

Ozone 101

Maricopa County Air Quality Department

September 4, 2014

Tom Moore

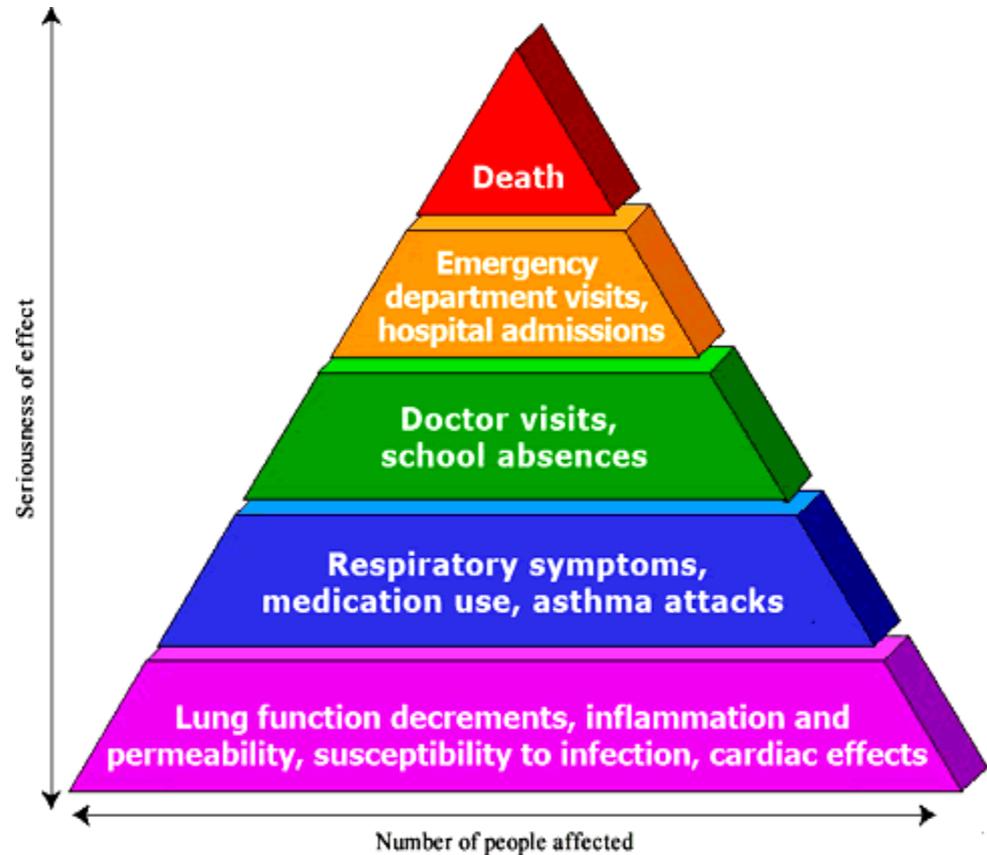
WRAP Air Quality Program Manager

WESTAR Council



Ozone

- Ozone is an air pollutant of concern, regulated under the Clean Air Act
- High ozone at ground level is unhealthy, especially affecting those with asthma and other upper respiratory illnesses
- At-risk groups include children, the elderly, and those who work or exercise outdoors



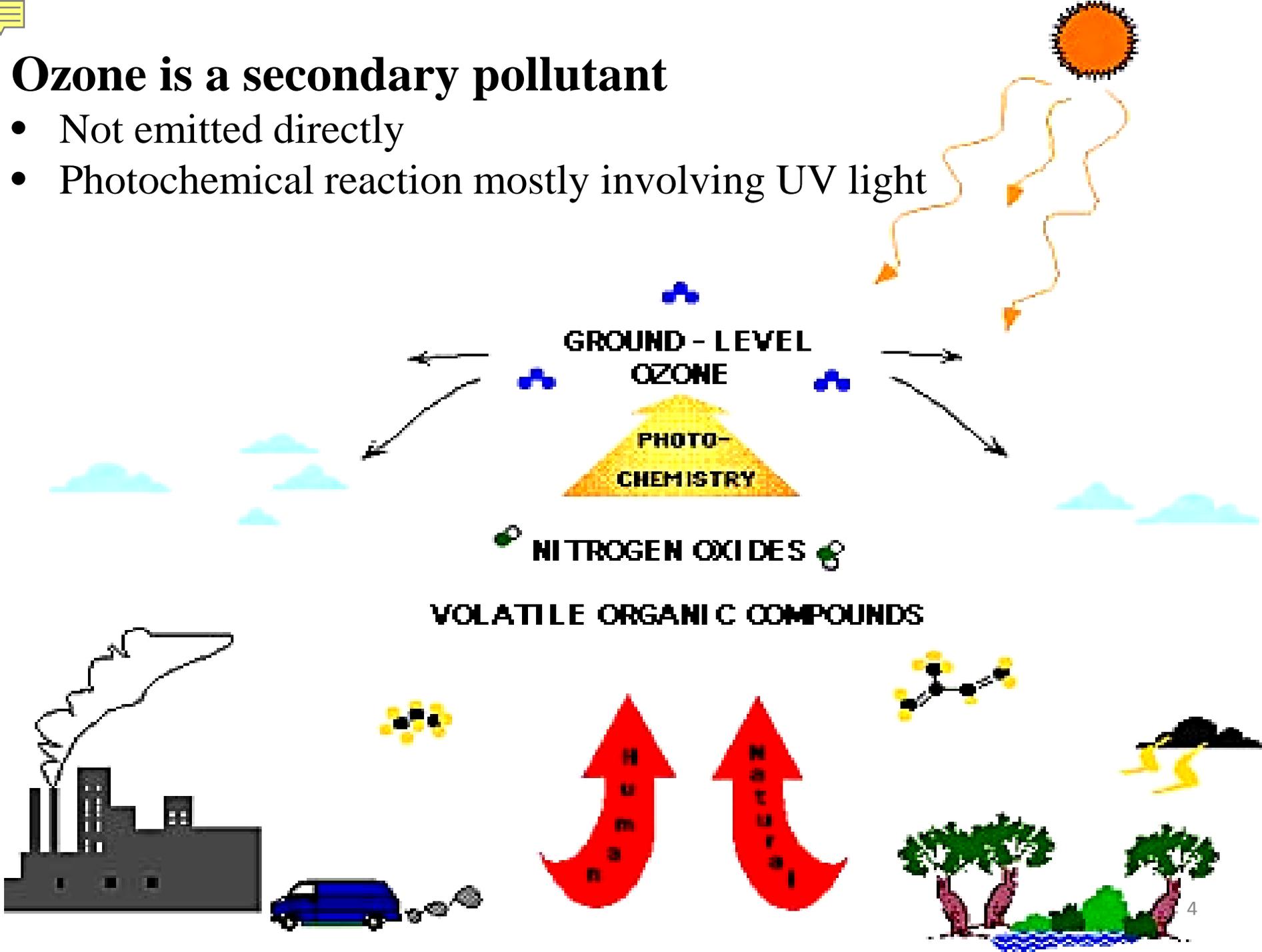
How Does Ozone Affect the Environment?

