May 9, 2019

Submitted Electronically

Mr. Mike Stoker
Regional Administrator
Region 9
U.S. Environmental Protection Agency
75 Hawthorne Street
San Francisco, California 94105

Dear Mr. Stoker:

The California Air Resources Board (CARB) is submitting to the United States Environmental Protection Agency (U.S. EPA) the San Joaquin Valley (Valley) *2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards* (2018 Plan) and the *2016 Moderate Area Plan for the 2012 PM2.5 Standard* (2016 Moderate Plan) as revisions to the California State Implementation Plan (SIP).

Together, the 2018 Plan and the 2016 Moderate Plan meet Clean Air Act requirements for four fine particulate matter (PM2.5) national ambient air quality standards (standards) in the Valley. The 2018 Plan demonstrates that the Valley will attain each of the four standards by the applicable Serious area deadlines. The 2016 Moderate Plan is the required prerequisite to the 2018 Plan that demonstrates that attainment of the 12 microgram per cubic meter ($\mu g/m^3$) annual standard is impracticable by the Moderate area deadline and requests that the Valley be reclassified as a Serious nonattainment area.

The San Joaquin Valley Air Pollution Control District (District) Board adopted the 2016 Moderate Plan on September 15, 2016, and the 2018 Plan on November 15, 2018. CARB adopted both SIPs on January 24, 2019.

This submittal consists of electronic copies of the following materials:

1. 2018 Plan;

2. 2016 Moderate Plan;

3. CARB SIP Completeness Checklists for:
    a. The 2018 Plan;
    b. The 2016 Moderate Plan;

4. CARB Resolution 19-1 adopting the 2018 Plan and 2016 Moderate Plan as revisions to the California SIP;

5. Public notice for the CARB January 24, 2019, public meeting to consider approval of the 2018 Plan and 2016 Moderate Plan;

6. Transcript for the CARB January 24, 2019, public meeting to consider approval of the 2018 Plan and 2016 Moderate Plan;

7. Comments log and written comments regarding the 2018 Plan and 2016 Moderate Plan received by CARB for the January 24, 2019, public meeting;

8. District submittal for the 2018 Plan, including:
    a. Public notice evidence for the District November 15, 2018, public meeting to consider approval of the 2018 Plan;
    b. District Resolution 18-11-16 adopting the 2018 Plan;
    c. Letter from the District to CARB transmitting the 2018 Plan to CARB for submittal to U.S. EPA as a revision to the California SIP; and

9. District submittal for the 2016 Moderate Plan, including:
    a. Public notice evidence for the District September 15, 2016, public meeting to consider approval of the 2016 Moderate Plan;
    b. District Resolution 16-9-10 adopting the 2016 Moderate Plan;
    c. Letter from the District to CARB transmitting the 2016 Moderate Plan to CARB for submittal to U.S. EPA as a revision to the California SIP.

At its October 25, 2018, meeting CARB adopted the *San Joaquin Valley Supplement to the 2016 State Strategy for the State Implementation Plan* (Valley State SIP Strategy). The Valley State SIP Strategy contains those elements necessary for the 2018 Plan that fall under CARB's authority to adopt and implement. CARB submitted the Valley State SIP Strategy along with all related documentation consistent with federal requirements to U.S. EPA on November 16, 2018. For completeness, CARB is incorporating by reference the Valley State SIP Strategy and related documentation in this submittal.

Motor Vehicle Emission Budgets

The 2018 Plan includes on-road motor vehicle emission budgets calculated using EMFAC2014. Upon U.S. EPA approval of EMFAC2017 anticipated in the second quarter of 2019, these budgets will be outdated and will need to be revised using EMFAC2017 prior to the expiration of the grace period established by U.S. EPA. CARB will submit updated budgets for the 2018 Plan to U.S. EPA by the fourth quarter of 2020. CARB requests therefore that U.S. EPA limit its approval of the budgets submitted today to last only until the effective date of future U.S. EPA adequacy findings for replacement budgets. (See 40 CFR 93.118(e)(1).)

Without the ability to replace the applicable motor vehicle emission budgets with submitted budgets found adequate using the budget adequacy process, the benefits of using the updated data may not be realized for a year or more after the SIPs are submitted, due to the SIP approval process. We appreciate U.S. EPA's willingness to work with CARB staff in our efforts to utilize motor vehicle emission budgets based on the most up-to-date, accurate data as soon as possible upon availability.

