TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

March 31, 2014

Environmental Protection Agency
Air Docket
Mailcode: 2822T
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Re: Docket ID No. EPA-HQ-OAR-2013-0743

Dear Sir or Madam:

The Texas Commission on Environmental Quality (TCEQ) appreciates the opportunity to respond to the United States Environmental Protection Agency's (EPA) Notice of Availability of the EPA's 2011 Emissions Modeling Platform (78 FR 70935), published in the *Federal Register* on November 27, 2013.

Detailed comments on the draft modeling platform are enclosed. If there are any questions concerning the TCEQ's comments, please contact Mr. Steve Hagle, P.E., Deputy Director, Office of Air, at 512-239-1295 or steve.hagle@tceq.texas.gov.

Sincerely,

Richard A. Hyde, P.E.
Executive Director

cc: Guy Donaldson
EPA Region 6

COMMENTS BY THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY REGARDING THE 2011 EMISSIONS MODELING PLATFORM

DOCKET ID NO. EPA-HQ-OAR-2013-0743

I. Summary

On November 27, 2013, the United States Environmental Protection Agency (EPA) published in the *Federal Register* a Notice of Availability of the EPA's 2011 Emissions Modeling Platform (78 FR 70935). The Texas Commission on Environmental Quality (TCEQ) provides the following comments on this notice and the modeling platform.

II. Comments

The EPA should use state-submitted inventory and projection data where available.

The TCEQ has submitted information regarding Texas point and non-point growth factors and operational changes at point sources for use in projecting the 2011 National Emissions Inventory (NEI) to future years. The TCEQ submitted this information to provide the EPA better data to predict future emissions growth.

If the EPA makes changes to state-submitted emissions inventory data, the EPA should allow states the opportunity to review and comment on the changes.

When implementing national consistency for NEI projection values, the EPA should not select the most conservative assumptions to predict future emissions growth when more specific information is available.

The EPA should allow states to comment on the process that the EPA proposes to use to ensure national consistency for NEI projection values - particularly for emissions from source categories that have the greatest potential to impact regional transport. The EPA should identify whether the data submitted by all states for transport-related categories are based on equivalent assumptions or methodologies. For example, the EPA should explain which states are using emission factors or projections based on specific study data. The EPA should then make all states' data available for review in an easily accessible format, post its preferred approaches for review and comment, and allow states to provide comment on how the EPA will ensure that emissions data is consistent between states. The states' input should be considered in making the final selection of a method for projection from the NEI.

The EPA's release of the Technical Support Document (TSD) late in the comment period did not give states sufficient time to review it before the close of the comment period for the 2011 Modeling Platform.

The Notice states that the EPA will provide "…supporting data, and methods that are used to process the 2011 NEI and related data into a form that can be used for air quality modeling." The TCEQ appreciates EPA's efforts to release the TSD for review, but notes that since the TSD was not released until February 26, 2014, late in the comment period, review was necessarily limited. Many of the comments below stem from this initial limited review. If there are additional comments, the TCEQ will address those in its comments to EPA's 2018 Modeling Platform.

The EPA should formally acknowledge that 2011 is not representative of historical ozone formation for Texas and surrounding states because of the atypical meteorology (e.g., extreme temperatures) and related events (e.g., wildfires, exceptional drought), and that 2011 may not be conducive to good model performance.

In its August 15, 2013 presentation, "Development of 2011 Platform," the EPA states "Meteorology in summer of 2011 was not extreme in terms of being overly conducive or unconducive to photochemistry." The TCEQ disagrees with this assessment as it applies to Texas. In 2011, Texas experienced exceptional (beyond extreme) drought[1] conditions, affecting and being affected by record temperatures[2], soil moisture levels, crop losses, livestock losses, and record wildfires[3]. In fact, Texas had the warmest summer for any state in the nation going back to when instrument records began in 1895[4]. Oklahoma came in second, with both states exceeding records set during the infamous "Dust Bowl" of the 1930's. EPA's own surface air temperature anomaly map (August 15, 2013) notes that 2011 temperatures were nearly three degrees hotter than the 30-year mean in Texas and Oklahoma[5]. Data indicates 2011 was the most severe year for both the number and expanse of wildfires in Texas (see footnote 3). Emissions from the fires likely result in significant increases in particulate matter (PM) and ozone, and these increases likely affect the baseline modeling performance for Texas and other affected areas.

