122	49,659	4,678	44,981	90.6%
Storage Tanks	123	54,424	31,429	22,995	42.3%
	Total	**202,839**	**89,924**	**112,915**	**55.7%**

ERG estimated emission reductions based on a 2028 projected emissions inventory prepared by the Western Regional Air Partnership (WRAP).[2] The following emissions inventory files provided by WRAP were used in this analysis and served as the "pre-rule" inventory:

- NMED_OG_2028_NONPOINT_13Jan2021.xlsx
- NMED_OG_2028_POINT_13Jan2021.xlsx

These files contain emission estimates for nonpoint (area) and point sources, respectively, projected for the future year 2028. The pre-rule inventory accounts for expected reductions from other state and federal rules already in place, but does not consider the reductions expected as a result of the proposed NMED rule. Emission records contained in the inventory include information such as county, SCC, and pollutant (for nonpoint records) and facility name, SCC, county, and pollutant (for point source records).

Using available information on existing requirements (e.g. allowable permit limits or New Source Performance Standards requirements), existing control device data, and the proposed rule requirements, ERG estimated the percent reduction for each pollutant and SCC combination that would result from promulgation of the proposed rule.

For example, storage tank VOC emissions characterized in the nonpoint inventory under SCC 2310010200 (Oil Well Tanks - Flashing & Standing/Working/Breathing) would be reduced under the requirements in Section 123 of the draft rule, which requires storage tanks with VOC emissions between 2 and 10 tons per year to reduce emissions by 95%. Considering the

[2] Revised Final Report: 2028 Future Year Oil and Gas Emission Inventory for WESTAR-WRAP States - Scenario #1: Continuation of Historical Trends. Prepared by Ramboll US Corporation, March 2020.

fraction of tanks already controlled as well as the proposed rule requirements, ERG estimated that VOC emissions from storage tanks in the counties affected by the rule would be reduced by an additional 53.1% as a result of the proposed rule requirements.

Attachment A shows the pre and post-rule VOC and NOx emissions as well as total emission reduction estimates for nonpoint and point sources by SCC ("Nonpoint Reductions" and "Point Reductions" tabs), and by rule section ("Reduction Summaries" tab).

Attachments B and C show the estimated emission reductions for nonpoint and point sources, respectively, based on the estimated percent reductions calculated for each SCC and the pre-rule inventory files.