Past Submittals

The comprehensive 2018 Plan supersedes past submittals to U.S. EPA which the agency has not yet acted on for the 1997 and 2006 standards. Specifically, the portions of the 2018 Plan pertaining to the 1997 standard supersede all elements of the *2015 Plan for the 1997 PM2.5 Standard* (submitted by CARB on June 25, 2015), including motor vehicle emission budgets (submitted by CARB August 13, 2015). The portions of the 2018 Plan pertaining to the 2006 standard supersede all portions of the *2012 PM2.5 Plan* for the 2006 standard (submitted by CARB March 4, 2013) which do not pertain to Moderate area requirements.

Clarifying Information

Lastly, U.S. EPA has requested that CARB provide clarifying information regarding model sensitivity related to ammonia as a precursor to PM2.5 and controls to reduce ammonia emissions. CARB's response is provided in Attachment A to this letter.

CARB staff is committed to working with U.S. EPA staff to provide any additional clarifying information needed. If you have any questions, please contact Mr. Kurt Karperos, Deputy Executive Officer, at (916) 322-2739, or have your staff contact Dr. Michael Benjamin, Chief, Air Quality Planning and Science Division, at (916) 201-8968.

Sincerely,

Richard W. Corey
Executive Officer

Enclosures

cc: Ms. Elizabeth Adams, Acting Director
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Mr. Samir Sheikh
Executive Director / Air Pollution Control Officer
San Joaquin Valley Air Pollution Control District
1990 East Gettysburg Avenue
Fresno, California 93726

Mr. Kurt Karperos
Deputy Executive Officer

Dr. Michael T. Benjamin, Chief
Air Quality Planning and Science Division

Attachment A

Clarifying information for the San Joaquin Valley 2018 Plan regarding model sensitivity related to ammonia and ammonia controls

CARB is confident in the model and in the conclusions around ammonia sensitivity.

As early as the 1995 Integrated Modeling Study (IMS95), in situ measurements in the San Joaquin Valley (SJV) indicated the region was NH_3 saturated, which supports NO_x being the controlling precursor to ammonium nitrate formation (Kumar et al., 1998; Blanchard et al, 2000). Wintertime measurements five years later during the CRPAQS field study (December 1999 through February 2001) were consistent with the IMS95 findings, where nearly all of the measurements were NH_3 saturated (Lurmann et al., 2006). More recent measurements during the Discover-AQ field campaign in January and February 2013 (Parworth et al., 2017; and Figure 1), support previous findings of an NH_3 saturated environment, where a small to moderate reduction in NH_3 emissions is likely to have little to no effect on ammonium nitrate concentrations.

