

Update on Secondary PM_{2.5} Formation in the San Joaquin Valley and Research on Potential Controls

November 16, 2017



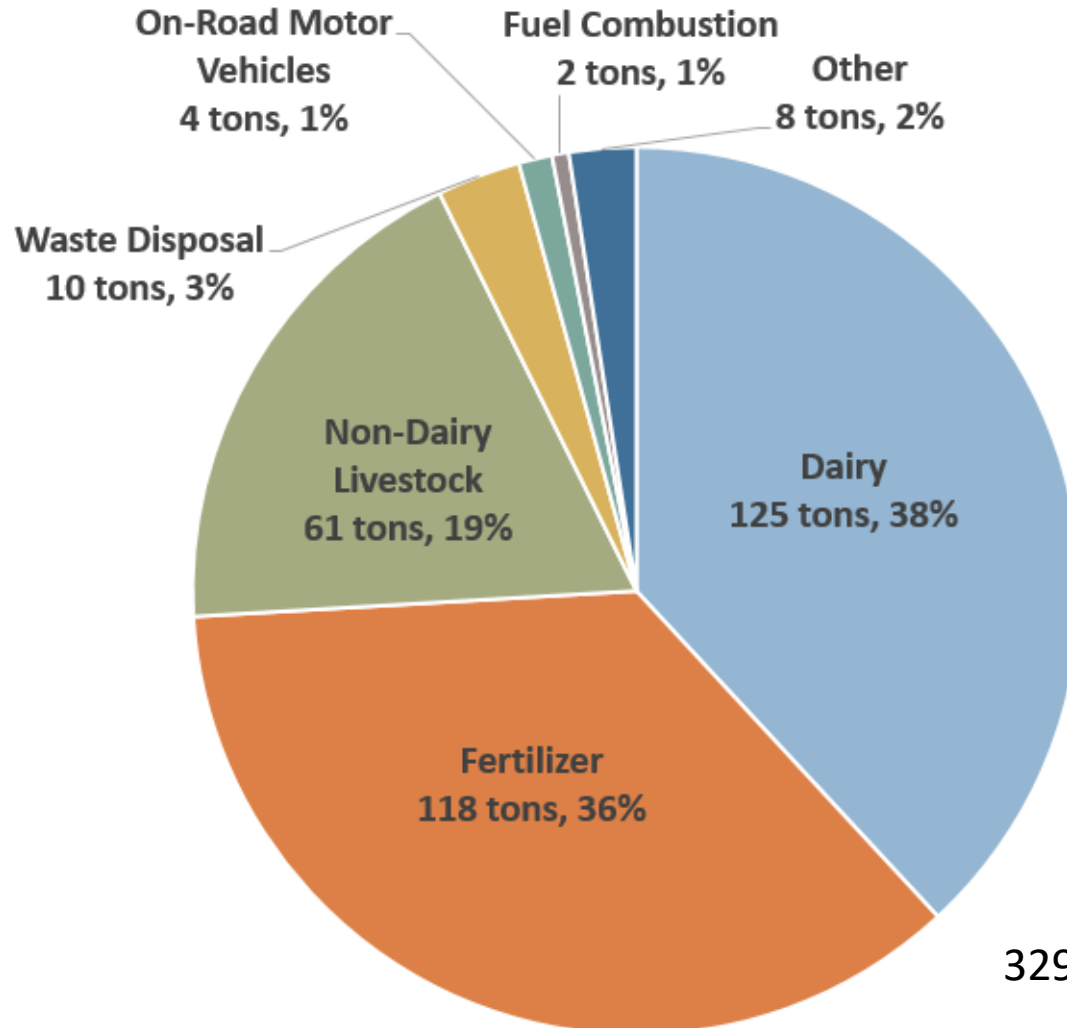
Presentation Outline

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- Role of ammonia in forming PM_{2.5}
- Required SIP precursors analysis
- District controls reducing ammonia
- Connection of ammonia and methane

