Revisiting Cache Valley Ambient Ammonia: Winter 2021/2022

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The importance of ambient ammonia (NH_3) to the formation of ammonium nitrate (NH_4NO_3)-dominated wintertime $PM_{2.5}$ in northern Utah has been well documented in recent years (e.g. UWFPS, 2017). As summarized by Martin and Baasandorj (2016), Cache Valley, in particular, has been well documented to have unusually elevated ambient concentrations of NH_3 when compared to the rest of the continental United States. Using various methodologies, studies have been conducted in 2002-2004, 2004/2005, 2006, 2016, and 2017 to assess and characterize the spatial and temporal distributions and particle-forming significance of Cache Valley's ambient NH_3. Additionally, many of these earlier studies precipitated the establishment of a Cache Valley site (and Salt Lake City) as part of the National Atmospheric Deposition Program's Ammonia Monitoring Network (NADP AMoN; Site UT01). Analysis of some of the above findings, particularly the UWFPS (2017), showed that the wintertime Cache Valley airshed was sufficiently NH_3-rich in regards to ultimate ammonium nitrate formation, were incorporated into state regulations (R307-403-1) declaring NH_3 was not a significant $PM_{2.5}$ precursor, thereby removing it from potential emission regulations in future State Implementation Plans (SIPs). The same finding was not supported for the Wasatch Front airsheds.

Starting in late December 2021 and continuing through early March 2022, a Picarro G2103 Cavity Ring-Down Spectroscopy (CRDS) system was used to measure ambient ammonia at two well-characterized, previous UDAQ monitoring locations: Logan (4620244 N, 430290 E) and Smithfield (4632671 N 429270 E). During the study period several inversion episodes were captured wherein the 24-hr $PM_{2.5}$ ranged up to >40 µg/m^3. Additional supporting pollutant and meteorological information has been obtained from UDAQ, as well as the Utah Environmental Observatory dataset (https//caas.usu.edu/weather), the latter of which provides information on vertical temperature structure, and thereby implied inversions, within the Cache Valley.

As expected, elevated NH_3 concentrations seem to correlate well with elevated $PM_{2.5}$ levels, with ambient NH_3 approaching 200 ppb during inversion periods. Examinations of these correlations, along with comparisons of potentially-related additional pollutant species and meteorological parameters will be presented. Further, these recent measurements will be compared and contrasted to the historical measurements.