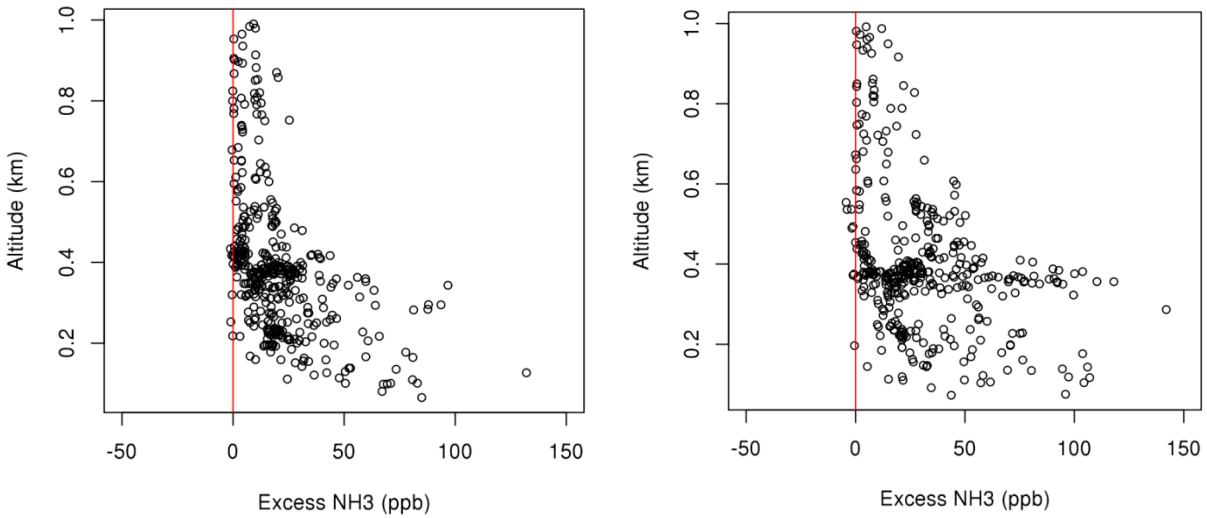

Figure 1. Excess NH_3 in the SJV on January 18, 2013 (left) and January 20, 2013 (right) based on NASA aircraft measurements, where excess NH_3 is calculated following Blanchard et al. (2000).

Between 2000 and 2013, anthropogenic NO_x emissions were estimated to have declined by over 50%, while NH_3 emissions declined by roughly 4% (Figure 2). By 2025 (not including emission reduction commitments from the 2018 PM2.5 SIP), anthropogenic NO_x emissions are estimated to decline by nearly 80% from 2000 levels, while NH_3 emissions are estimated to decrease by only 5% (Figure 2). The large NO_x reductions compared to relatively small NH_3 reductions means that the SJV has shifted (and will continue to shift) towards an even greater level of NH_3 saturation.

Modeling sensitivity results suggest that a 30% reduction in NH_3 emissions in 2013 is sufficient to have a non-trivial effect on ammonium nitrate levels, but by 2024, that same 30% reduction in NH_3 emissions has a negligible effect on ammonium nitrate levels. This is consistent with our understanding of how NH_3 reductions will affect ammonium nitrate formation in a NH_3 saturated environment and how that will change as the level of NH_3 saturation increases (as it does under the current projection of emissions from 2013 to 2024).