Sources of Ammonia in the Valley

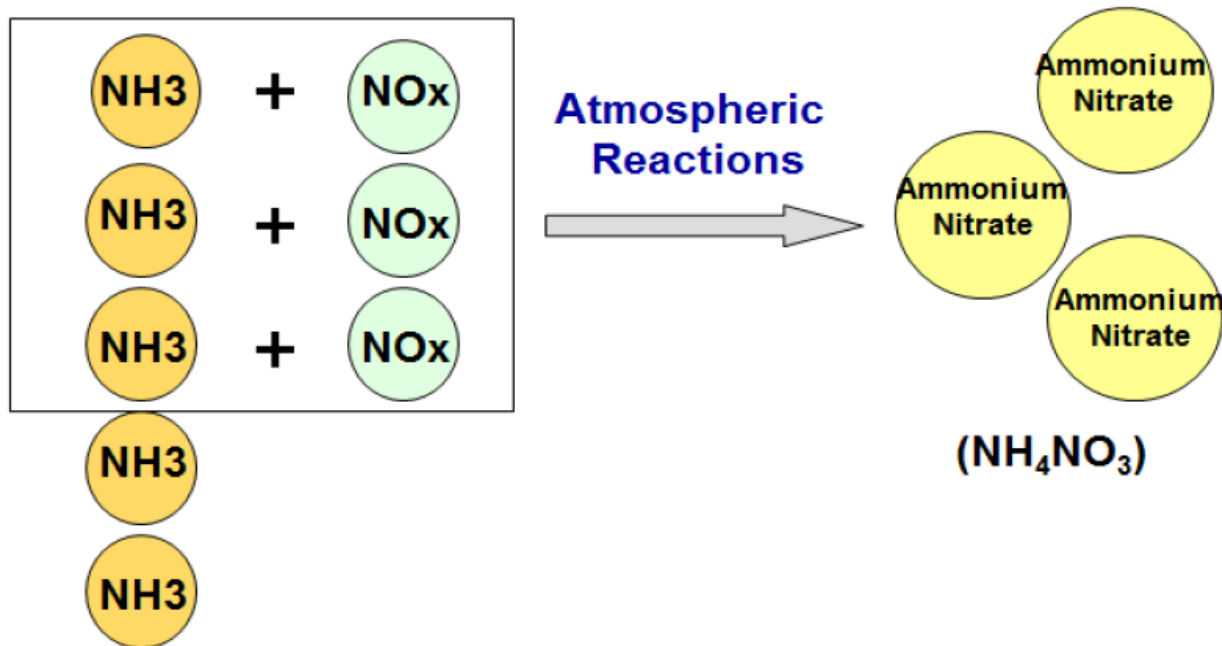
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329 tons per day, 2013

Role of Ammonia in PM2.5 Formation

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Limiting precursor: Target the gas in least supply to provide the most effective improvement in air quality

US EPA 'Significant' Precursor Guidance

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PM SIP must determine significance of four precursors:

SO₂ NO_x ROG Ammonia

Step 1:

Determine the air quality impact of emission reductions in the base year



Step 2:

Further assess significance in impact of existing and new controls on the relative abundance of in atmospheric reactions

Ammonia Precursor Analysis in the Valley

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Step 1:

Determine the air quality impact of emission reductions in the base year

- PM2.5 impact at Bakersfield above threshold with 30% reduction of ammonia emissions

	Modeled Impact		EPA Recommended Threshold
24-hour	3.3 $\mu\text{g}/\text{m}^3$	>	1.3 $\mu\text{g}/\text{m}^3$
Annual	0.41 $\mu\text{g}/\text{m}^3$	>	0.2 $\mu\text{g}/\text{m}^3$

Step 2:

Further assess significance in impact of existing and new controls on the relative abundance of in atmospheric reactions

- CARB mobile controls provide about 58% reduction in NOx emissions in future
- PM2.5 impact at Bakersfield below threshold with 30% reduction of ammonia emissions in future

