Major Source Modification Ammonia Threshold

Utah Division of Air Quality

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In order to determine an ammonia threshold for what is considered a major source modification, UDAQ added seven fictitious point sources of ammonia to Utah's point source emissions inventory. UDAQ used the CAMx 6.30 model with modeling parameters chosen as to best optimize model performance. A 2024 "baseline" emissions inventory was developed and used based on projections of 2014 NEI data. The year, 2024, was chosen as to consider the implementation time for a new major source modification. CAMx parameterization and model domain information is detailed in UDAQ's Model Performance Evaluation documentation for the 2017 Salt Lake Nonattainment Area Serious Daily $PM_{2.5}$ SIP.

In this document, we consider the ammonia threshold for the Salt Lake and Provo nonattainment areas in turn. For both nonattainment areas, differences in modeled 24-hour $PM_{2.5}$ between an ammonia-augmented point source inventory and baseline inventory were calculated. These differences in modeled 24-hour $PM_{2.5}$ were used to examine if 70 tons/year of ammonia was a reasonable threshold for a major source modification.

The stack parameters considered in the ammonia-augmented point source modeling scenario are listed in Table 1. An elevated stack height of 254 ft was considered for each fictitious ammonia point source emission. This stack parameter was copied from the second tallest stack in the Utah point source inventory. It is also assumed that each fictitious ammonia point source emits 70 tons/year of ammonia.

Meteorology for a modeled high-$PM_{2.5}$ episode was based on an early January, 2011 persistent cold pool episode. The day of the episode where $PM_{2.5}$ concentrations were observed (and simulated) to be the highest was January 7, 2011 (MDT). Therefore, differences between 24-hour $PM_{2.5}$ were analyzed for January 7 in both, Salt Lake and Provo, nonattainment areas.

Salt Lake Nonattainment Area

The maximum modeled 24-hour $PM_{2.5}$ difference in Salt Lake nonattainment area is 1.13 μgm^{-3} (Figure 1). The location of this maximum difference occurs in Salt Lake County, south of the three 24-hour $PM_{2.5}$ Federal Reference Method (FRM) monitors in Salt Lake County.

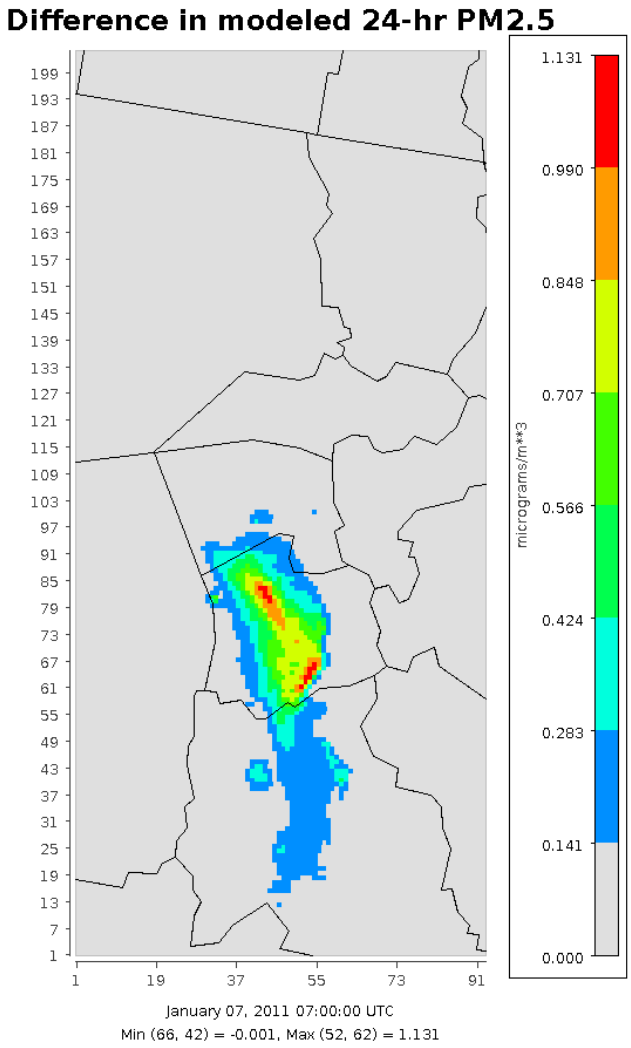

Figure 1: Difference in modeled 24-hour $PM_{2.5}$ between 2024 ammonia-augmented point source and 2024 Baseline runs for January 7, 2011 (MDT).

For this analysis, UDAQ placed three fictitious ammonia point sources in Salt Lake County. Each ammonia source emitted 70 tons/year of ammonia at a temporally constant rate (i.e., uniform emission rate across hour, day, and month). Please see Figure 2, below, for locations of all fictitious ammonia point sources in the UDAQ modeling domain. These hypothetical sources were strategically placed in industrialized areas.