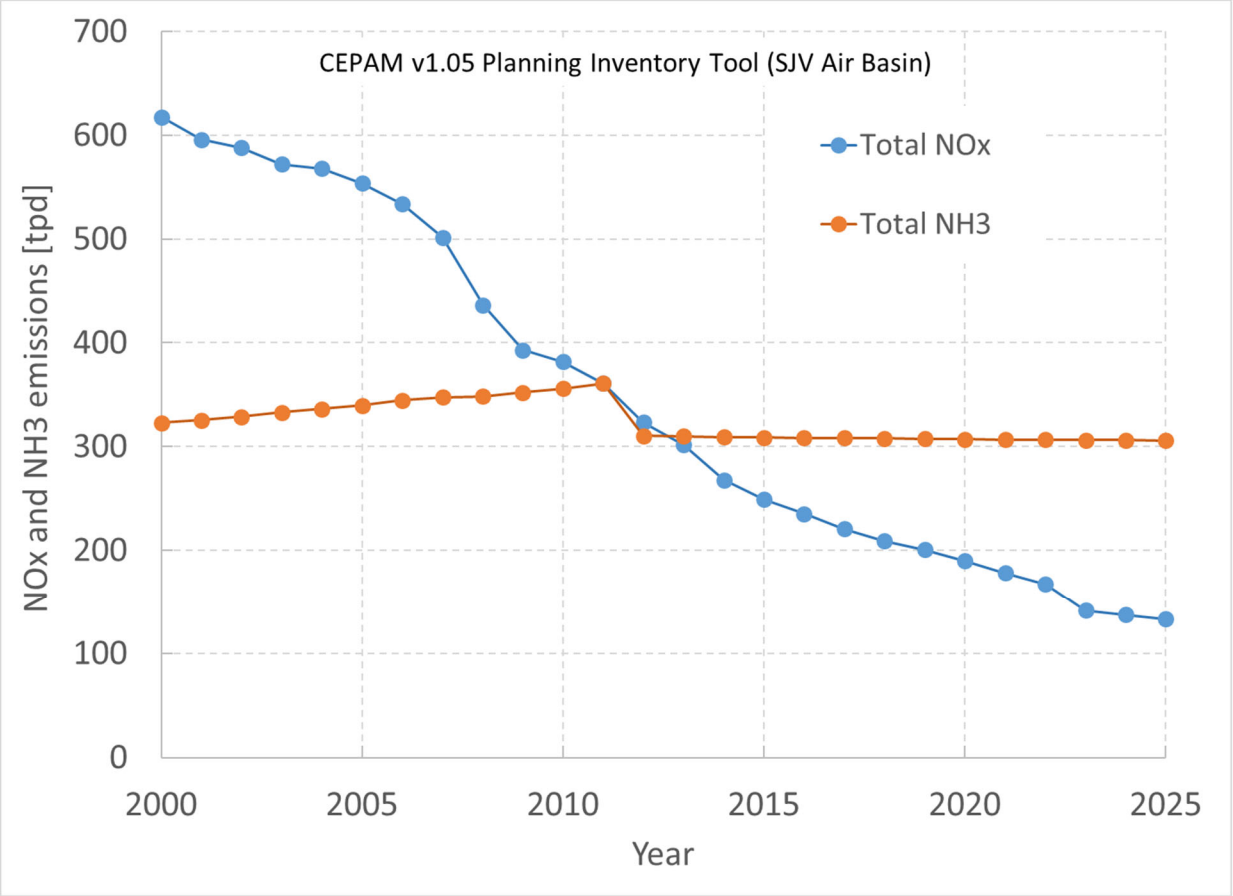

Figure 2. Trends in wintertime anthropogenic NO_x and NH_3 emissions in the SJV (CEPAM v1.05 Planning Inventory Tool).

Peak $PM_{2.5}$ levels throughout the SJV have been significantly reduced (in magnitude, as well as spatial extent and frequency of occurrence) since the early 2000's. However, the highest values affecting the $PM_{2.5}$ design value calculation are strongly influenced by meteorological conditions, and prolonged adverse meteorology, such as the recent drought, may keep the $PM_{2.5}$ design value higher than would have otherwise been expected.

Since the late 1990's, the $PM_{2.5}$ problem in the SJV has continued to improve, both spatially and temporally, with a reduction in the spatial extent of elevated $PM_{2.5}$ levels and in the number of days exceeding the $PM_{2.5}$ standard (Figure 3). Over the same time period, annual average $PM_{2.5}$ levels have steadily declined, along with the upper percentiles in daily average $PM_{2.5}$ concentration. Figure 4 shows the trend in 80^{th}, 85^{th}, 90^{th}, and 95^{th} percentile $PM_{2.5}$ concentration in Fresno for total $PM_{2.5}$, ammonium nitrate, and carbonaceous compounds based on measurement from the chemical speciation network. At all four percentiles and for each PM species, a steady reduction in $PM_{2.5}$ has been observed in Fresno since the early 2000's (similar trends were also observed in Bakersfield), so clearly the control strategy developed for the SJV has resulted in a reduction in $PM_{2.5}$ over time.

In contrast, over the same time period, peak $PM_{2.5}$ levels (98^{th} percentile), relevant to the design value calculation, did not show a steady decline (Figure 3). Instead, the peak $PM_{2.5}$ concentrations declined in the early 2000's, but then leveled off from around 2003 to 2011, before rising again to early 2000 levels and then dropping precipitously in 2015. The rise in 98^{th} percentile $PM_{2.5}$ levels from 2011 to 2015 coincides with the prolonged drought experienced in the SJV (particularly southern SJV) over the same time period (Figure 5). Peak $PM_{2.5}$ levels are particularly sensitive to meteorological conditions, both in terms of the formation and buildup of ammonium nitrate, as well as emission activity for sources such as residential wood combustion (RWC). Under conditions of prolonged drought, where stagnant conditions persist and rainfall is severely limited, peak $PM_{2.5}$ levels can remain high despite continued emission reductions. However, it is expected that as NO_x emissions continue to decline and as greater controls and/or restrictions on activity for direct $PM_{2.5}$ sources such as cooking and RWC are implemented, peak $PM_{2.5}$ will begin to decline despite the presence of unfavorable meteorology.