Drought and wildfires introduce many additional unknowns into modeling, which will prompt additional comments from states once the EPA's baseline 2011 modeling results are released. There has been significant research within the last decade studying the effects of drought stress on vegetation and biogenic emissions[6]. The biogenic emissions models and inputs are still being

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[1] Nielsen-Gammon, J.W., The 2011 Texas Drought: A Briefing Packet for the Texas Legislature, October 31, 2011: p. 27. Page 27 depicts the U.S. Drought Monitor for Texas showing that 88% of the state was classified as exceptional drought.

[2] Nielsen-Gammon, J.W., The 2011 Texas Drought: A Briefing Packet for the Texas Legislature, October 31, 2011: p. 3.

[3] Jones, J., et al, 2011 Texas Wildfires: Common Denominators of Home Destruction, Texas A&M Forest Service report, http://texasfirewise.org, p. 7, 16.

[4] Hoerling, M., A. Kumar, R. Dole, J. Nielson-Gammon, J. Eischeid, J. Perlwitz, X. Quan, T. Zhang, P. Pegion, and M. Chen, 2012: Anatomy of an Extreme Event. J. Climate. doi:10.1175/JCLI-D-12-00270.1, p.2.

[5] Corroborated by footnote 2.

[6] Selected references include:

Ormeno, E., et al., Water deficit stress induces different monoterpene and sesquiterpene emission changes in Mediterranean species. Relationship between terpene emissions and plant water potential. Chemosphere, 2007. 67(2): p. 276-284.

Pegoraro, E., et al., The effect of elevated atmospheric CO2 and drought on sources and sinks of isoprene in a temperate and tropical rainforest mesocosm. Global Change Biology, 2005. 11(8): p. 1234-1246.

Pegoraro, E., et al., Effect of drought on isoprene emission rates from leaves of Quercus virginiana Mill. Atmospheric Environment, 2004. 38(36): p. 6149-6156.

Penuelas, J., et al., Increase in isoprene and monoterpene emissions after re-watering of droughted Quercus ilex seedlings. Biologia Plantarum, 2009. 53(2): p. 351-354.

Rennenberg, H., et al., Physiological responses of forest trees to heat and drought. Plant Biology, 2006. 8(5): p. 556-571.

Brown, J. F., Wardlow, B. D., Tadesse, T., Hayes, M. J., and Reed, B. C. (2008). The Vegetation Drought Response Index (VegDRI): a new integrated approach for monitoring drought stress in vegetation.

updated to incorporate that research. Current peer-reviewed research is still not in agreement on what such prolonged drought does to the biogenic emissions (e.g., extent of vegetation mortality, tree canopy change, volatile organic compound (VOC) species emission change), nor exactly how soil moisture should be adjusted for the biogenic models and the meteorological models. For these reasons, the TCEQ has avoided modeling 2011 episodes. The TCEQ urges the EPA to acknowledge that the modeled meteorology (affected by exceptional temperatures, soil moisture, and land cover changes) and related events that affect emissions (e.g., wildfires, exceptional drought, unknown changes in biogenic emissions) for 2011 in Texas are not fully representative of historical ozone formation.