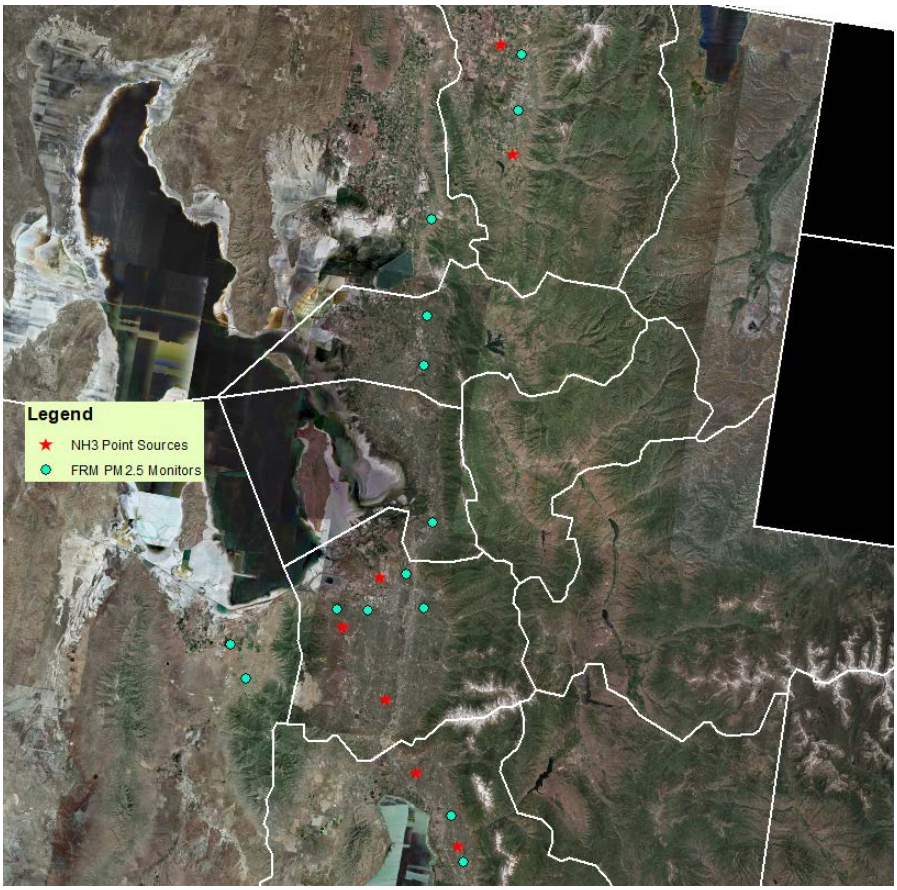

Figure 2: Red stars show location of fictitious ammonia point sources. There are three such sources placed in Salt Lake County and two sources are placed in Utah County. Blue dots show location of 24-hour $PM_{2.5}$ FRM monitors.

These three sources contributed 210 tons/year (70 tons/year/source x 3 sources) of ammonia to the Salt Lake nonattainment area. This contribution of 210 tons/year of ammonia leads to a maximum simulated increase in 24-hour $PM_{2.5}$ of 1.13 μgm^{-3} over the Salt Lake nonattainment area.

Stack height (ft)	254
Stack diameter (ft)	3
Exit temperature (F)	128
Exit velocity (ft/sec)	21.93
Flow rate (ft^3/sec)	155
Total emissions (tons/year)	70
Inventory	2024, projected from 2014 emissions

Table 1: Description of stack parameters and ammonia emission rate for the hypothetical ammonia point sources.

We assume an increase in ammonia emissions is deemed “significant” if that increase in ammonia emissions leads to an additional 1.3 μgm^{-3} or greater of simulated 24-hour $PM_{2.5}$. This threshold of 1.3 μgm^{-3} is the level identified in EPA’s Draft PM2.5 Precursor Demonstration Guidance[1] (November 17, 2016). The draft guidance speaks only to the determination of whether new major sources of any $PM_{2.5}$ precursor would be exempted from Nonattainment New Source Review requirements. The establishment of a significance threshold for modifications involving ammonia is not addressed.

A contribution of 210 tons/year (70 tons/year/source x 3 sources) of ammonia is therefore not significant since it leads to a maximum of 1.13 μgm^{-3} of additional 24-hour $PM_{2.5}$. We conclude then that an ammonia threshold of 70 tons/year is likely quite conservative for major source modifications in the Salt Lake nonattainment area.

