Local Ozone Precursor Controls Available: Phoenix Area Case Study

Authors: **Fiona Jiang**, John Grant, and Greg Yarwood, Ramboll

2023 International Emissions Inventory Conference, Seattle, WA
September 27, 2023

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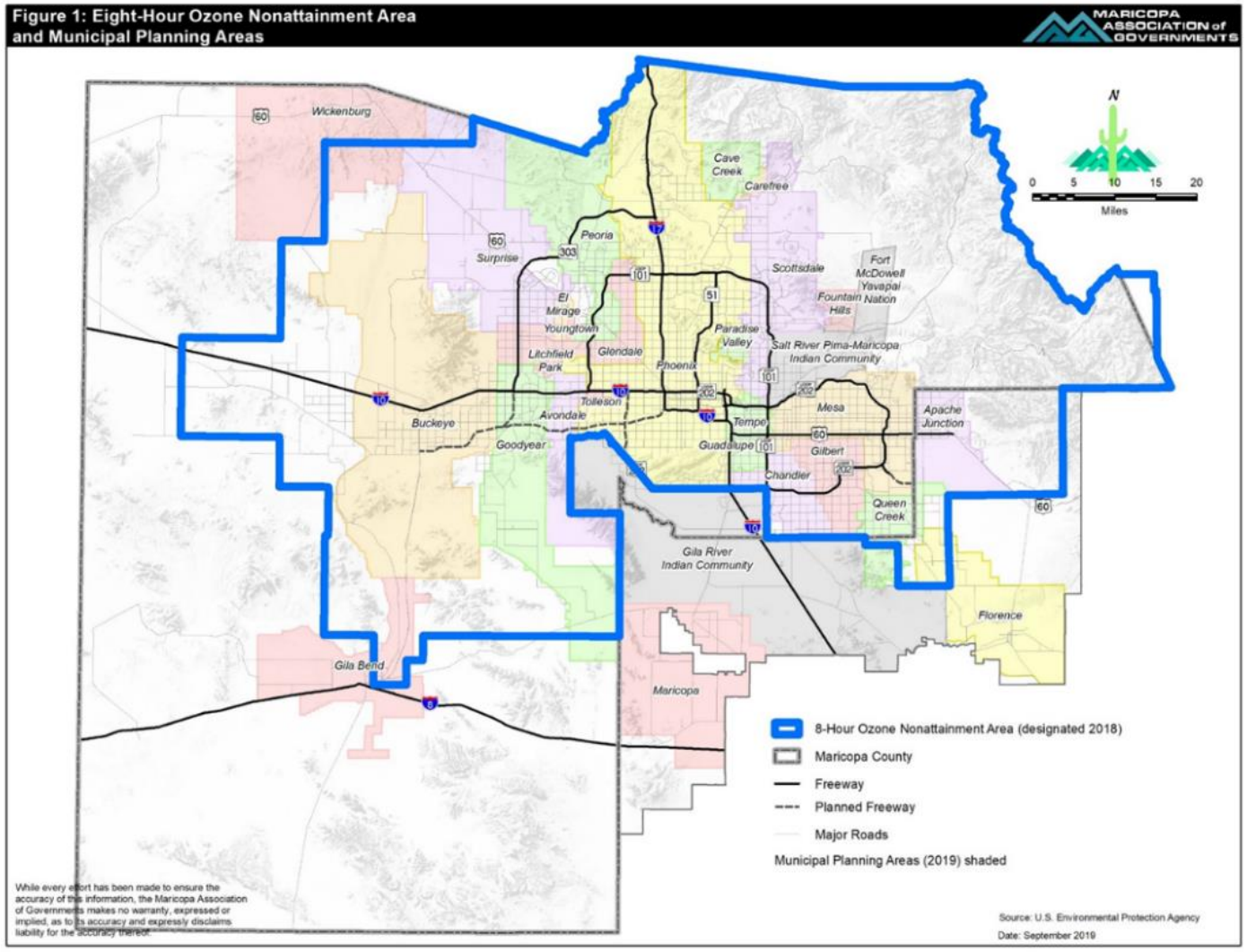
Agenda