- Ground-level ozone damages vegetation and ecosystems
- Crop damage in the United States alone is estimated at \$500 million
- Also damages foliage of trees and other plants

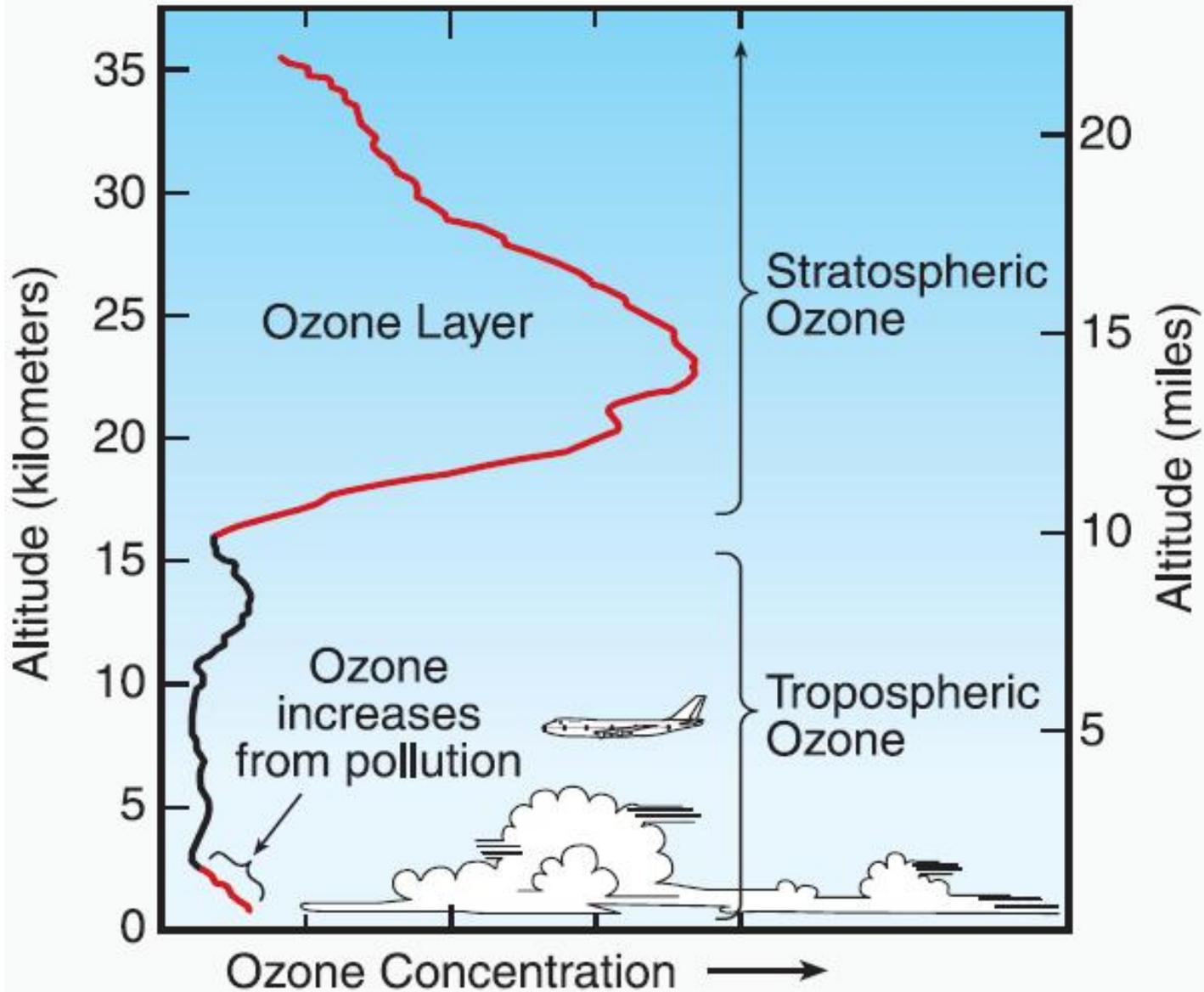


Ozone is a secondary pollutant

- Not emitted directly
- Photochemical reaction mostly involving UV light



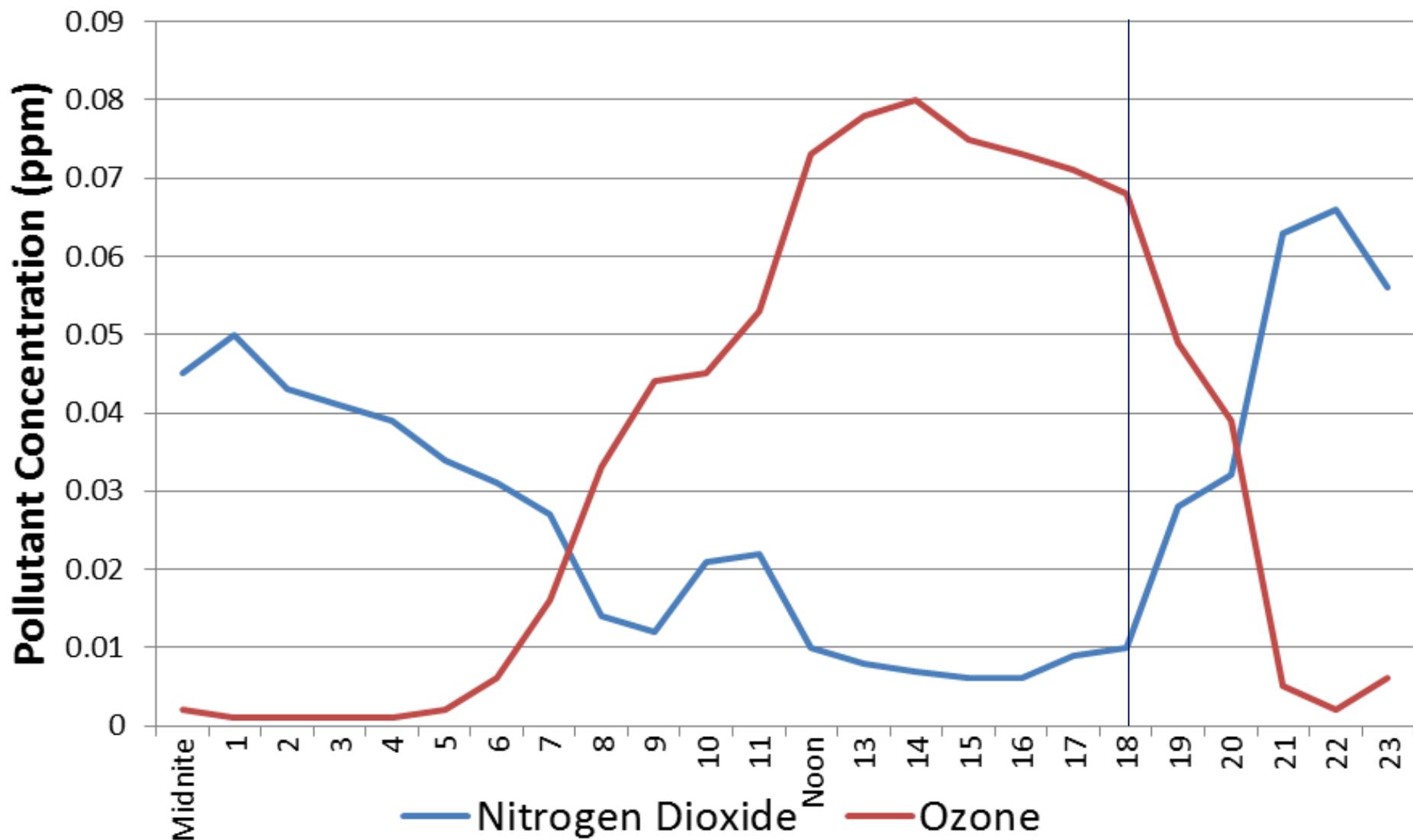
Ozone in the Atmosphere