Provo Nonattainment Area

UDAQ did an analysis for the Provo nonattainment area similar as that of the Salt Lake nonattainment area described in the preceding section. For the Provo nonattainment area, we added two fictitious ammonia point sources to urban Utah County (see Figure 2, above). The ammonia emission rates and stack parameters for each of the two fictitious ammonia point sources are the same as what was used in the Salt Lake nonattainment and are documented in Table 1 above. Together, the two sources contribute 140 tons/year (70 tons/year/source x 2 sources) of additional ammonia emissions to the Provo nonattainment area.

[1] https://www.epa.gov/sites/production/files/2016-11/documents/transmittal_memo_and_draft_pm25_precursor_demo_guidance_11_17_16.pdf

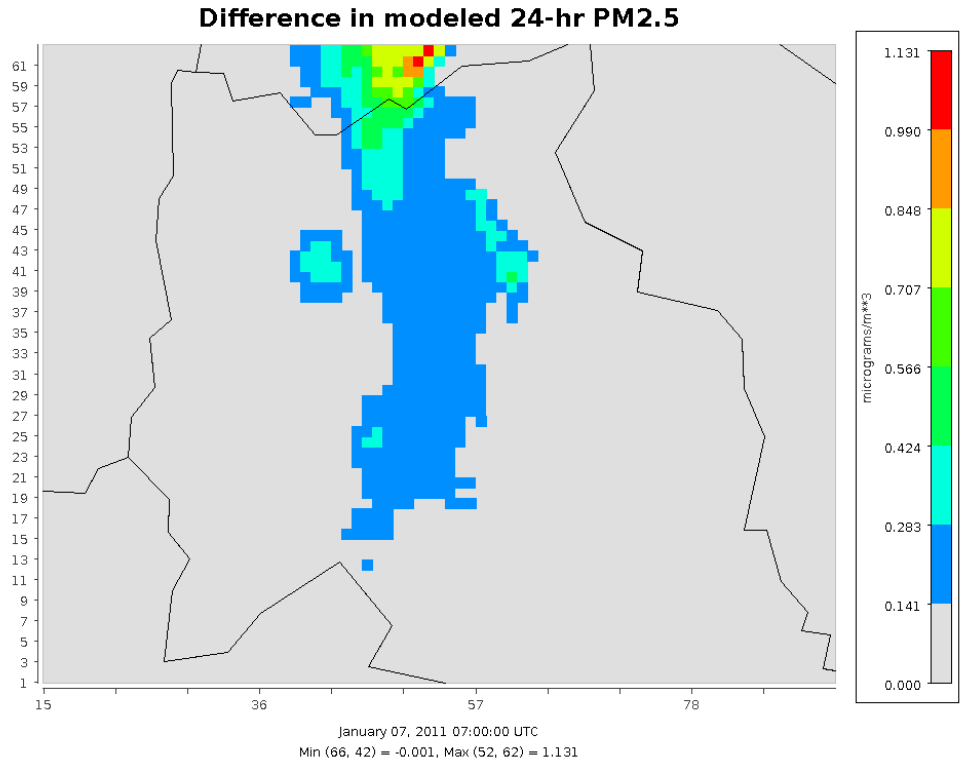

Figure 3: Difference in modeled 24-hour $PM_{2.5}$ between 2024 ammonia-augmented point source and 2024 Baseline runs for January 7, 2011 (MDT). Here, we zoom into the Provo nonattainment area.

For the Provo nonattainment area, the biggest differences in modeled 24-hour $PM_{2.5}$ were seen near the border between Salt Lake County and Utah County. These differences were, however, less than 1.3 μgm^{-3}. Since adding 140 tons/year of ammonia didn't produce a difference greater than 1.3 μgm^{-3}, we conclude that an ammonia threshold of 70 tons/year is likely quite conservative for major source modifications in the Provo nonattainment area.

Conclusion

For the Salt Lake and Provo nonattainment areas, we found that adding 210 and 140 tons/year of additional ammonia emissions, respectively, didn't lead to a difference in modeled 24-hour $PM_{2.5}$ greater than 1.3 μgm^{-3}. Therefore, we conclude that 70 tons/year is a reasonable threshold for the Salt Lake and Provo nonattainment areas.

Based on UDAQ's emissions inventories there are very few existing sources of ammonia in the PM2.5 nonattainment areas. Therefore, it remains very unlikely that the permitting office would see a modification resulting in a net emissions increase of ammonia that would approach even 20 tons/year.

Most ammonia additions are the result of NOx control resulting from selective catalytic reduction (SCR) applied to sources of combustion. Judging from similar sources, a 20 tons/year increase of ammonia would include a commensurate increase in NOx of roughly 350 tons/year. Such an increase would require offsetting for NOx, and since there are essentially no credits available to cover the permitting requirement, UDAQ would be unable to approve such an increase.