As a result, 2011 will likely result in poor model performance during the base case for Texas and similar areas. But, if the EPA somehow achieves acceptable performance for Texas, the potential for developing inappropriate control strategy requirements remains. Because 2011 represents such an exceptional drought year, there is great likelihood that any emissions reduction strategies based on that year will not be appropriate for more normal meteorological years. Similarly, the Midwest suffered extreme drought in 2012, and California suffered (and continued to suffer into early 2014) a drought of historic proportions in 2013. In fact, it is impossible to find a single "representative" year for the entire country; therefore, the EPA should model multiple years to form a rational basis for national rules such as the Transport Rule.

The EPA should be more specific about one of the procedures being proposed for creating temporal profiles for electric generating units (EGUs).

On page 54 of its TSD, EPA states that apart from the individual nitrogen dioxide, sulfur dioxide, and heat input temporal profiles, "an overall composite profile was also computed and was used in a few cases in which the fuel-specific profile was too irregular, or there were no CEMS units with the specific fuel in the region containing the unit." The EPA should provide more detail regarding the creation and use of these composite profiles specifically in cases where these composite profiles were used in the absence of CEMS data. Further details are necessary to support a rationale for why a particular composite is representative and appropriate for use in a specific situation. The EPA should also define the situation (associated values or characteristics) in which a fuel-specific profile is considered "too irregular."

The EPA should not rely solely on the Biogenic Emission Inventory System (BEIS) model results for biogenic emissions estimates.

The EPA should compare the Model of Emissions of Gases and Aerosols from Nature (MEGAN) model results to the BEIS results before drawing conclusions on estimates of biogenic impacts or before drawing conclusions of reduction strategies of anthropogenic precursors. In other words, it can make several parts per billion difference[7] on the results of precursor (nitrogen oxides, VOC, etc.) reduction strategies depending on which biogenic emissions model is being used. To quote one of the references of footnote 7, "Although it is difficult to determine which biogenic emissions estimates are more correct, the MEGAN v2.10 biogenic emission estimates have technical improvements over past inventories, particularly for the western states."

GIScience and Remote Sensing, 45(1), 16–46. doi:10.2747/1548-1603.45.1.16

Byun, H.-R., and Wilhite, D. A. (1999). Objective quantification of drought severity and duration. Journal of Climate, 12(9), 2747–2756.

[7] Blog discussion with several references at http://cgrer3dmodel.blogspot.com/2013/07/beis-vs-megan.html

The EPA should evaluate and share its justification for the use of BEIS over MEGAN. The TCEQ is not asking that both models (or various versions of both models) be used in all modeling runs, but the EPA should provide a sensitivity analysis for each area for which it may propose anthropogenic precursor emissions reductions. In other words, the EPA should be able to answer the question, how sensitive is the model's response to reductions of the precursors in a particular area to the choice of biogenic emissions model. If the results of sensitivity analyses demonstrate that MEGAN provides better model performance (when compared to monitors), then the EPA should use MEGAN instead of BEIS. The TCEQ recognizes that better performance may be difficult to quantify due to the large geographic area modeled and the lack of isoprene measurements, but if both models perform similarly, then the EPA should rely on MEGAN since it is being used by more scientists across the globe than is BEIS.

Of greater importance than the biogenic model choice for most of the nation is that the EPA should be sure to use the most recent land use and land cover (LULC) data, and it should use the most highly resolved data available. The TCEQ is willing to share its high resolution LULC data that has been updated recently for the eastern half of Texas.

The EPA should provide further information regarding the BEIS model and provide a comparison of BEIS output to isoprene measurements in order to gauge model performance.

The BEIS emissions PowerPoint presentation, referenced on page 34 of the TSD as a description of the model is not a description of the model. It is a comparison of BEIS 3.14 and MEGAN 2.04 output for 2003 using the SAPRC99 chemical mechanism. It offers very few details on the development, structure, inputs, outputs, and updates of BEIS. The EPA should provide actual references to the development of the model and updates to the model code. The EPA should also provide documentation of model validation studies, and its rationale for why the BEIS model is more appropriate than MEGAN 2.0, as discussed above.

