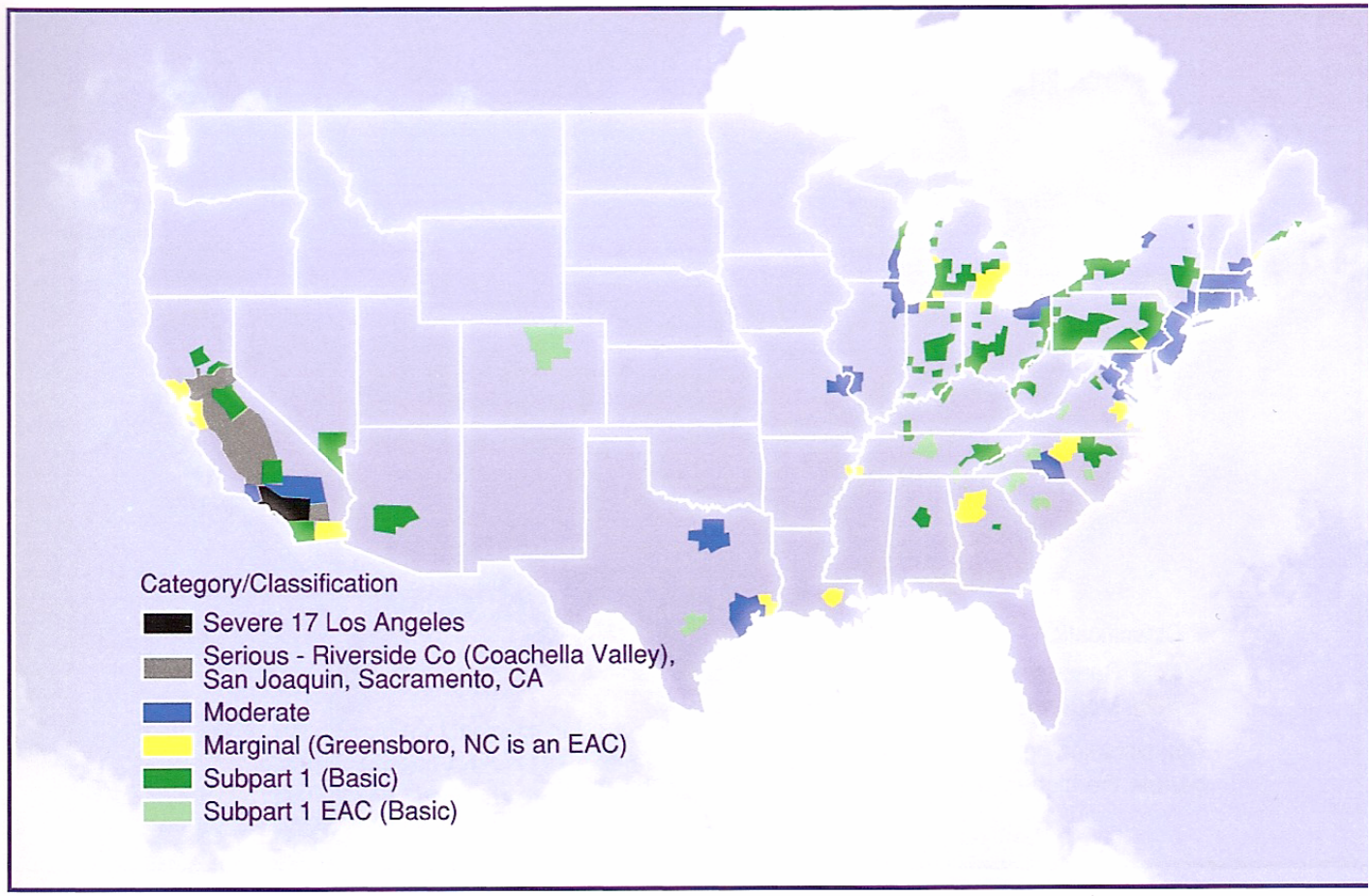
AIR QUALITY MODELING APPROACH FOR THE EIGHT-HOUR OZONE PLAN FOR THE MARICOPA NONATTAINMENT AREA