1. Background and Purpose
2. Emission Inventory
3. Analysis
4. Conclusions/Limitations

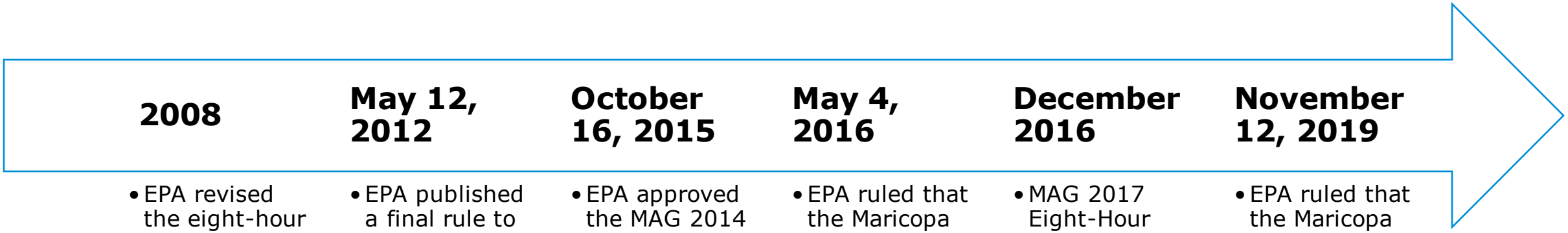
Phoenix-Mesa/Maricopa 8-hour Ozone nonattainment area



- Central portion of Arizona, including the city of Phoenix
- Maricopa County, parts of Gila County, and parts of Pinal County

Courtesy of Maricopa Association of Governments (MAG)

Timeline (2008 Ozone Standard, 2008-2019)



2008

- EPA revised the eight-hour ozone standard from 0.08 ppm to **0.075 ppm**

May 12, 2012

- EPA published a final rule to designate the Maricopa NAA as a **Marginal** Area
- December 31, 2015 attainment date

October 16, 2015

- EPA approved the MAG 2014 Eight-Hour Ozone Plan-Submittal of Marginal Area Requirements

May 4, 2016

- EPA ruled that the Maricopa Eight-Hour Ozone NAA did not attain the 2008 standard and reclassified the area from Marginal to **Moderate**
- July 20, 2018 attainment date

December 2016

- MAG 2017 Eight-Hour Ozone Moderate Area Plan submitted to EPA
- Demonstrated that the 2008 standard would be met in the 2017 ozone season

November 12, 2019

- EPA ruled that the Maricopa NAA **attained** the 2008 ozone standard

Timeline (2015 Ozone Standard, 2015-present)

2015

- EPA revised the eight-hour ozone standard to **0.070 ppm**

June 4, 2018

- EPA designated the Maricopa NAA as a **Marginal** Area
- August 3, 2021 attainment date

October 7, 2022

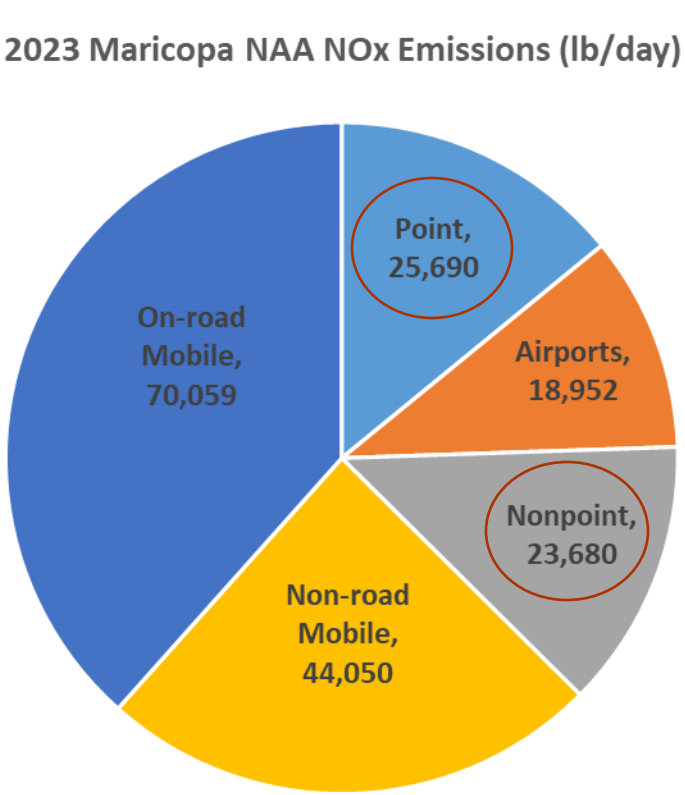
- EPA ruled that the Maricopa Eight-Hour Ozone NAA did not attain the 2015 standard and reclassified the area from Marginal to **Moderate**
- August 3, 2024 attainment date

The Maricopa NAA has a long history of ozone planning, therefore, **new and available** control measures are needed to reduce ozone precursor emissions and meet RFP requirements