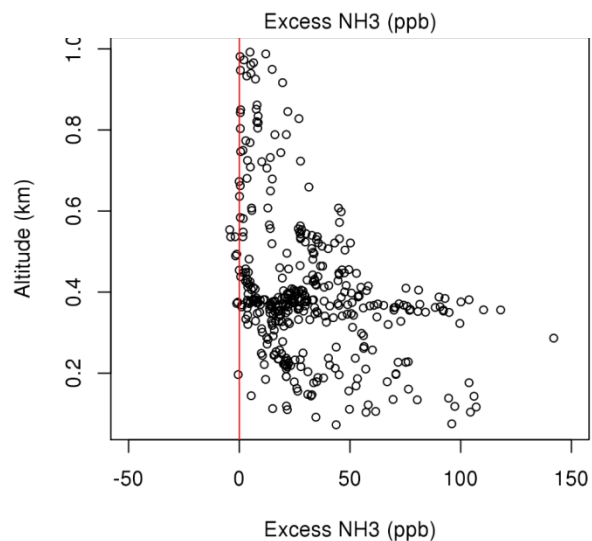
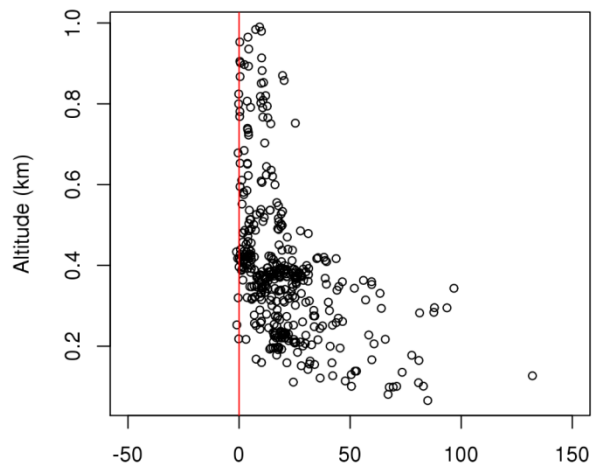
	Modeled Impact		EPA Recommended Threshold
24-hour	0.9 $\mu\text{g}/\text{m}^3$	<	1.3 $\mu\text{g}/\text{m}^3$
Annual	0.11 $\mu\text{g}/\text{m}^3$	<	0.2 $\mu\text{g}/\text{m}^3$

- 30% reduction of ammonia emissions is about 100 tons per day

Significance Analysis Supported by Empirical Data

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- Field study measurements indicate ammonia is in excess in the Valley
- Ammonia concentrations in SJV and SoCAB have increased
- NO_x reductions are the most effective path to reduce PM concentration
 - Can provide some PM reductions
 - Ammonia is eye and respiratory irritant at low concentrations
- Continue to look for opportunities to reduce ammonia



Excess NH₃ in the SJV on Jan 18 (Top) and Jan 20 (Bottom) based on NASA aircraft measurements in 2013

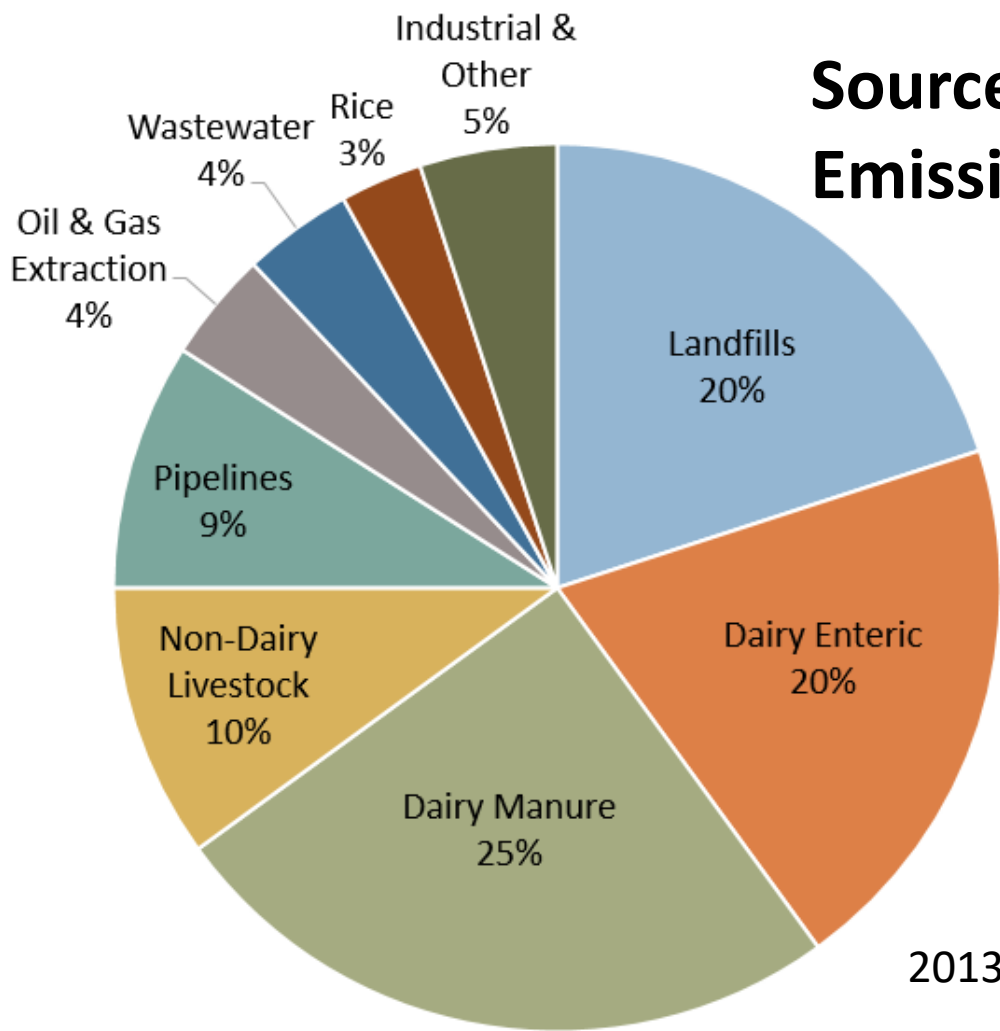
District Controls on Ammonia from Dairies