Complex Photochemistry near the ground

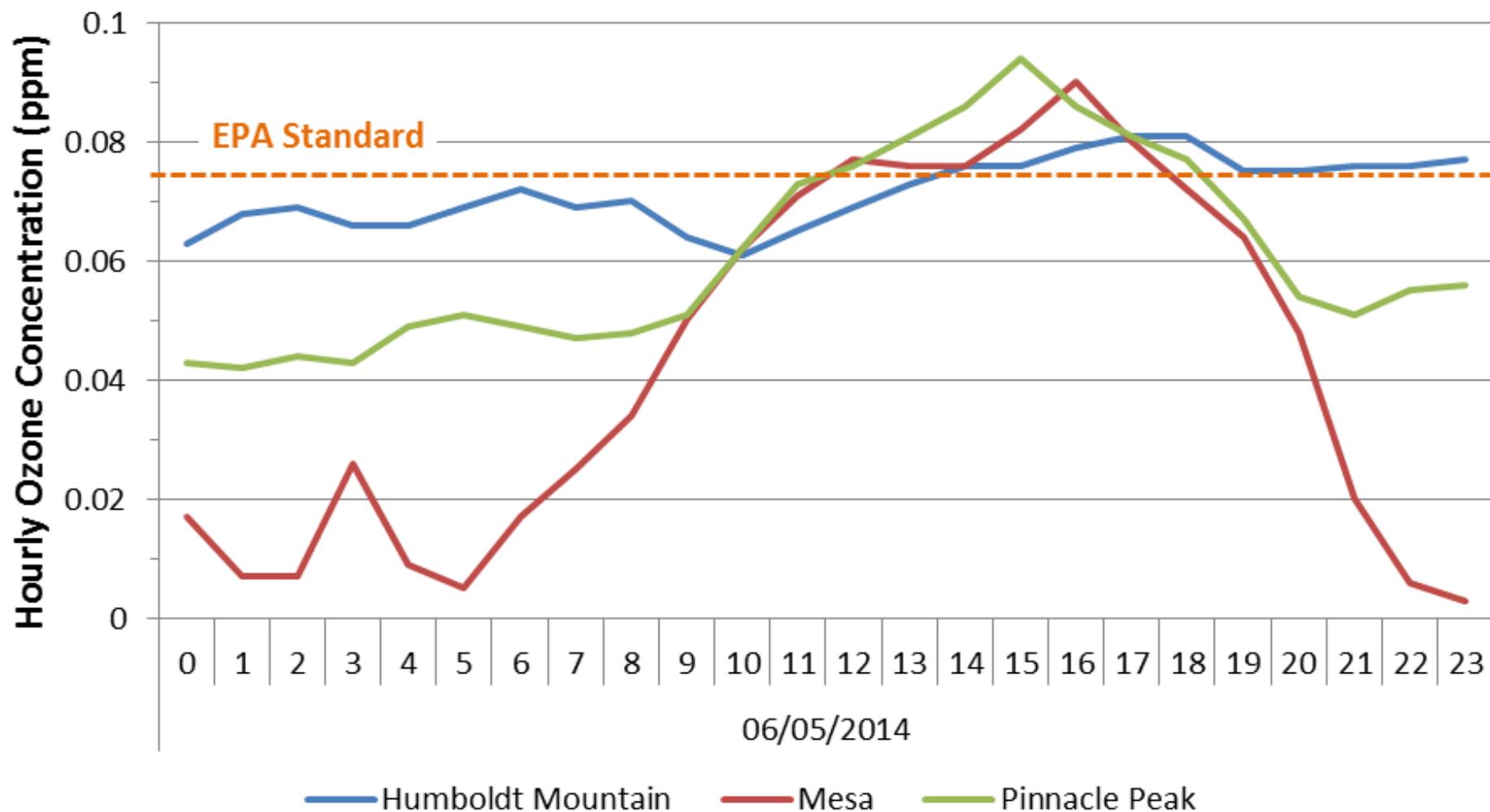
- Not a simple path to forming ozone
- NO_x in the atmosphere
 - Older, aged NO_x emissions drive ozone formation
 - Fresh NO_x attacks existing ozone
 - Reduces ozone downwind of high traffic areas and smokestacks
 - Increases ozone as NO_x plume ages and mixes away from source
- NO_x and ozone peak at different times of day