Air Quality Technical Advisory Committee

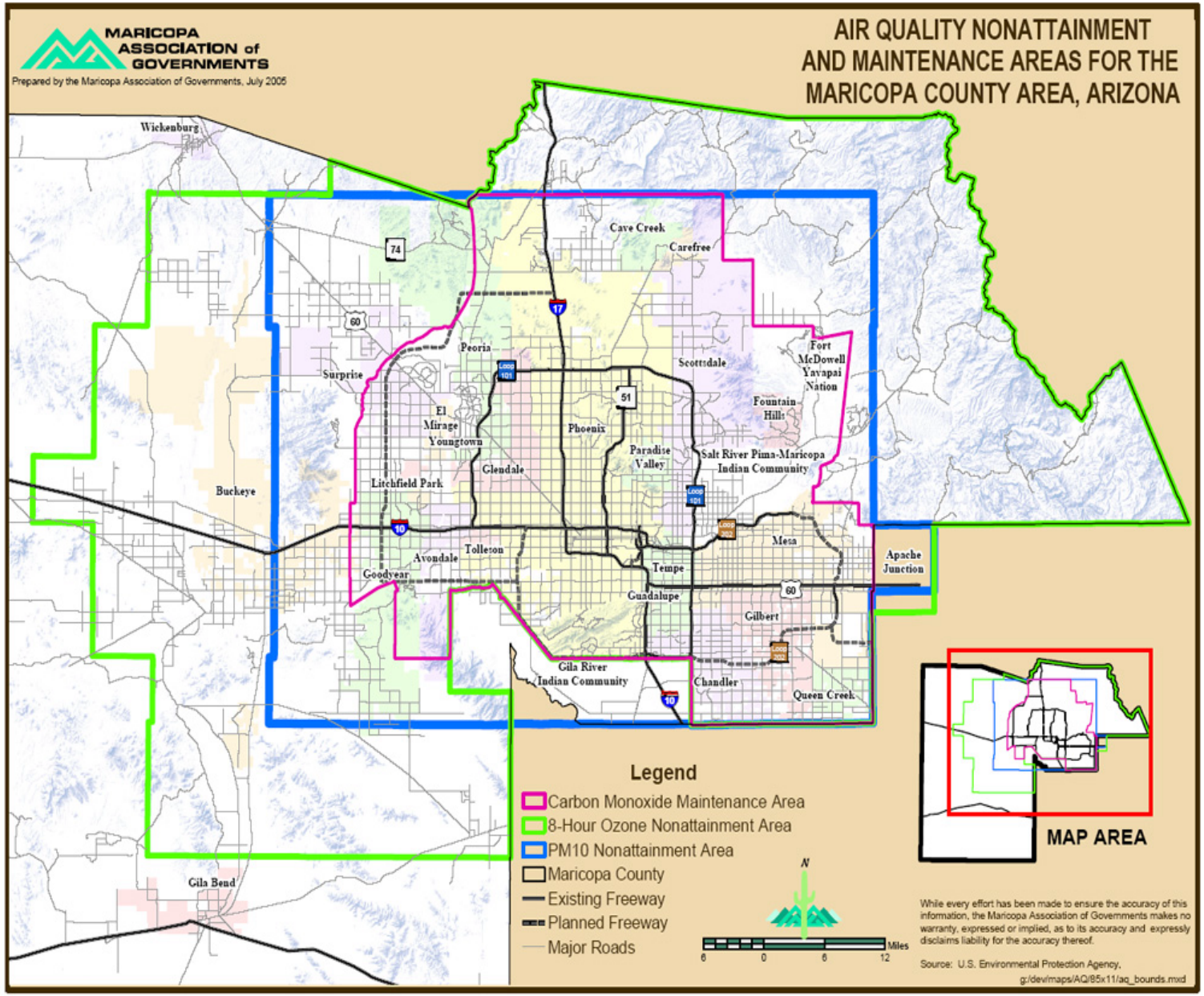
January 11, 2007

MARICOPA ASSOCIATION of GOVERNMENTS

Eight-Hour Ozone Nonattainment Area Classifications



ENVIRONMENTAL SERVICES



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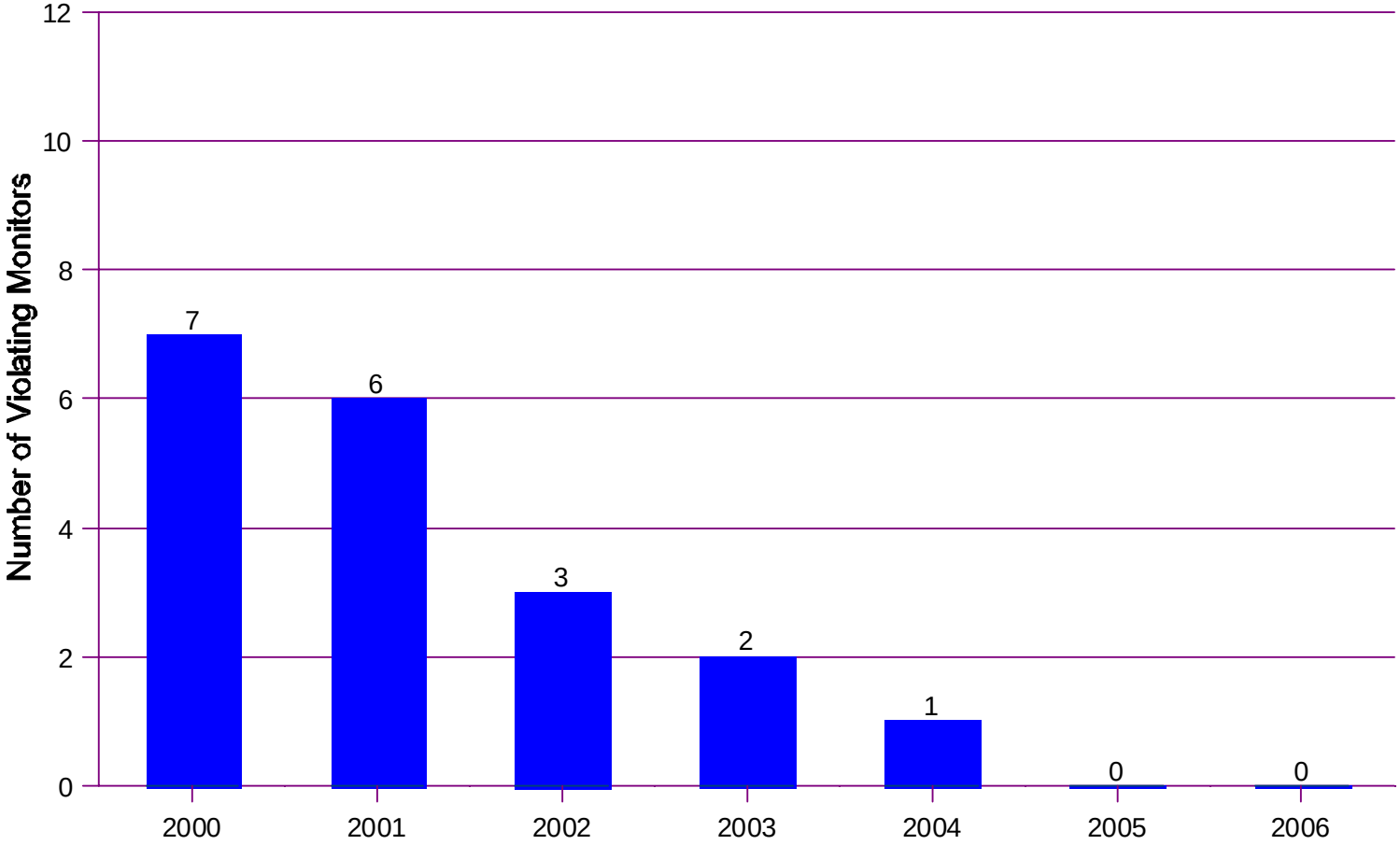
8-Hour Ozone Monitoring Data

VIOLATIONS OF THE 8-HOUR OZONE STANDARD IN THE MARICOPA COUNTY NONATTAINMENT AREA

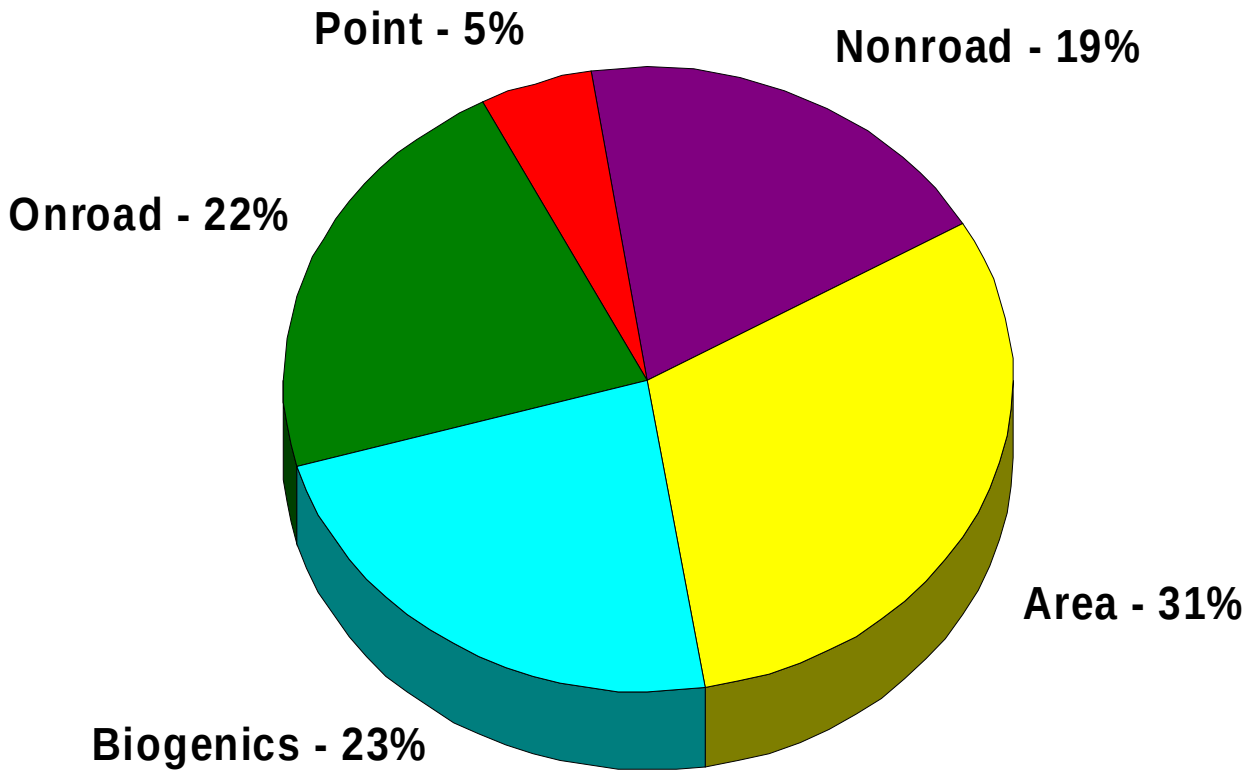


Attainment Demonstration for Eight-Hour Ozone

- EPA nonattainment designations were effective on June 15, 2004
  - Maricopa County nonattainment area is classified as “Basic”
- Plan due to EPA by June 15, 2007
- Use most recent emissions inventory
- Demonstrate attainment via modeling
- Attainment of the standard required at all ozone monitors by June 15, 2009
  - Based on 2006-2008 monitoring data

