Ozone NAAQS Implementation: Addressing Background Ozone

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WESTAR
Western States Air Resources Council

WRAP
Western Regional Air Partnership

Five Ozone Planning Needs under the Clean Air Act

1. Ozone NAAQS planning – requires photochemical modeling for SIP attainment demonstrations for nonattainment areas.
2. Ozone transport SIPs – photochemical source apportionment modeling can be used to quantify U.S. ozone transport between states and other jurisdictions.
3. Identification of Ozone exceptional events caused by stratospheric intrusion and wildfires – requires observations and data analysis, supplemented with global/regional scale photochemical models and regression models.
4. Identification of international transport of Ozone for §179B demonstrations - requires nested global and regional scale photochemical modeling to evaluate international transport of Ozone.
5. Identification of §182 Rural Transport Areas – combination of data analysis and photochemical modeling.

In the West under CAA, whom to do which ?

Alone or together ?

- States/Locals
- Regional
- Federal

What is U.S. Background Ozone?

Any ozone formed from sources or processes other than U.S. manmade emissions of NOx, VOCs, CH4 and CO.

Sources may include:

- International transport of ozone precursors;
- Stratospheric intrusion of ozone;
- Lightning;
- Biogenic emissions;
- Wildfire

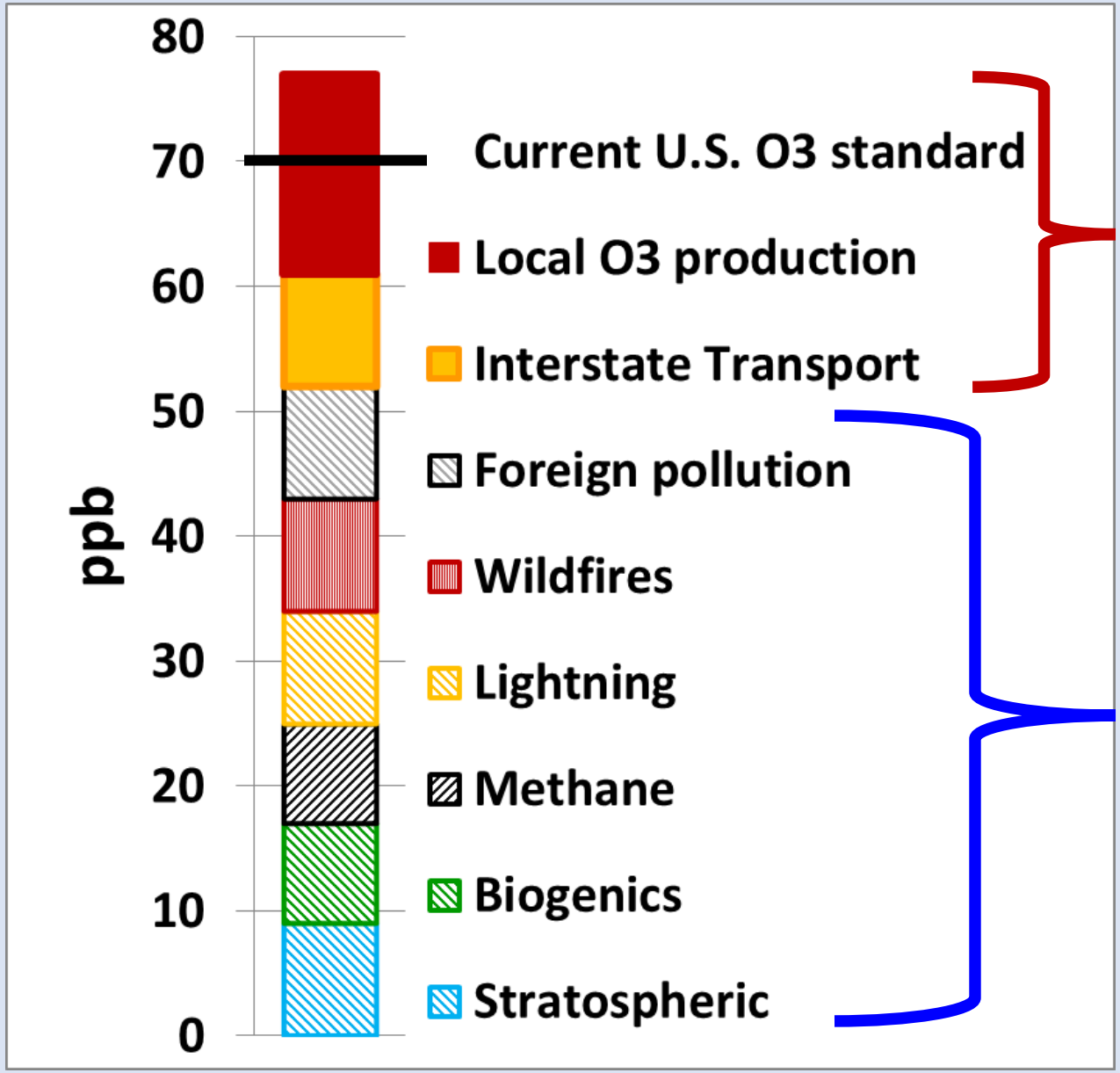
Along the west coast, seasonal mean concentration is 30-50 ppb (Jaffe et al., 2004)