Typical Hourly Profile for Ozone and NO₂ Concentrations at an Urban Site



Data for the Central Phoenix monitoring site, June 5, 2014

Hourly Ozone Concentrations at Urban, Exurban and Remote Sites, June 5, 2014

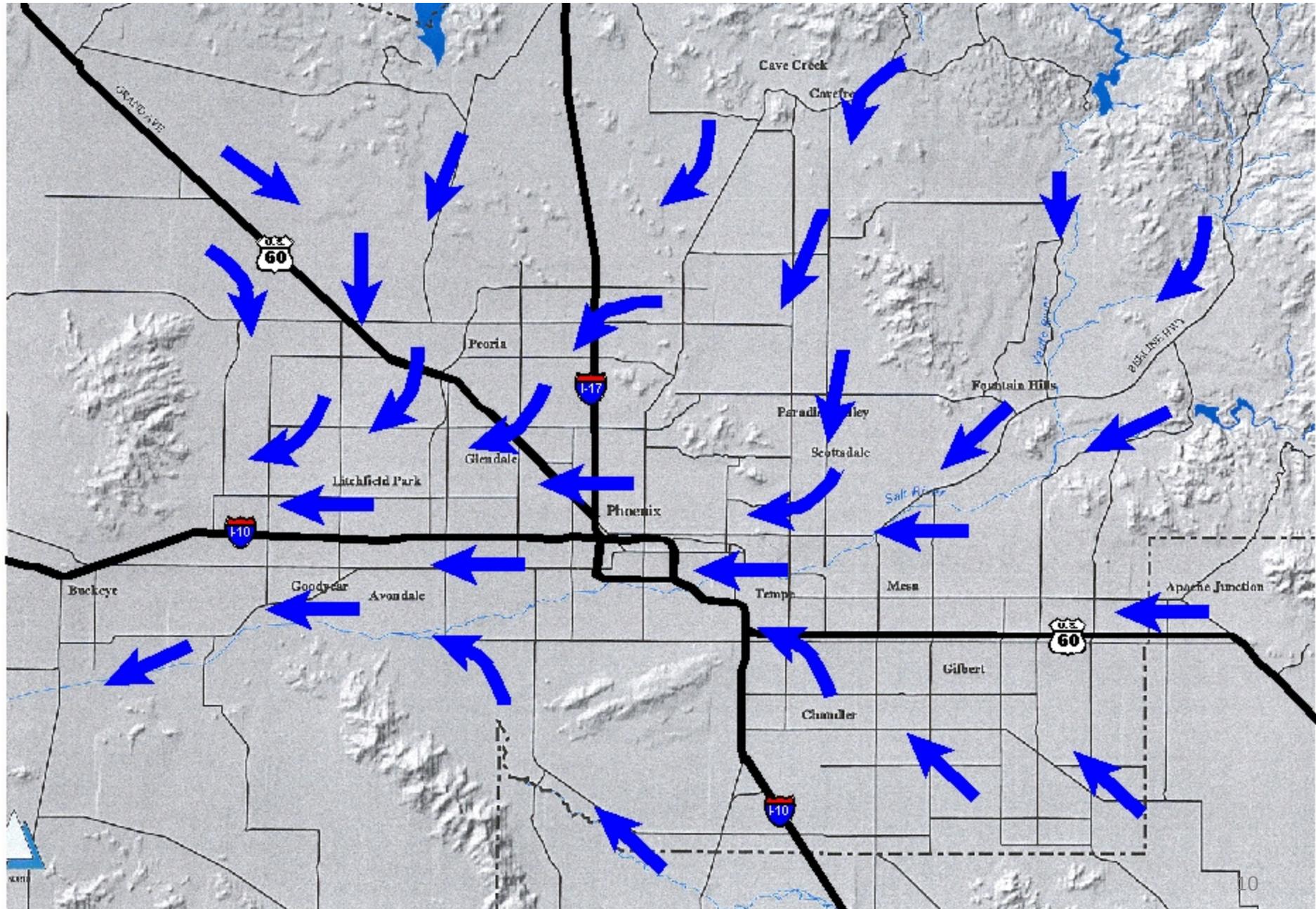




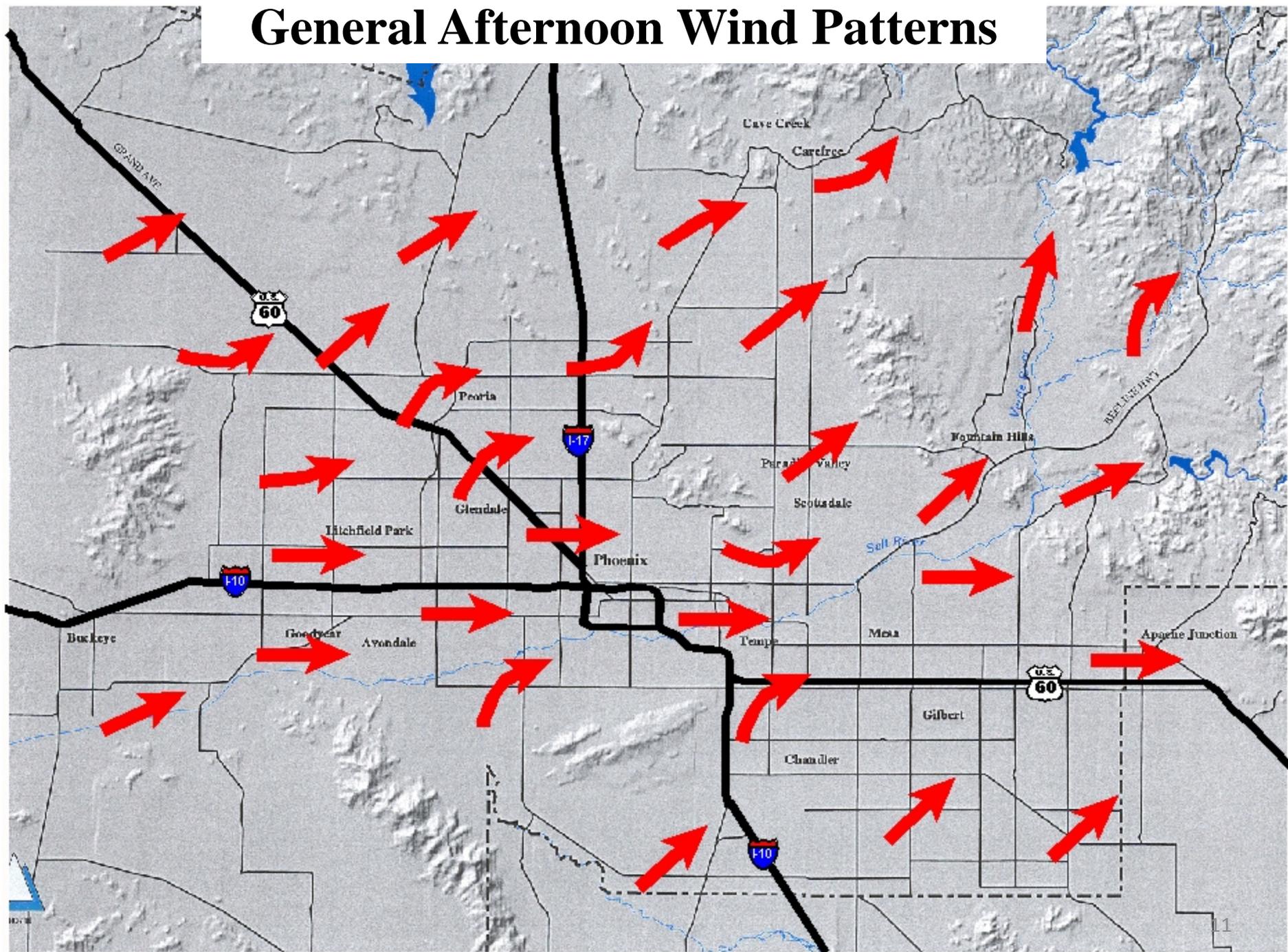
Weather and geography are the most important influences