Figure 2-4 on page 35 of the TSD represents the EPA's 2011 annual biogenic isoprene output from BEIS 3.14. The EPA should provide comparisons of BEIS output to isoprene measurements to gauge model performance. The TCEQ again suggests using MEGAN 2.10, which is documented and used by many in the global air quality modeling community.

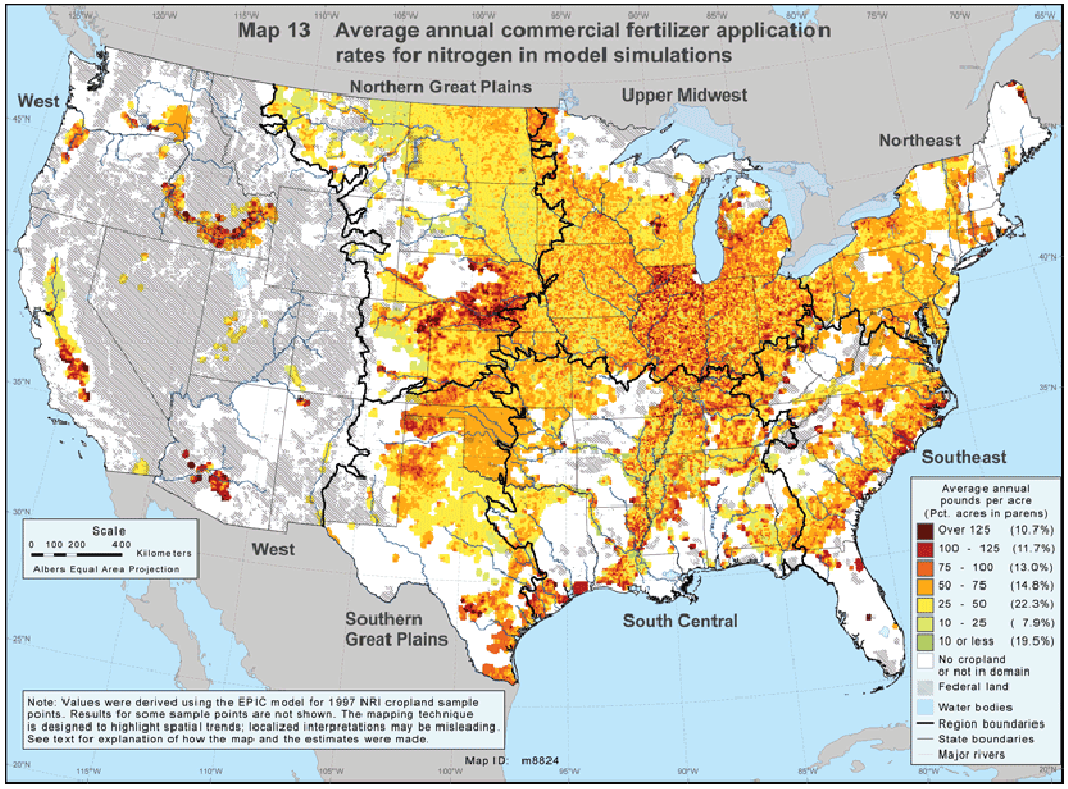
The EPA should verify that the biogenic nitrogen oxide (NO) emissions estimates from BEIS for portions of south Texas for 2011 are accurate.

Figure 2-3 on page 35 of the TSD represents the 2011 annual NO emissions output from BEIS 3.14. The TCEQ believes the BEIS-predicted NO total for south Texas areas are too high, are not based on fact, and have not been compared to NO monitored measurements to gauge model performance. The TCEQ notes that the largest annual total biogenic NO emissions in the nation represented in Figure 2-3 on page 35 of the TSD occur in south Texas. These are immense estimates – larger in quantity than the agricultural areas in the cornbelt (across Iowa and Illinois). This is very difficult to believe. While there is a "winter garden" area in this general vicinity of Texas, the amount of NO for this area of south Texas appears to be overestimated. It is not clear why the EPA's modeling shows these high values of NO in this area, but TCEQ research indicates that it may be due to an overestimate of the amount of fertilizer applied to the soil, which is the major source of biogenic NO. The EPA has not supplied enough information in its TSD for the TCEQ to discern the source of the inputs that EPA used for these 2011 BEIS outputs.