O_3 Design Values at pairs of monitoring sites

Site location	Meters Above Sea Level	O_3 Design Value
Bend, OR	**1135**	**59**
Mt. Bachelor, OR	**2763**	**75**
Carbon, WY	**2015**	**55**
Centennial, WY	**3178**	**66**
Camp Dodge, NH	**451**	**57**
Mt. Washington NH	**1914**	**67**

For nearby locations, higher elevation sites show much higher O_3 design values, demonstrating how background ozone is more important at elevation.

Why does background O_3 matter for NAAQS planning?



Controllable sources

- Consider U.S. emissions trends
- (further) by States if nonattainment
- by **EPA if allowed by CAA / litigation record / policy, i.e., CSAPR**

Background / uncontrollable sources

- rolling 3-year NAAQS compliance statistic
- States have to react to variability and magnitude

Sources of surface O_3

Domestic/controllable O_3 sources in yellow.

Foreign/non-controllable O_3 sources in blue.

Challenges to quantifying US Background Ozone for SIPs

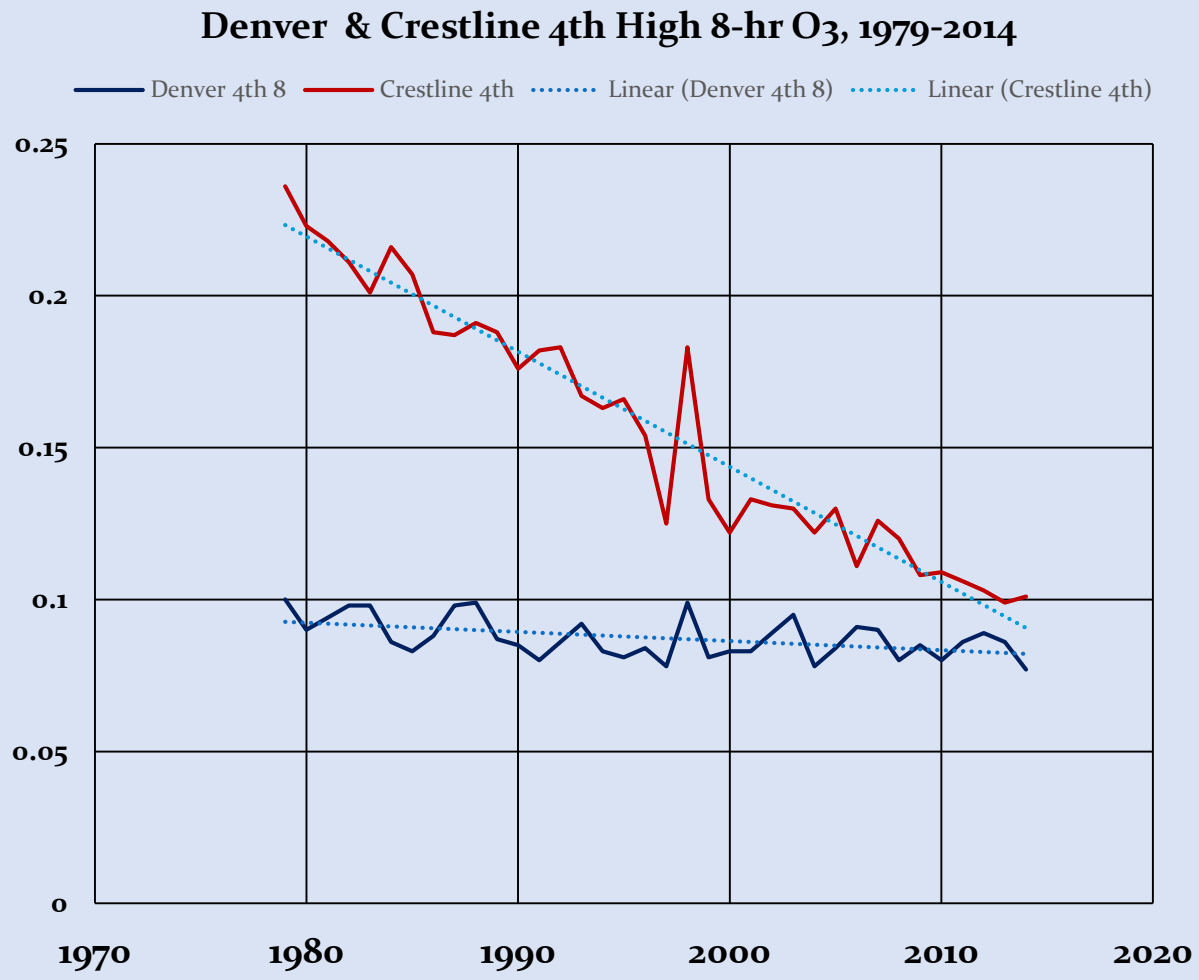
- Complex, contributing sources like wildfire, international transport and stratospheric intrusion that are difficult for estimating emissions, modeling and monitoring
- Relatively small fractions of local anthropogenic emissions that are controllable
- Need for a chemical transport model initialized using boundary conditions derived from global models—benefits and limitations of various models for different uses

O3 trends at high elevation sites in Western U.S.