- Atmospheric stability
 - Phoenix area has lowest average wind speeds of major metro areas in U.S.
 - Temperature inversions occur in summer too
- Topography
 - Broad alluvial basin, surrounded by small mountain ranges
 - Surface heating and cooling direct air movement

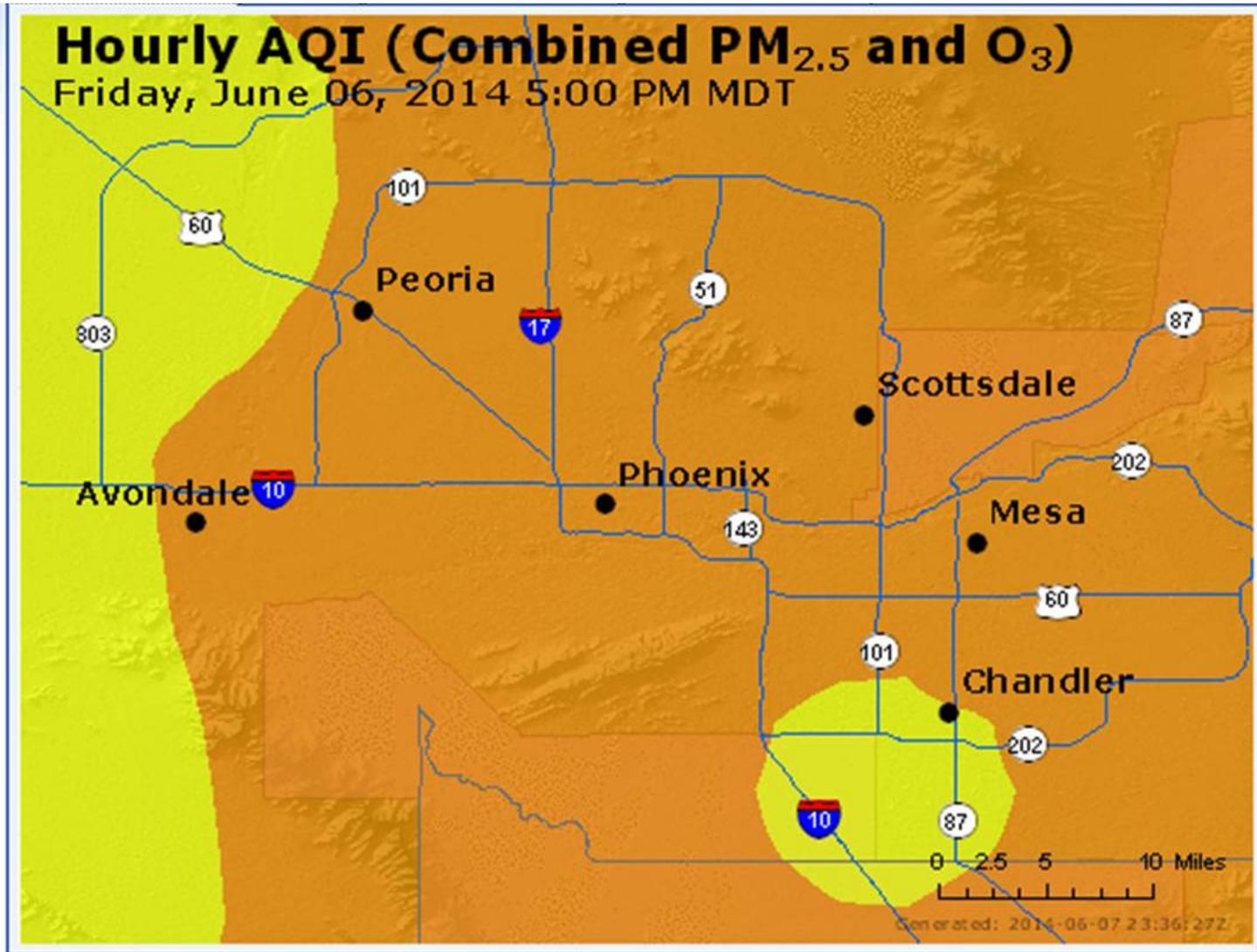
General Late Night/Early Morning Wind Patterns