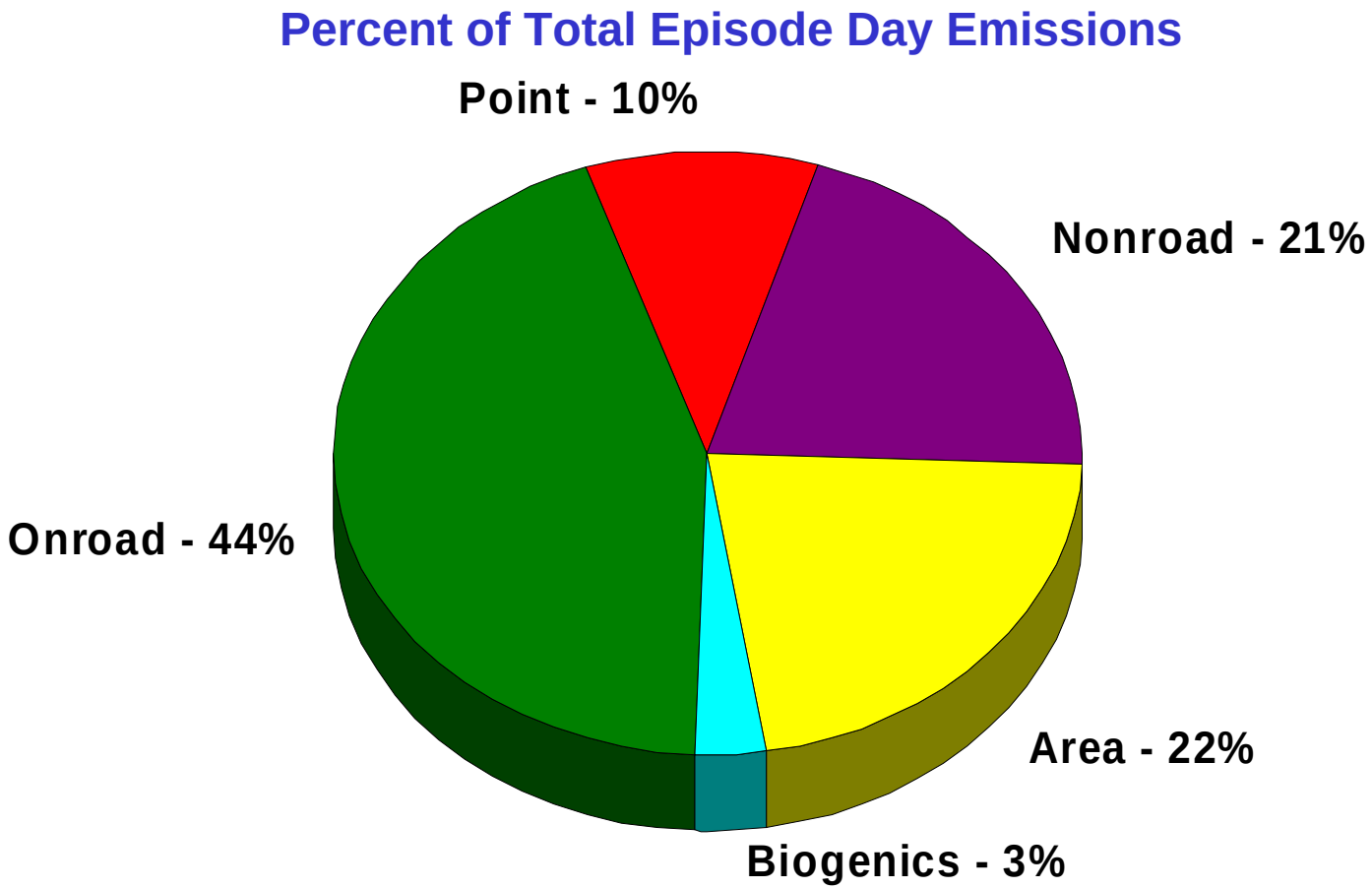
2006 Regional VOC Emissions with Committed Control Measures

Percent of Total Episode Day Emissions



Source: MAG, "One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area," March, 2004

2006 Regional NOx Emissions with Committed Control Measures



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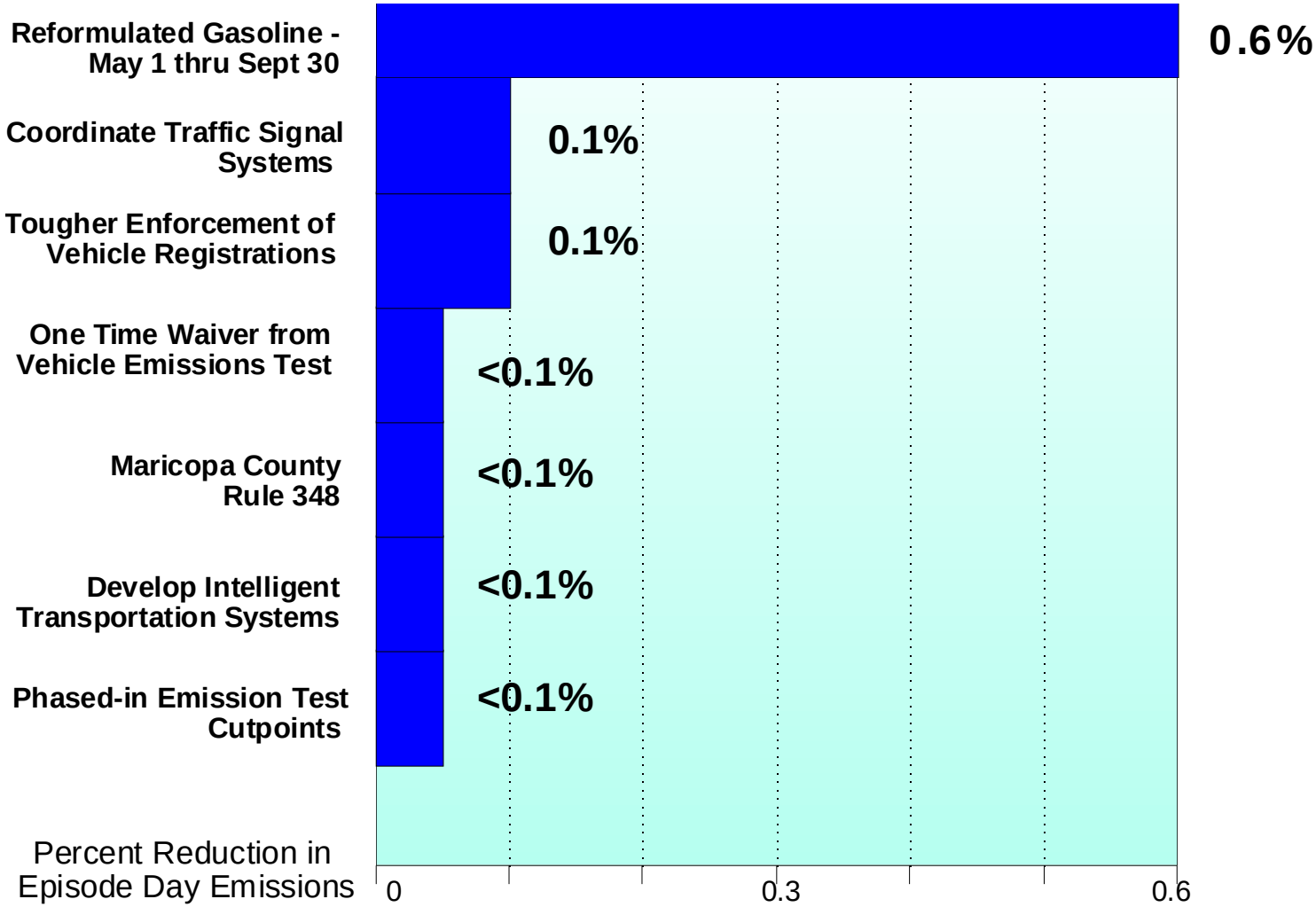
2015 VOC Emission Reductions