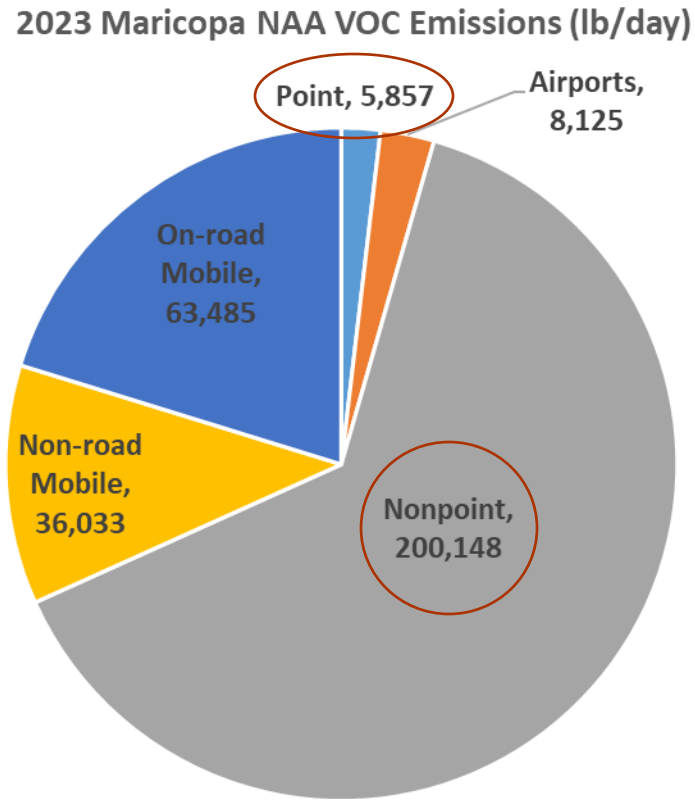
With the August 3, 2024 attainment date, seeking control measures with **short-term emissions reductions** is necessary

Purpose –
Screening analysis to assist MAG in determining what new control measures to implement in State Implementation Plan (SIP)

2023 Anthropogenic Emission Inventory



* 2023 April to September average day emissions
* Anthropogenic emissions, not including biogenic sources



Step 1: Review of existing local control measures

Extent and Product

- Evaluated existing regulations and control measures applicable in the Maricopa NAA
  - NOx and VOC
  - Sectors: nonpoint, point, onroad, nonroad
  - E.g., MAG 2017 Eight-Hour Ozone Moderate Area Plan for the Maricopa nonattainment area
- Developed a comprehensive list of on-the-books emission reduction programs
  - Identified fully/partially implemented control measures; partially implemented control measures would be analyzed in the next step

Examples

- Nonpoint: Maricopa County Air Quality Department (MCAQD) Rule 331 - Solvent Cleaning
- Point: National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters
- Onroad: Catalytic Converter Replacement Program
- Nonroad: Restrictions on the Use of Gasoline-Powered Blowers for Landscaping Maintenance

Step 2: Research on new potential control measures

Sources and References

Started with in-house database and literature review, example include

- Control Strategy Tool (CoST) Control Measure Database (CMDB)
- EPA Menu of Control Measures
- South Coast AQMD 2016 and 2022 air quality management plans and South Coast AQMD rules
- California 2022 State Implementation Plan Strategy and California 2016 State Implementation Plan
- Ozone Transportation Commission VOC Controls

Product

- Developed a reasonably comprehensive list of candidate control measures that could be implemented in SIP

- Ruled out control measures
  - with no applicable emissions in the Maricopa NAA;
  - for which implementation time frame precluded attainment of substantial emission reductions in 2023;
  - for which information was not readily available to evaluate control measures

Step 3: Nonpoint Sources Approach

- Among the rest of the potential control measures, full emission reduction and cost-effectiveness analysis for measures with potential emission reductions greater than 1,000 pounds per day and limited emission reduction analysis for lower emission reduction measures

- Main considerations:
  - Approach to develop a control efficiency and cost
  - Take into account existing controls (if applicable)
  - Other implementation considerations, e.g., rule penetration rate

- To develop a uniform cost analysis, all the control cost estimates were adjusted to 2021 dollars based on the Consumer Price Index (CPI)*

*U.S. Bureau of Labor Statistics, available online at https://www.bls.gov/cpi/data.htm

Measure Description

1. Stage I (or Phase I) refers to the emissions source category associated with the transfer of gasoline from tanker trucks to underground storage tanks (USTs)
2. Seeks potential VOC emissions reductions that are achievable for Stage I vapor recovery that occurs at the gasoline dispensing facilities (GDF)

References

- MCAQD RULE 353. Available online at: https://www.maricopa.gov/DocumentCenter/View/5281/Rule-353---Storage-and-Loading-of-Gasoline-at-a-Gasoline-Dispensing-Facility-GDF-PDF?bidId=
- ERG, 2012. "Air Program Support for Stage I and Stage II Programs in Massachusetts Final Report." Prepared for: Massachusetts Department of Environmental Protection. Eastern Research Group. December.