General Afternoon Wind Patterns



June 6, 2014 Phoenix metro area Ozone and PM pollution from MCAQD & ADEQ monitors



Good

Moderate

USG

Unhealthy

Very Unhealthy

Hazardous

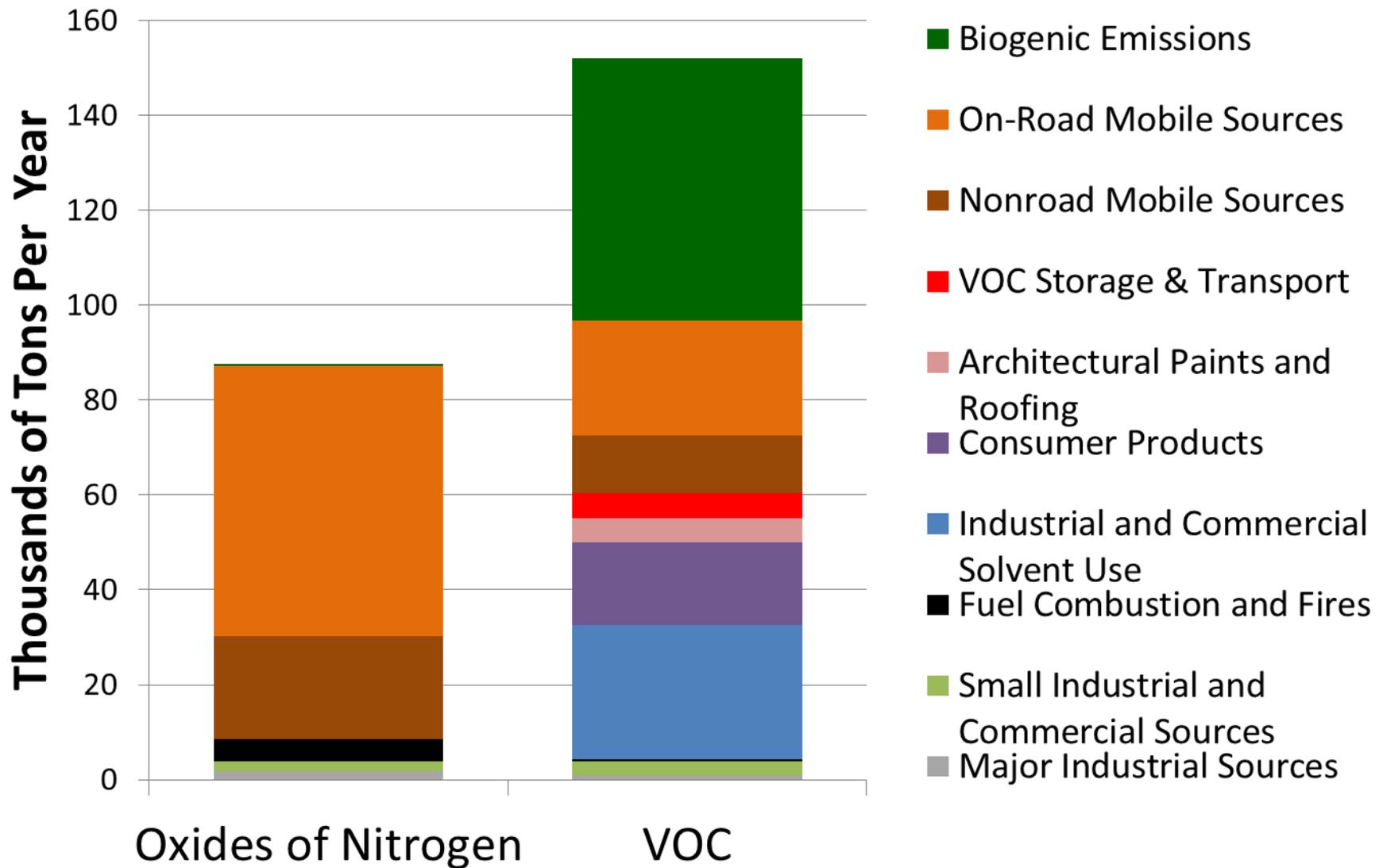
! Action Day



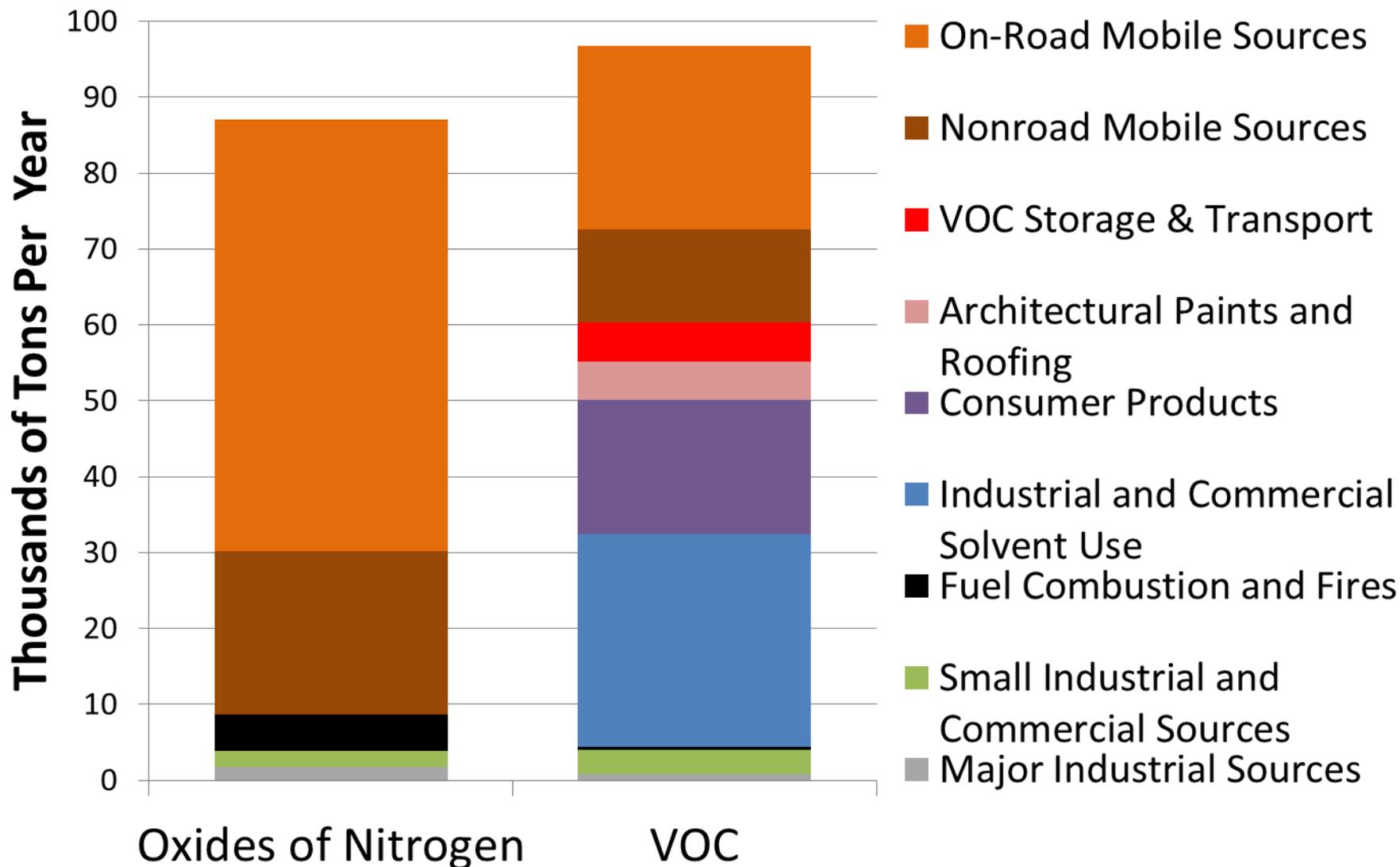
Ozone Precursor Pollutants and Their Sources