From Committed Control Measures



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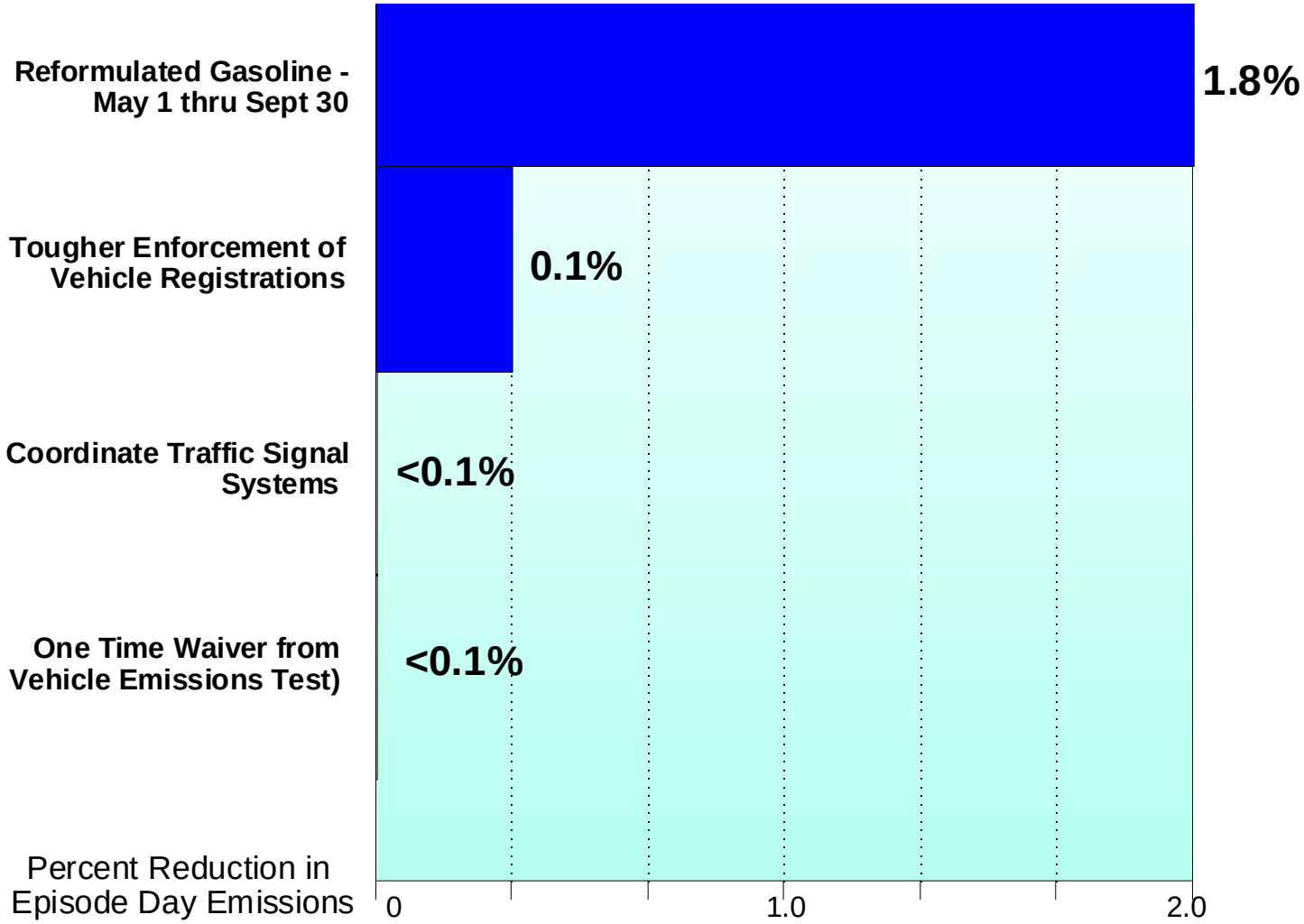


Source: MAG, "One-Hour Ozone Redesignation Request and Maintenance Plan for the Maricopa County Nonattainment Area," March, 2004

8-Hour Ozone Modeling

- Modeling protocol completed in Jan 2006 (http://www.mag.maricopa.gov/detail.cms?item=5221)
- Using MM5 meteorological model and CAMx photochemical dispersion model
  - CMAQ model may also be applied to validate CAMx results
- Validating models for three ozone episodes with different emissions sources and meteorology
  - August 5-11, 2001 (local and transport)
  - June 3-7, 2002 (predominantly transport)
  - July 8-14, 2002 (predominantly local)
- Quantifying emission reduction benefits of existing control measures in 2008

Committed Measures in the One-Hour Ozone Maintenance Plan

- Maintenance Measures
  - Summer Fuel Reformulation (May 1- Sept 30)
  - Phased-In Emission Test Cutpoints
  - One-time Waiver from Vehicle Emissions Test
  - Coordinate Traffic Signal Systems
  - Develop Intelligent Transportation Systems
  - Tougher Enforcement of Vehicle Registration and Emission Test Compliance
  - Maricopa County Rule 348: Aerospace Manufacturing and Rework Operations
- Contingency Measures
  - Expansion of Area A Boundaries
  - Gross Emitter Waiver Provision
  - Increase Waiver Repair Limit