Figure 1 shows that fertilizer application may be a source of the added nitrogen. However, additional research by the TCEQ does not offer support for the EPA's BEIS NO output. For example, the TCEQ reviewed data on the expense of fertilizer, lime, and soil conditioners used in the U.S., (found at

http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Ag_Atlas_Maps/Economics/Farm_Production_Expenses/07-M057-RGBDot1-largetext.pdf) and the use of nitrogen fertilizer in the U.S., (found at http://pubs.usgs.gov/wri/wri944176/fig6.gif).

Figure 1: Average Annual Commercial Fertilizer Application Rates for Nitrogen in Model Simulations



Source: http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_013373.pdf

The EPA should address how it is accounting for a season of exceptional wildfires and drought, and their aftereffects, in its biogenic emissions modeling.
Also note from above that the drought and wildfires that swept across portions of Texas in 2011 destroyed many millions of acres of biomass, including crops, forests and scrublands. The EPA should address how it is accounting for wildfires and drought in its biogenic emissions modeling. Without taking this information into account, biogenic VOC will be over-predicted, because BEIS will likely assume well-watered vegetation emitting at a rate tied to drought-induced high temperatures. Likewise, biogenic NO was much less than typically predicted by BEIS as well, because there were total crop failures in many parts of Texas, which affects the amount of fertilizer applied, and the soil moisture, which are crucial variables BEIS uses in determining soil NOx emissions. This will also be a concern as EPA uses these BEIS outputs for the 2018 future case, because it will certainly be outdated and inaccurate as the Texas drought has continued since 2011, and other states such as California have been experiencing record drought conditions post 2011.

The EPA should clarify and take specific public comment on certain other aspects of the modeling platform.
The EPA states that it will use "Oil and gas spatial surrogate updates for sources in the Northeast and western US." The EPA should clearly identify the geographic areas covered by these detailed spatial surrogates and should use surrogates provided by the states if available.

The EPA should provide states with the data and assumptions that went into the SMARTFIRE point source, day-specific files, so that states can check against their own state databases. Please clarify how the EPA is expecting to use this tool.

The EPA states that it is using detailed shipping lane emissions in the Great Lakes region. The EPA should provide the same amount of detail in its modeling of the Gulf of Mexico. The TCEQ is prepared to share its modeling files for Texas. If the EPA chooses not to use the TCEQ files, then the EPA should explain why it prefers the other data.

On page 39 of the TSD, the EPA discusses that the chemical mechanism it will use is CB05. The EPA should explain why it is not using the latest version of the carbon-bond mechanism. The EPA should consider using the CB6 chemical mechanism instead. It is generally accepted by the carbon-bond user community that the initial version of CB6 provided over-estimation of model-predicted ozone, but when the TCEQ compared modeling that used the recently-available CB6r2 option now available in CAMx, we obtained better model performance than CB05.

The EPA should specify which state-specific detailed files it is using for modeling the Texas on-road and non-road mobile source categories and provide a list to the state for confirmation.

The EPA should retain the use of 12 kilometer grid cell cells for the entire CONUS (as it appears that it has proposed to do).

In section 2.4.2 of the TSD (starting on page 28), there are two typographical link errors ("Error! Not a valid bookmark self-reference") on pages 29 and 30, and one typographical punctuation error that was perhaps supposed to start the first full paragraph on page 29. At the bottom of Table 3-3 on page 40 of the TSD, a typographical error in note number 5, should perhaps read, "CAMx uses different particulate species names for…"