- In the metro Phoenix area, sources of these pollutants include automobiles, gas-powered motors, and many smaller sources:
 - Gas stations
 - Consumer products
 - Solvents used in paint shops and finishing operations
 - wherever natural gas, gasoline, diesel fuel, kerosene, and oil are combusted
- Precursor behavior and characteristics
 - Timing of activity
 - Practices
 - Behavior

2011 Periodic Ozone Emissions Inventory for the Nonattainment Area



2011 Periodic Ozone Anthropogenic Emissions Inventory for the Nonattainment Area





Evolution of EPA National Ozone Standard 1971-2008

| Year | Primary/ Secondary | Indicator | Averaging Time | Level (ppm) | Form |
|------|-----------------------|-------------------------------|-------------------|----------------|---|
| 1971 | Same | Total photo-chemical oxidants | 1-hour | 0.08 | Not to be exceeded more than one hour per year |
| 1979 | Same | Ozone | 1-hour | 0.12 | Effectively, no more than 3 exceedance days over a 3-year period |
| 1997 | Same | Ozone | 8-hour | 0.08 | Annual fourth-highest daily max 8-hr concentration, averaged over 3 years |
| 2008 | Same | Ozone | 8-hour | 0.075 | Annual fourth-highest daily max 8-hr concentration, averaged over 3 years |



Future EPA National Ozone Standard

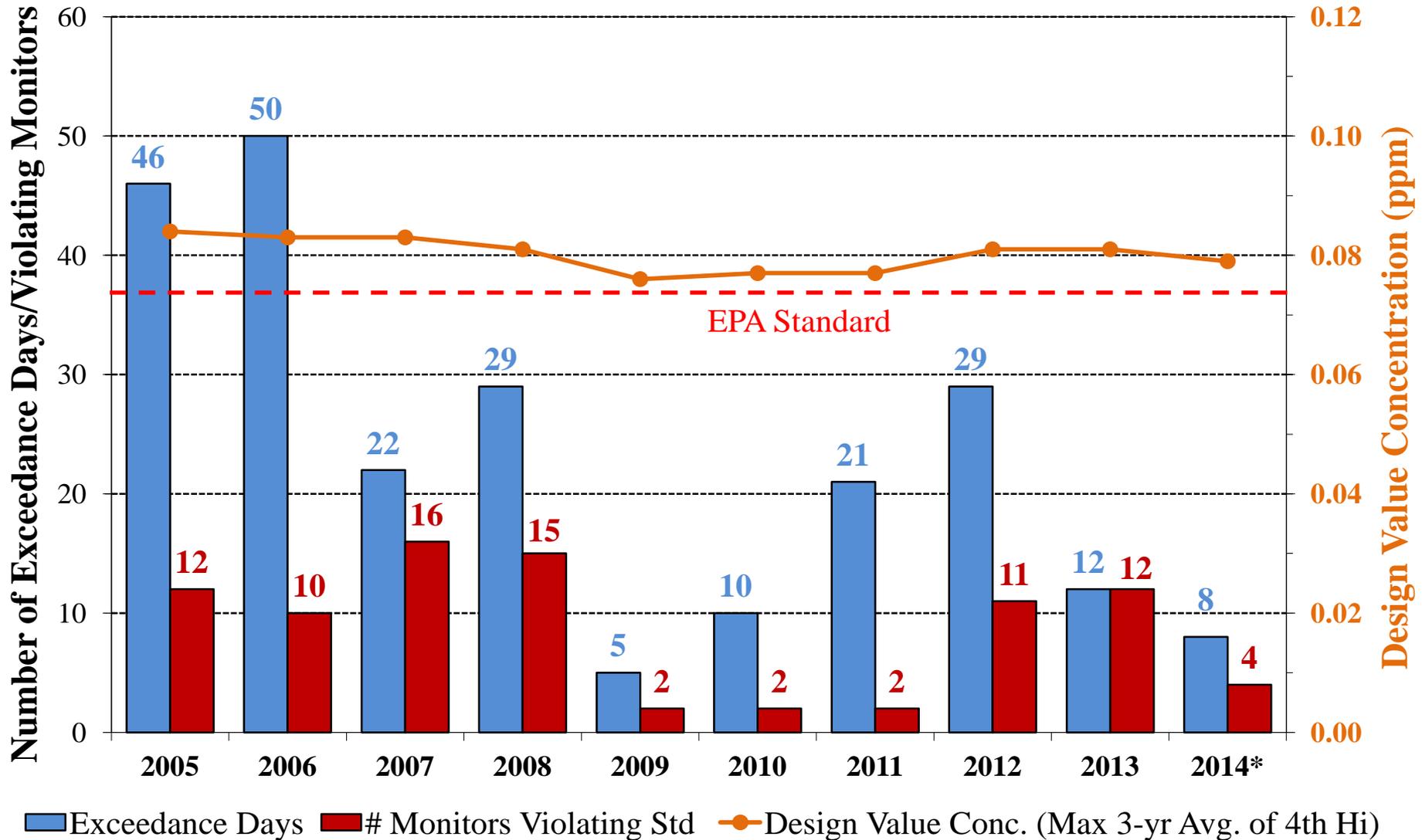
- Court-ordered deadlines
 - EPA (re)considering revised Ozone health standard in a range of 60 to 70 ppb
 - EPA also considering a secondary Ozone standard for ecosystem protection
 - Growing season / daylight hours-weighted cumulative metric