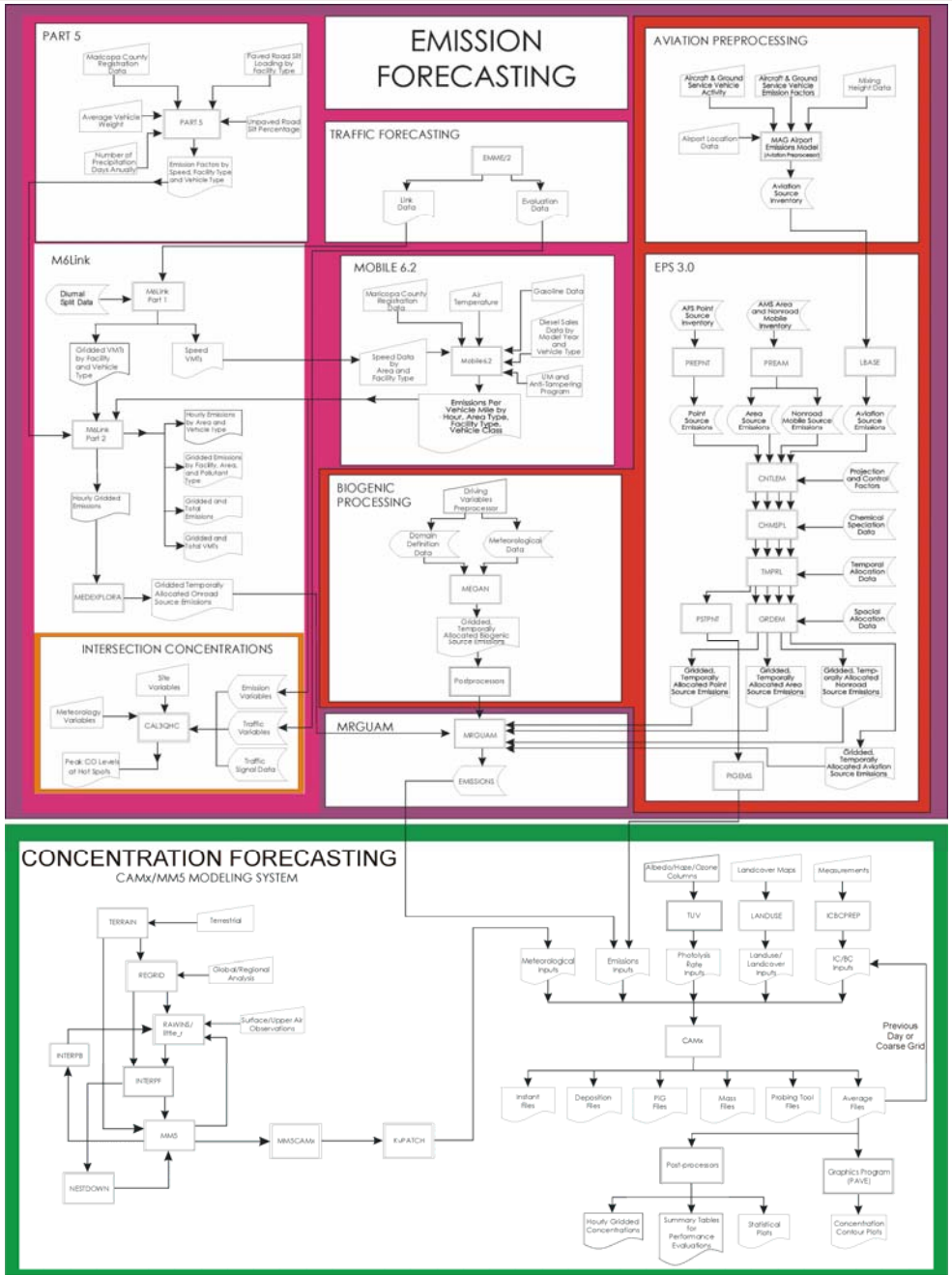
Status of 8-Hour Ozone Modeling

- Expect to show attainment in 2008 with existing committed measures
- Developed gridded 2001, 2002 and 2008 VOC and NOx emissions inventories for inner (4 km) modeling domain
- Incorporates MAG Biogenics Study results
  - MEGAN biogenics model developed by Dr. Alex Guenther for EPA
  - Includes field measurements in June 2006 of vegetative emissions in Maricopa County
  - Supplemented by vegetative emission rates measured by Dr. Guenther during the summer of 2006 in Clark County, Nevada