Gasoline Service Stations: Enhanced Stage I Vapor Recovery

Emission Reductions and Cost

2023 Applicable Emissions Estimates	
NOx:	0 lb/day
VOC:	2,376 lb/day
Control Measure Summary	
Total 2023 NOx Reduction:	*Not applicable*
Total 2023 VOC Reduction:	1,426 lb/day
NOx Cost-effectiveness:	*Not applicable*
VOC Cost-effectiveness:	*$2,753/ton VOC*

Approach

1. MCAQD Rule 353 requires GDFs with a capacity of more than 250 gallons to install, operate, and maintain a CARB-certified vapor recovery system, which is designed to reduce by at least 95% the VOC vapor.
2. Assume universal adoption of CARB Module 1 Phase I Vapor Recovery requirements that mandate Stage I enhanced vapor recovery with 98% control efficiency.
3. A control efficiency of 60% was estimated, resulting in emissions reductions 1,426 lb/day VOC.
4. The cost estimate was based on an ERG study published in 2012.

Step 3: Point Sources Approach

Control efficiency

- MCAQD provided
  - 2023 projected unit-level emissions inventory
  - Existing NOx control information

- Generic non-unit-specific control information based on the SCC code was used to estimate
  - Control efficiency of the existing control
  - Potential control measure combinations
  - Note on the caveat

- Potential emission reductions were calculated as the incremental reduction from the existing controls

Cost-effectiveness

- The control costs are annualized costs, including operating and maintenance (O&M) cost and capital cost amortized over the life of the control equipment.

- To develop a uniform cost analysis, all the control cost estimates were adjusted to 2021 dollars based on the Consumer Price Index (CPI)*

*U.S. Bureau of Labor Statistics, available online at https://www.bls.gov/cpi/data.htm

Electric Generation – Natural Gas

1. Natural gas combustion is mainly used to generate industrial and utility electric power, produce industrial process steam and heat, and heat residential and commercial space.
2. Natural gas is a major combustion fuel that is used in the Maricopa NAA

Emission Reductions and Cost

2023 Emissions Estimates	
NOx	17,751 lb/day

Control Measure Summary, Including 2023 NOx Emission Reduction Estimates		
Control Measure Name	**Potential NOx Reduction (lb/day)**	**Cost-effectiveness ($/ton)**
Selective Catalytic Reduction and Steam Injection	8,550	$2,686
SCR + Dry Low NOx Combustion	8,132	$1,932
Selective Catalytic Reduction and Water Injection	7,756	$3,262
Low NOx Burner	3,619	$1,016
Steam Injection	3,447	$2,631
Selective Catalytic Reduction	3,181	$1,735
Water Injection	3,102	$2,806
Low NOx Burner, Over-fired Air and Selective Non-Catalytic Reduction	2,903	$2,582
Natural Gas Reburn	1,988	$3,173
Low NOx Burner with separated Overfire Air	1,869	$588

Note: The control measure emission reductions and associated costs should not be considered additive because there are units for which more than one potential control is feasible.

Summary of Study

Nonpoint – 23 control measures

- 9 with potential emission reductions greater than 1,000 lb/day
- 14 with potential emission reductions less than 1,000 lb/day

Point – 50 control measures

- 17 facilities, 160+ units
- Three broad point source emission categories: (1) natural gas combustion; (2) oil combustion; and (3) industrial processes - non-ferrous metals

Details of the study results can be found online (linked in the next slide)

Conclusions/Limitations

- This study aimed to identify and evaluate new and available ozone precursor control measures by estimating emissions reductions and cost-effectiveness when sufficient information is available
- Supports regional air quality planning agency/Multi-Jurisdictional Organization for the SIP-planning process
- For point sources, further refinement of existing controls and unit-specific information will improve estimates. Feasibility to implement and actual emission reduction would depend on detailed engineering study for each facility that was beyond the scope of this study

Acknowledgments

- Maricopa Association of Governments staff: Matthew Poppen, Taejoo Shin, Elias Toon, and Julie Hoffman

The study report is available online at Final Report: Evaluating New and Available Ozone Precursor Control Measures in the Maricopa Nonattainment Area (azmag.gov)

Questions

Let’s chat!

Fiona Jiang
+1 415-899-0718
fjiang@ramboll.com

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Supplemental Slides

Nonpoint Control Measures Summary