Compliance with EPA National Ozone Standard

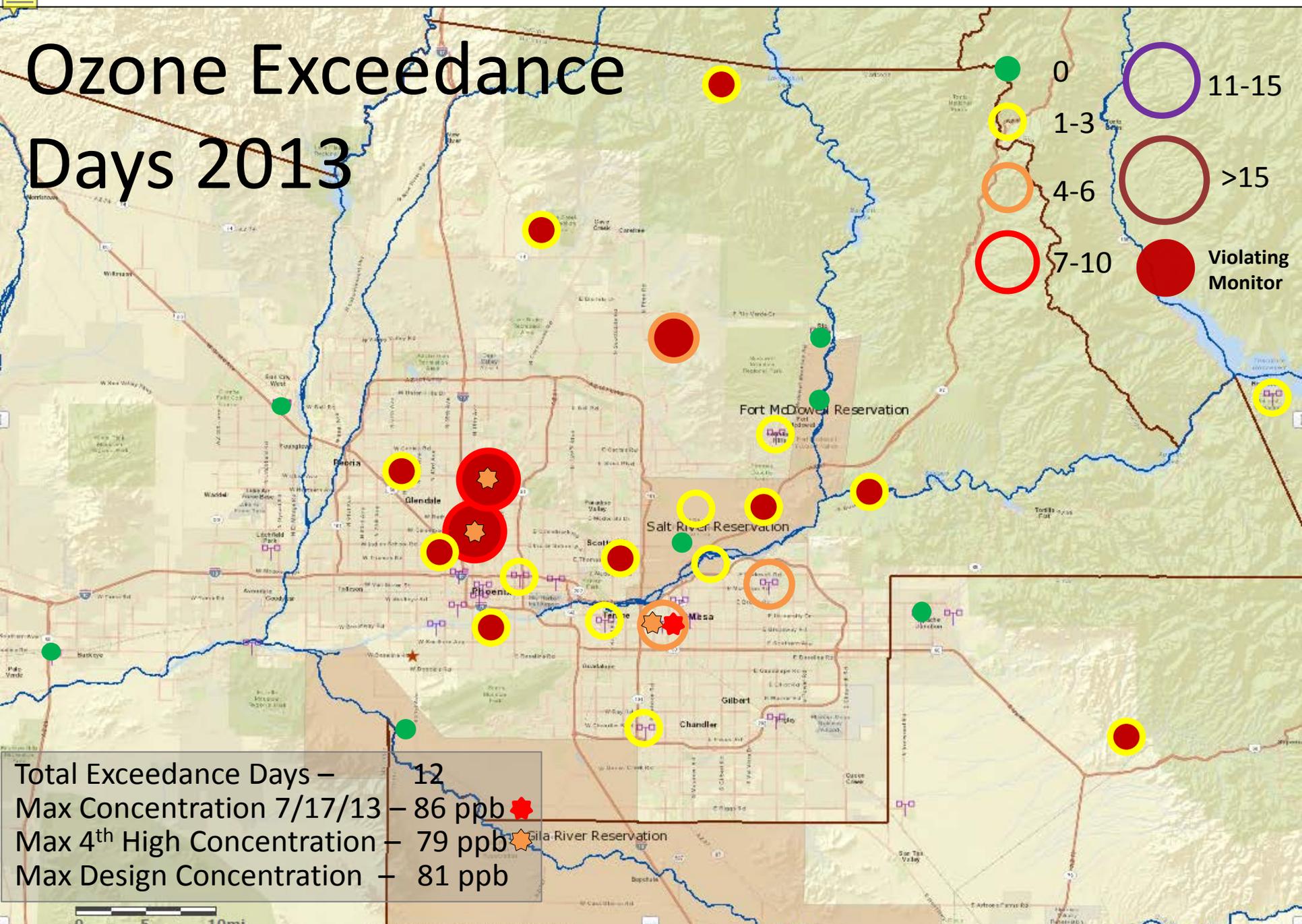
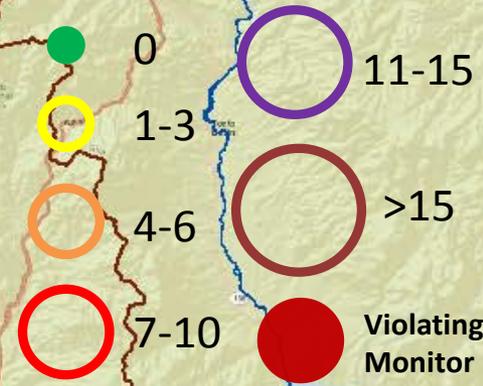
- Measured at ground station sites, highest 8-hour average each day
 - 4th highest values each year are averaged over 3-year periods to determine compliance (e.g., 2009-11, 2010-12, 2011-13)
 - Statistic is called a “Design Value” for that site for that time period
 - 3-year average of the 4th highest measured values is used to prevent flip-flopping in and out of attainment

8-hour Average Ambient Ozone Compliance Based on 2008 Federal Standard, Phoenix Nonattainment Area, 2005 – 2014*



*2014 data are preliminary through 8/31/14 and do not include tribal monitors.

Ozone Exceedance Days 2013



Total Exceedance Days – 12
 Max Concentration 7/17/13 – 86 ppb
 Max 4th High Concentration – 79 ppb
 Max Design Concentration – 81 ppb



Maricopa (Ak-Chin) Reservation

Summary

- Ozone is most the complicated air pollution problem in metro Phoenix
 - Chemistry
 - Meteorology
 - Sources
 - Persistent, long-term challenge
 - Standard becoming more stringent
- Public health problem
 - Also affects ecosystems and plant health