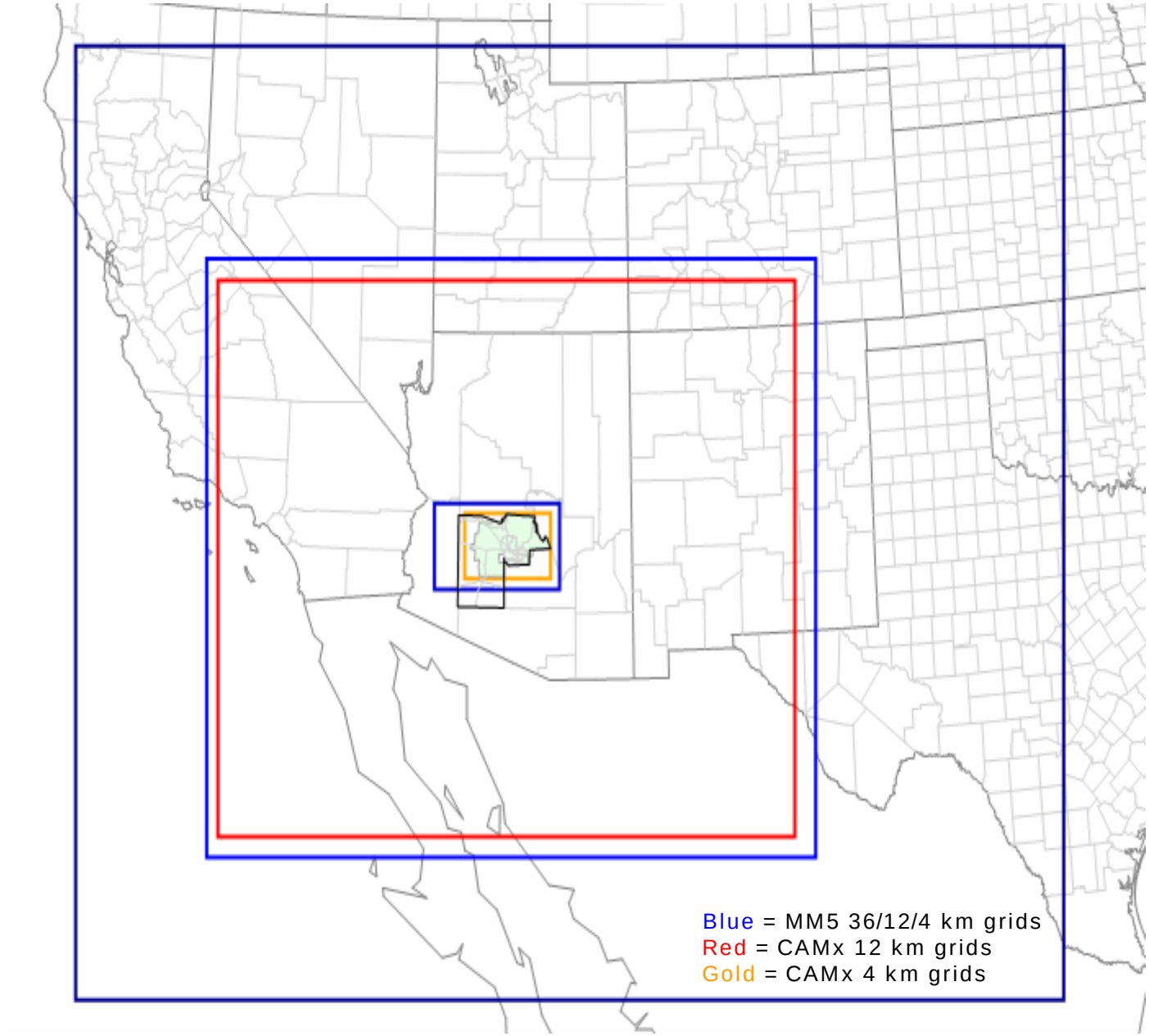
Status of 8-Hour Ozone Modeling

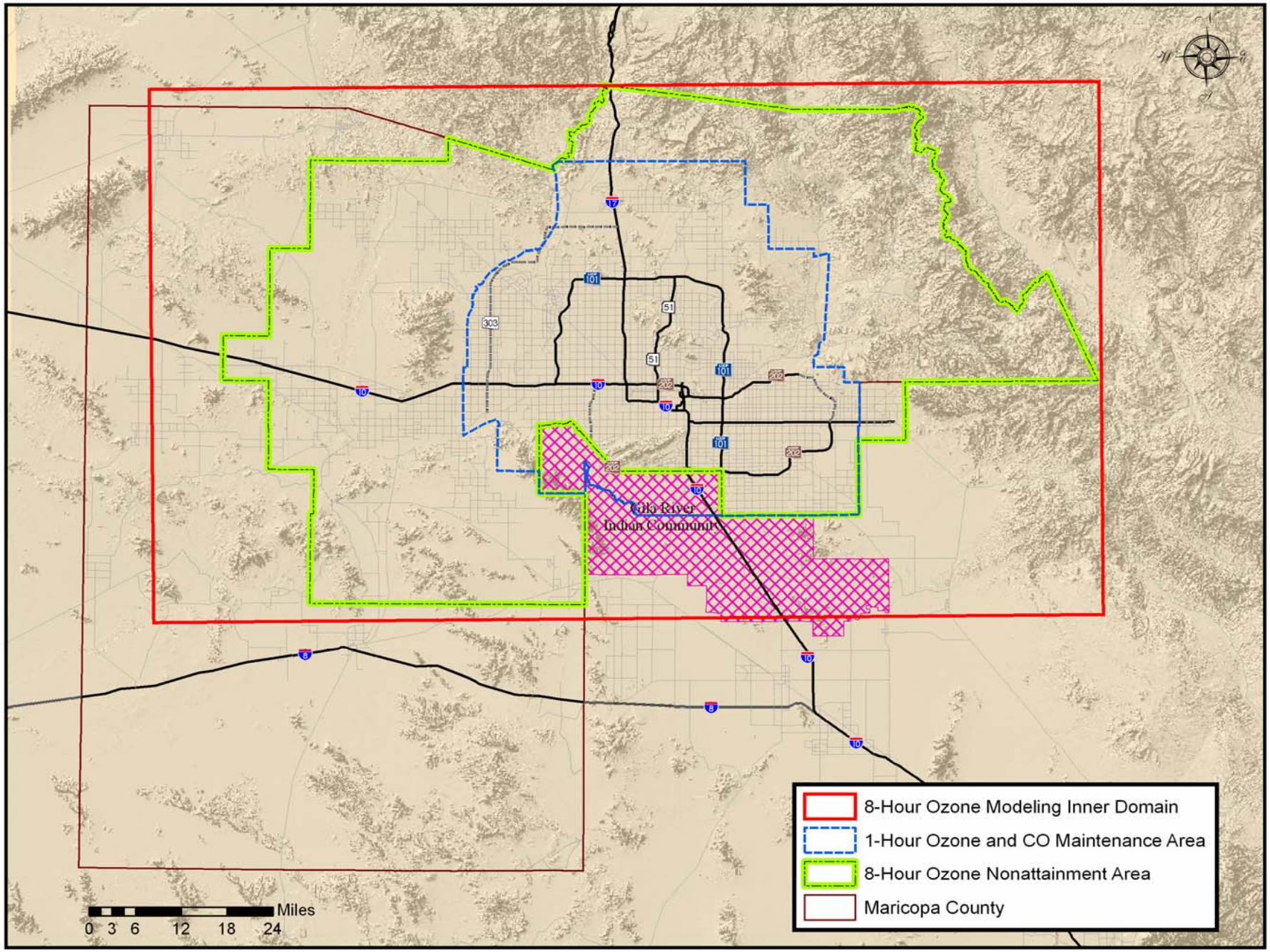
- Working with contractor - ENVIRON
  - Finalize CAMx validations for 3 episodes
    - Update ozone chemistry (CB05 vs. CB4)
    - Use MEGAN to develop biogenics emissions for 12 km modeling domain
  - Perform 2008 projections for 3 episodes
    - Project 2008 emissions and boundary conditions for 12 km modeling domain
  - Document weight of the evidence
    - Downward trends in VOC and NOx emissions and ozone concentrations
      - 2nd year of “clean” eight-hour ozone data

MAG Air Quality Modeling Chain



Nested CAMx and MM5 Modeling Domains





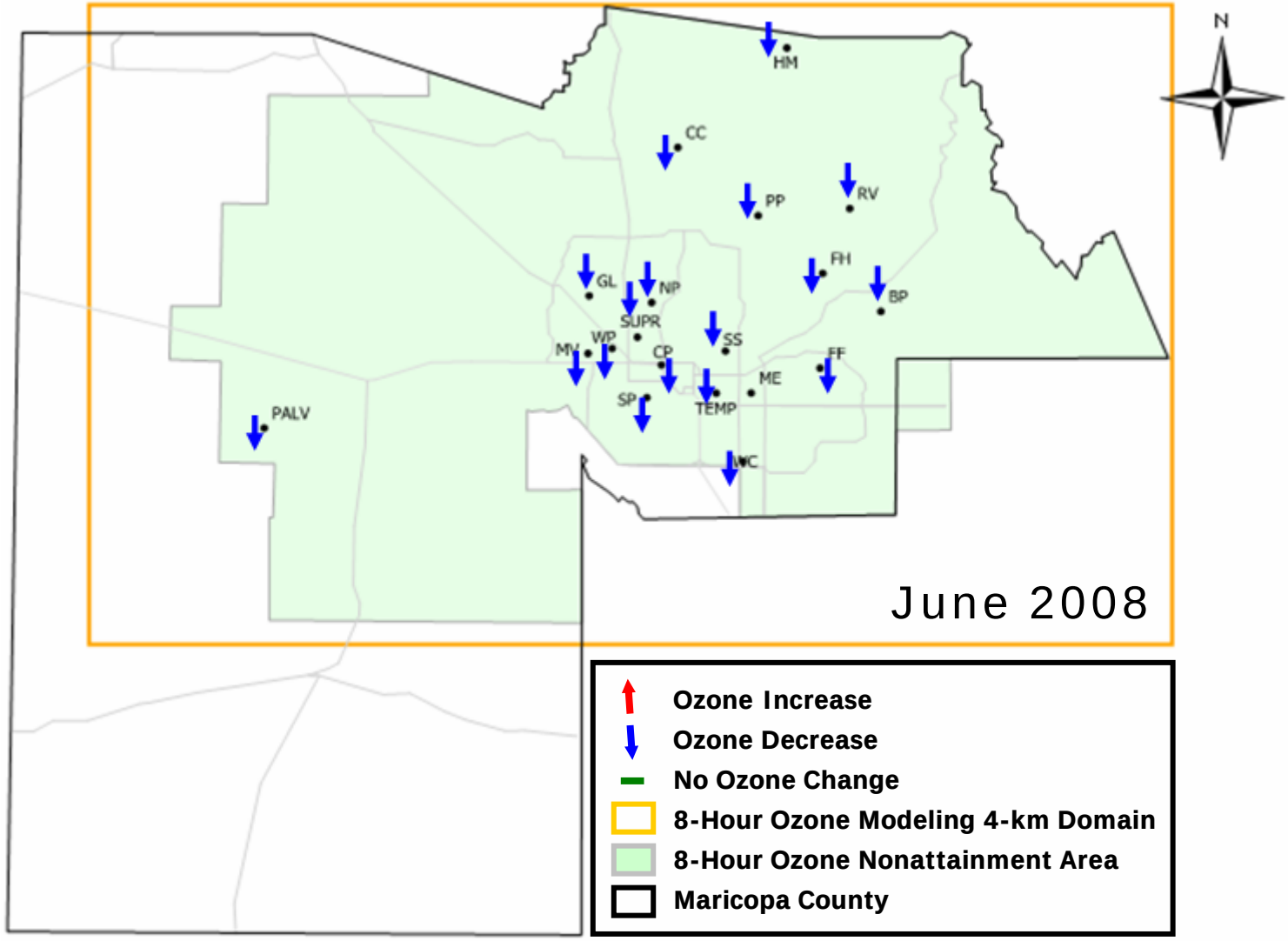
Eight-Hour Ozone Modeling Inner Domain (4 km grids)