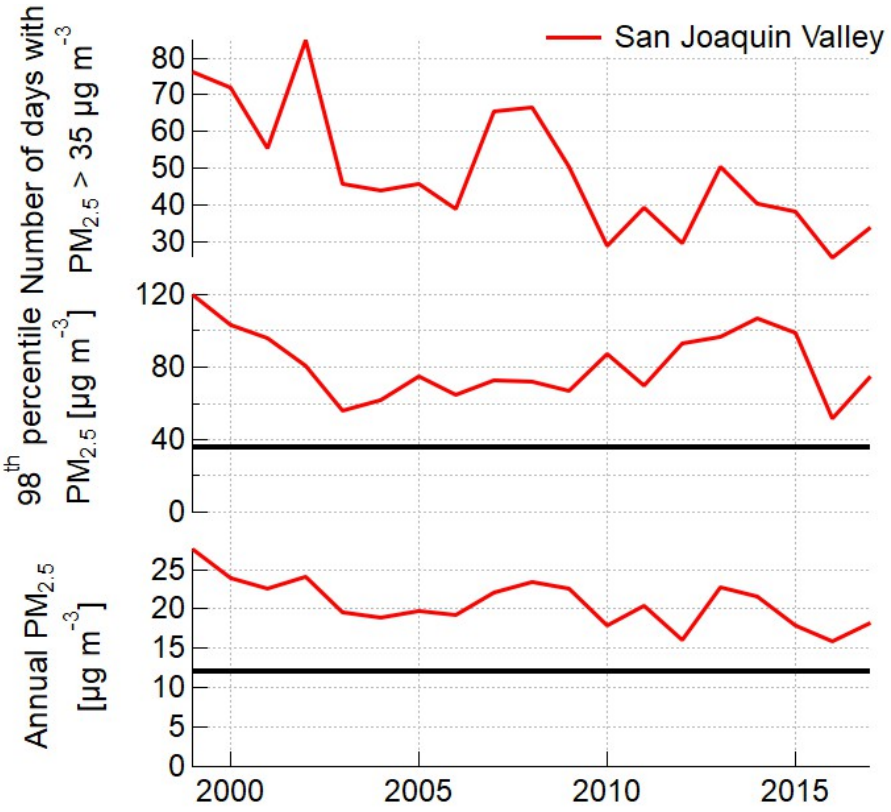

Figure 3. Trends in $PM_{2.5}$ mass and exceedances in the San Joaquin Valley.