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District Rule	Measures to Select From Include...
Conservation Management Practices <i>(Rule 4550)</i>	<ul style="list-style-type: none">• Frequent manure removal• Scraping and harrowing
Biosolids, Animal Manure, and Poultry Litter Operations <i>(Rule 4565)</i>	<ul style="list-style-type: none">• Timely incorporation or injection of manure into soil• Rapid covering of biosolid piles• Installation of aerated static piles
Confined Animal Facilities <i>(Rule 4570)</i>	<ul style="list-style-type: none">• Nutritional management to reduce nitrogen intake• Timely incorporation or injection of manure into soil• Increased frequency and effectiveness of manure removal from animal housing area• Covering of manure piles

Methane and Ammonia often Emitted by Same Sources

Sources of Methane Emissions Statewide



2013

- Effective methane mitigation strategies may also deliver reductions in local air pollutants

New Research

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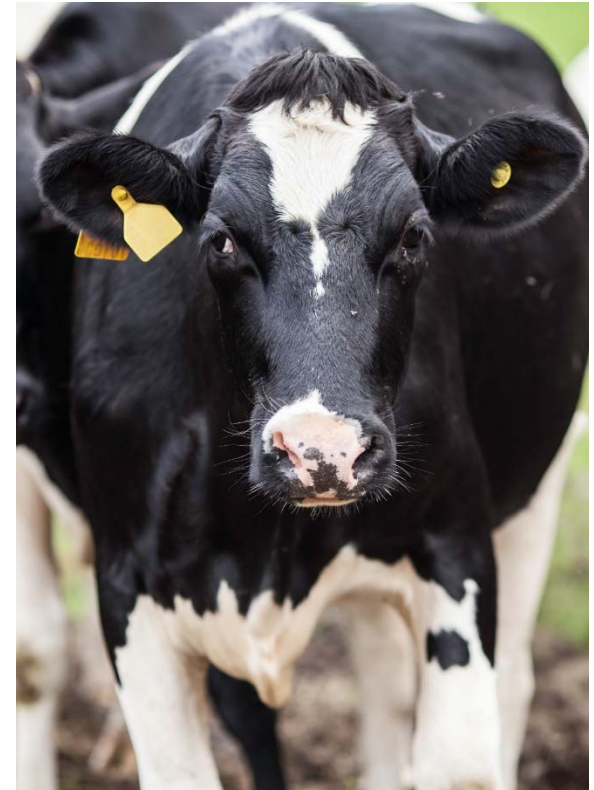
- Characterize source attribution of local and regional ammonia emissions using mobile surveyors
- Investigate dynamics of ammonia in complex urban environments
- Assess ammonia measurement capabilities at ambient monitoring stations
- Identify methane and ammonia sources using remote sensing technology



Research Spotlight

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- Evaluate real-world impact of various dairy manure management practices (e.g., digesters) on methane and ammonia emissions
- Expected deliverables:
 - Guidelines for alternative manure management practices with ammonia advantages
 - Understanding of how changes in dairy manure management practices affect emissions of methane and ammonia



Integrated Methane and Ammonia Approach

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- Dairy and Livestock Working Group evaluations of methane and ammonia issues
- CARB research on effect of dairy manure management practices on methane and ammonia emissions
- \$99 million from Greenhouse Gas Reduction Fund
- SLCP Reduction Strategy implementation with greenhouse gas and air pollutant co-benefits