NOx Exemption

- Section 183 of the Clean Air Act
  - Allows for exemptions when NOx reductions do not contribute to ozone attainment
  - Modeling in the MAG 1993 Ozone Plan concluded that reductions in NOx would increase ozone concentrations
- EPA approved a NOx exemption for the Maricopa County 1-hour ozone nonattainment area on April 19, 1995
  - Expired when the 1-hour ozone standard was revoked on June 15, 2005
  - New exemption required for 8-hour ozone
- If modeling shows NOx reductions will increase 8-hour ozone in 2008, a NOx exemption will be requested
  - Preliminary 2008 forecast for the June episode shows that NOx reductions increase ozone in the urbanized portion of the nonattainment area

Future Design Value (DVF)$_I$ Change

- Anthropogenic **VOC** Reduction (40%)



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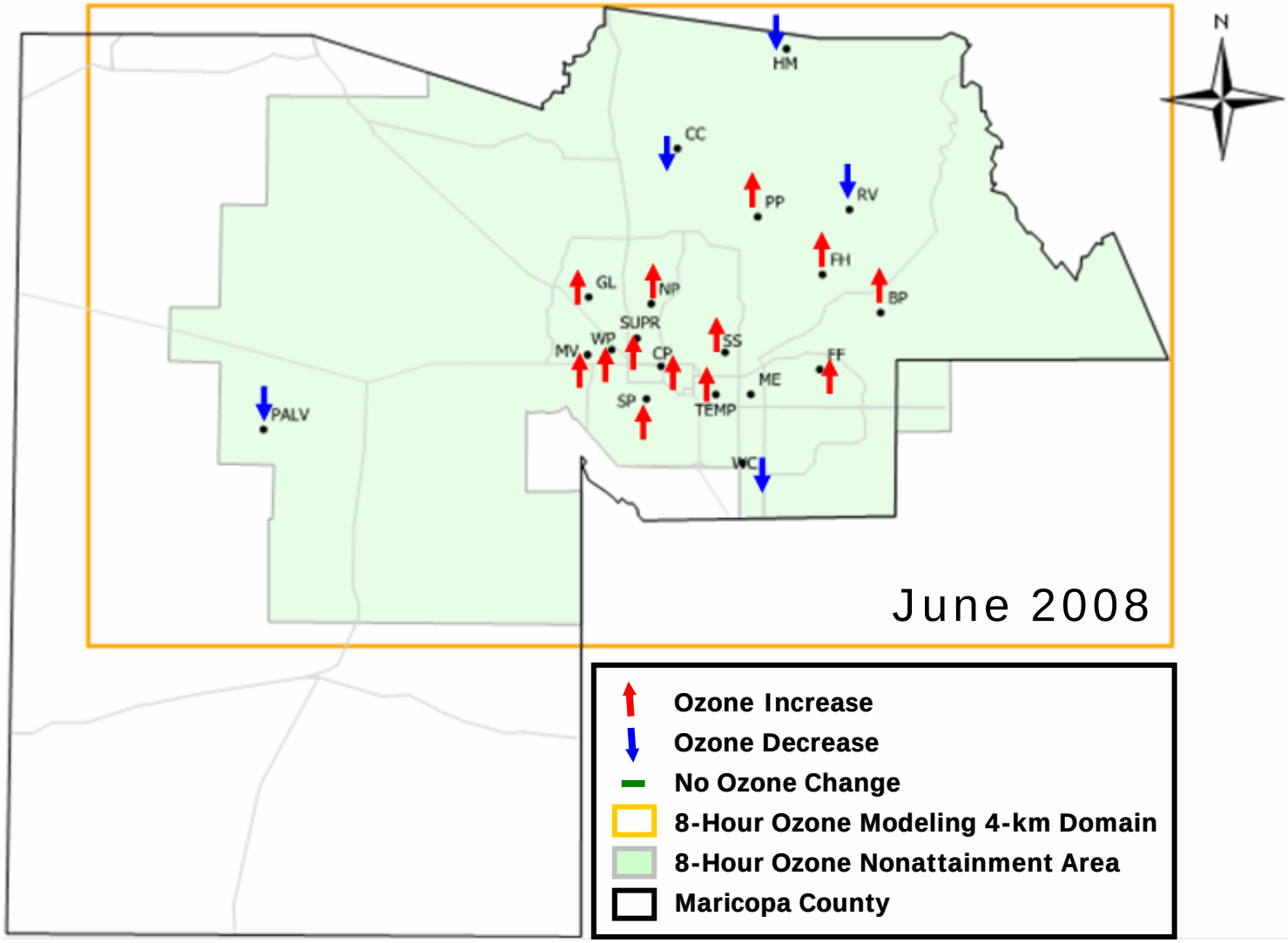
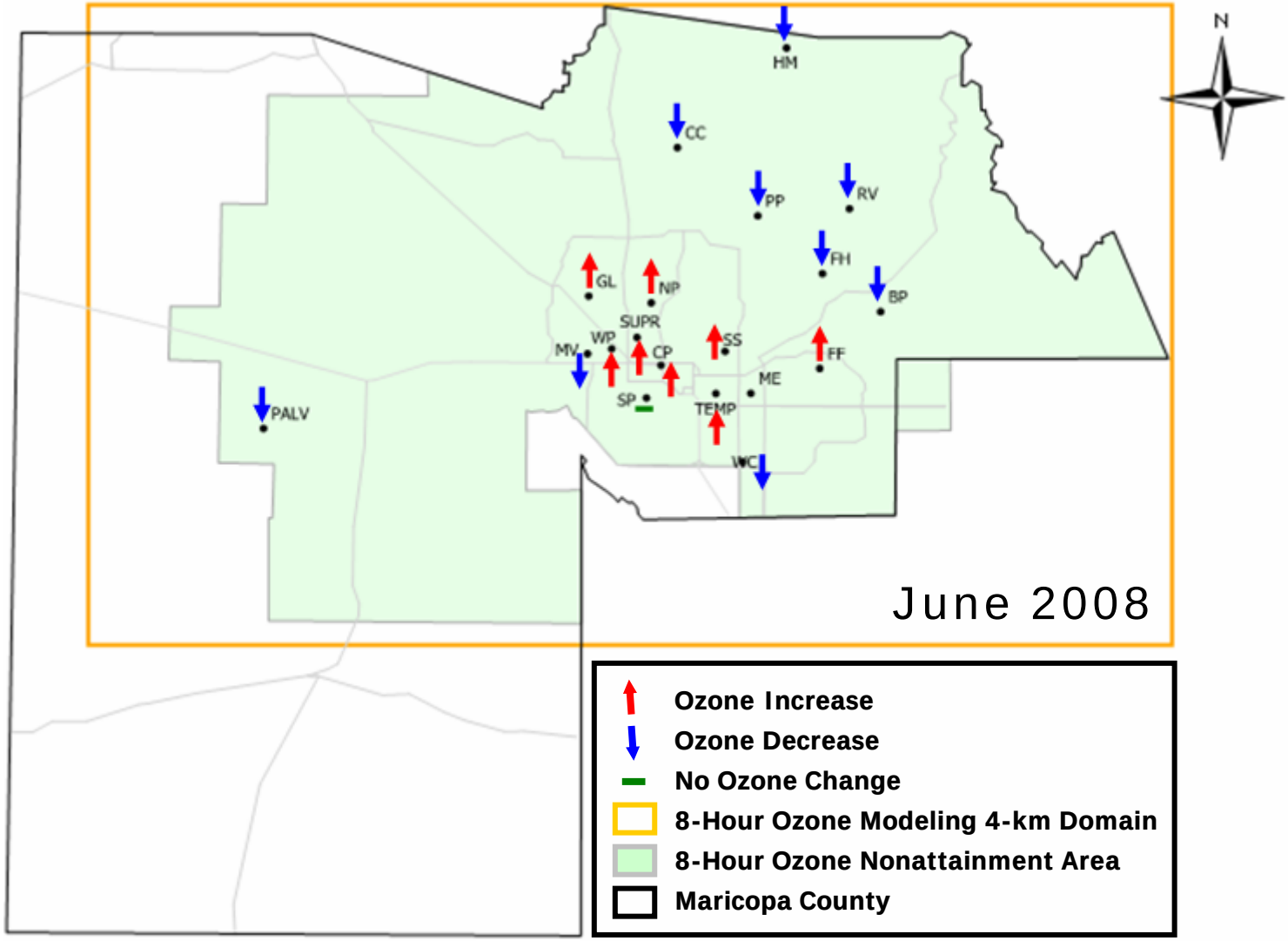