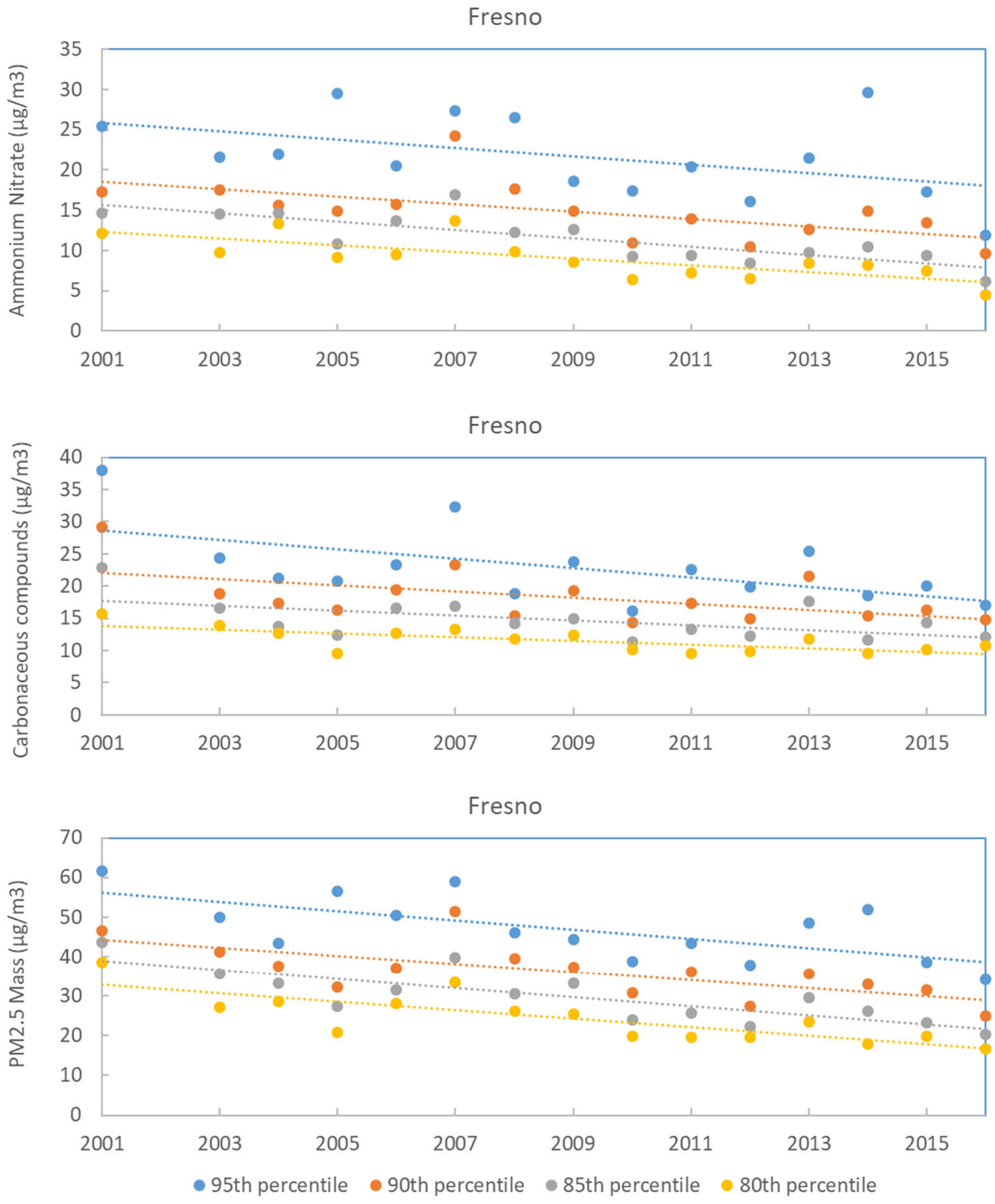

Figure 4. Trends in $PM_{2.5}$ ammonium nitrate (top), carbonaceous compounds (middle), and total mass (bottom) from 2001 to 2016 at the Fresno monitoring site.

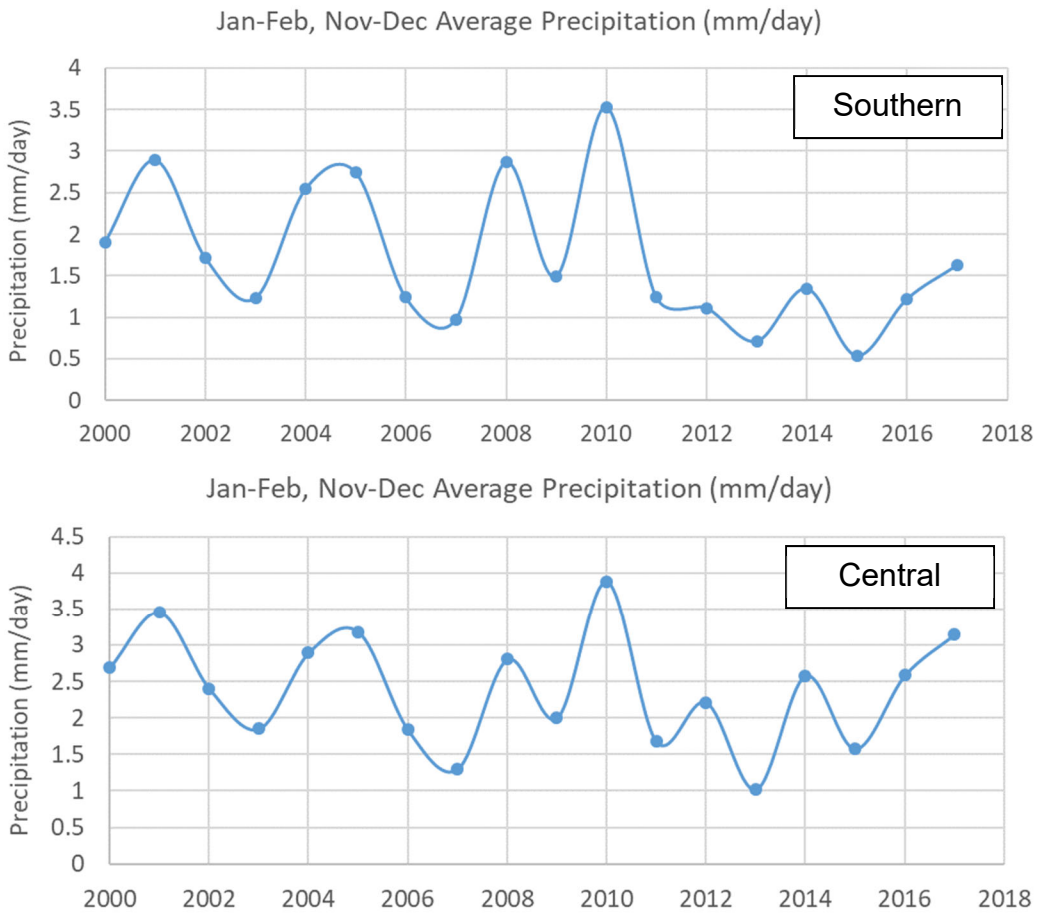

Figure 5. Precipitation trends in the Southern (top) and Central (bottom) SJV from the Global Precipitation Climatology Project (https://www.esrl.noaa.gov/psd/data/gridded/data.gpcp.html).

References

Blanchard, C.L.; Roth, P.M.; Tanenbaum, S.J.; Ziman, S.D.; Seinfeld, J.H. The Use of Ambient Measurements to Identify Which Precursor Species Limit Aerosol Nitrate Formation; *J. Air & Waste Manage. Assoc.* **2000**, *50,* 2073-2084.

Kumar, N.; Lurmann, F.W.; Pandis, S.; Ansari, A. *Analysis of Atmospheric Chemistry during 1995 Integrated Monitoring Study*; STI-997214-1791-FR; Report prepared for the San Joaquin Valleywide Air Pollution Study Agency, c/o the California Air Resources Board, Sacramento, CA, by Sonoma Technology, Inc.: Petaluma, CA, 1998.

Lurmann, F. W., S. G. Brown, M. C. McCarthy, and P. T. Roberts. Processes Influencing Secondary Aerosol Formation in the San Joaquin Valley during Winter; *J. Air & Waste Manage. Assoc.* 2006, 56, 1679-1693, https://doi.org/10.1080/10473289.2006.10464573

Parworth, C. L., D. E. Young, H. Kim, X. Zhang, C. D. Cappa, S. Collier, and Q. Zhang. Wintertime water-soluble aerosol composition and particle water content in Fresno, California, *J. Geophys. Res.*, 122, 3155-3170, doi:10.1002/2016JD026173

CARB is working to fill knowledge gaps on feasible and effective ammonia controls.

Development of effective air pollution mitigation strategies for ammonia requires additional spatiotemporal understanding of atmospheric ammonia emissions that are currently lacking as a result of limited data. CARB is conducting research, both in-house and with external partners, to characterize gaseous ammonia emissions from agricultural activities in the San Joaquin Valley. The results of these studies will help future development of CARB's ammonia emission inventory, State Implementation Plan, Short-Lived Climate Pollutant Reduction Strategy, and community air protection program (AB 617).

CARB's Research Division has developed a new mobile measurement platform equipped with a state-of-the-science ammonia analyzer and other advanced analytical instruments to improve the understanding of various ammonia sources in California. Last year (September and October 2018), CARB staff collaborated with researchers from the University of California, Davis, to quantify emissions from several dairies in the SJV as part of the ongoing projects funded by the California Department of Food and Agriculture, CARB, and industry. Methane, oxides of nitrogen, and other air pollutants and meteorological parameters were measured at or near dairies in addition to ammonia. The major objective is to evaluate the effectiveness of various alternative manure management practices (AMMP) with respect to emission reductions as CARB staff will revisit these dairies after they implement the selected AMMP technologies. This effort is a direct response to SB 1383 requirements and goals. The MMP is designed to identify air pollution sources and estimate their emission rates. Its mobility makes it ideal for field measurements that require large spatial coverage, such as mapping ammonia mixing ratios with an emphasis on determining the magnitude of emissions, characterizing spatial variability of emissions, and identifying dominant sources of emissions.

CARB staff is also working with academic researchers and industry representatives to explore potential opportunities to reduce the emissions of ammonia and other air pollutants from dairy manure lagoons which are one of the largest contributors to ammonia in California. Preliminary experiments have been conducted, and further investigation is underway at some SJV dairies with the support from farmers. Additionally, CARB staff is planning to analyze existing satellite data to refine the spatial resolution and allocation of ammonia in California. This may also help evaluate the impact of major wildfires on surface ammonia levels in recent years, and can be used to compare with the estimation methodology in the current ammonia emission inventory associated with wildfires.