Future Design Value (DVF), Change

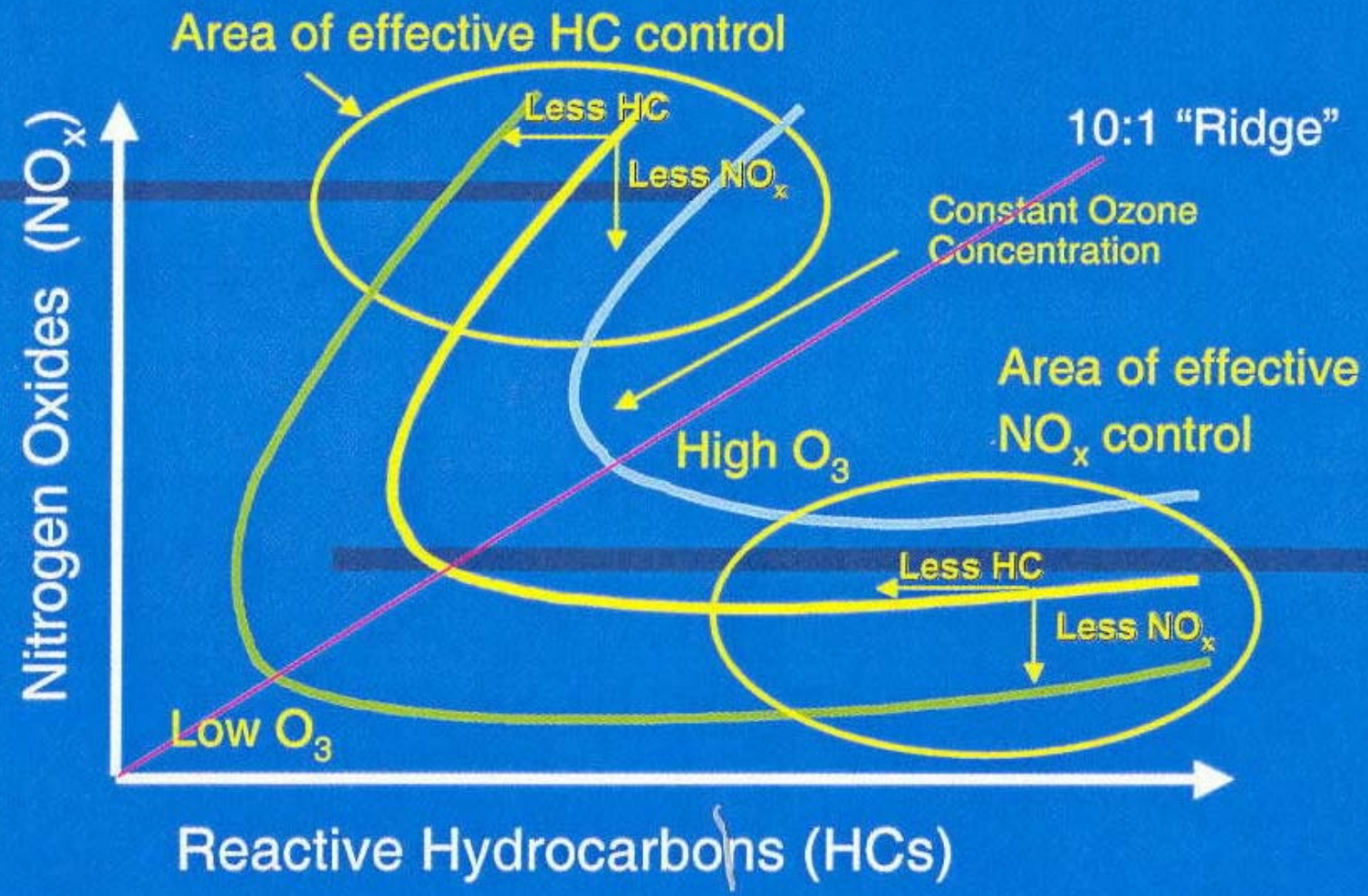
- Anthropogenic **VOC & NOx** Reduction (40%)



How Can Decreases in NOx Emissions Increase Ozone?

- Nitrogen oxides (NO, NO_2) can either promote or inhibit ozone formation
  - Night and morning
    - Ozone is titrated (reduced) by NO, forming NO_2
    - Excess NO_2 inhibits chemical reactions that form ozone
  - Mid-day and Afternoon
    - Sunlight drives chemistry out of “NOx inhibition” state towards ozone production state
- High NOx emissions, relative to VOCs, can strongly inhibit ozone formation
  - Reducing NOx emissions can increase ozone

Ozone Isopleth Plot (EKMA Diagram)



8-Hour Ozone Plan Schedule

- **Jan 2007 – Modeling completed**
- **Mar 2007 - Document available**
- **Apr 2007 - Public hearing**
- **Apr 2007 - AQTAC recommendation**
- **May 2007 - Regional Council action**
- **Jun 2007 - Submit to ADEQ/EPA**

For more information

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www.mag.maricopa.gov

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