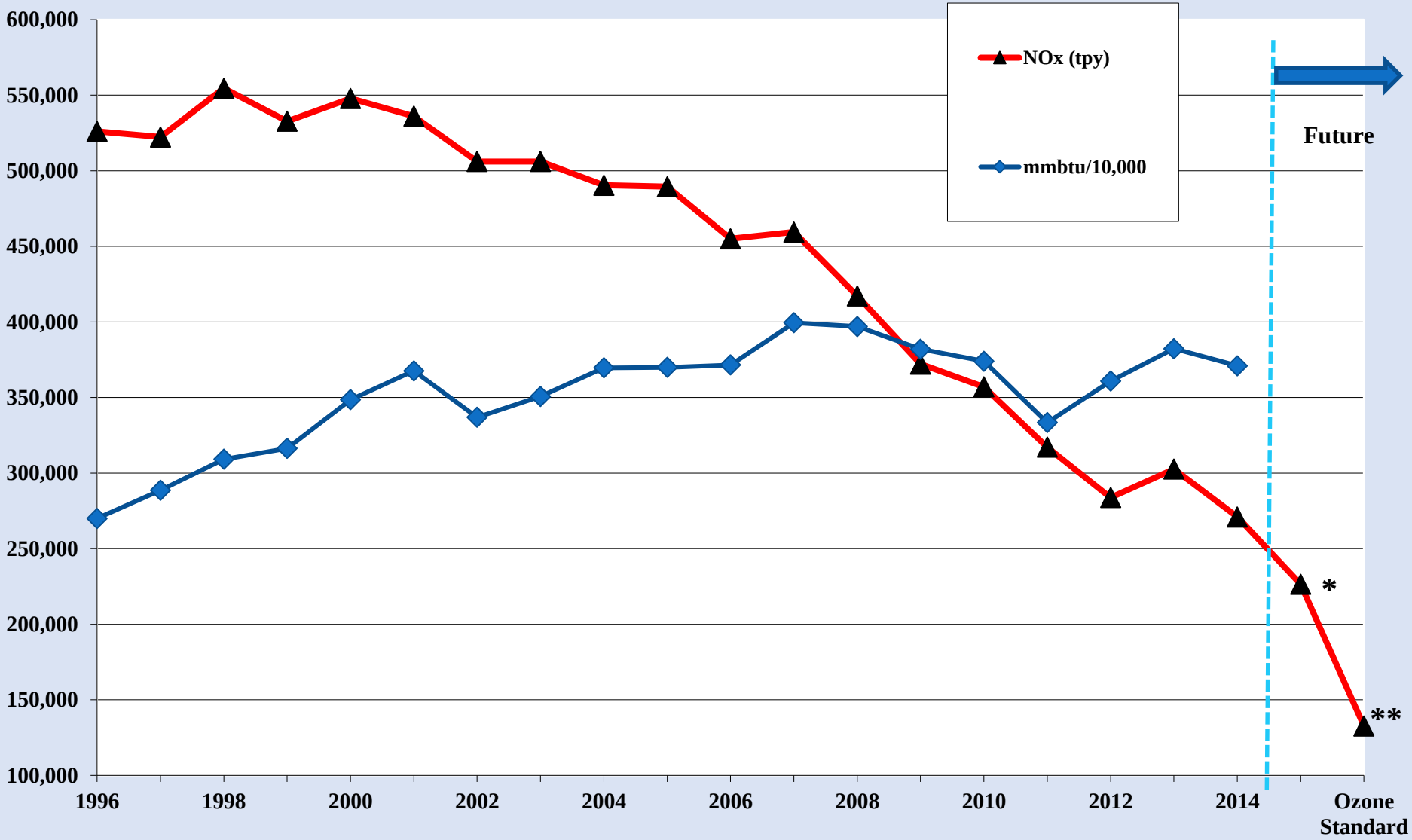
Flat O3 trend in Denver

Need to understand roles of:

- International and interstate transport
- Wildfires
- Stratospheric O3
- Population growth
- Oil and gas development
- Seasonal variation



Western Interconnect Fossil Fuel Power Plant Emissions



1996through 2014 data from EPA data for fossil fuel-fired electrical generating units in the 11-state Western Interconnect

* Additional NOx reductions estimate - BART controls from Regional Haze baseline planning

** Further NOx reductions estimate from applying maximum post-combustion controls to all remaining units

Strategies for Improving US Background Ozone Estimates

- More monitoring data to improve characterization of background O_3 and to evaluate the accuracy of model-based estimates of USB:
  - More measurements to improve characterization of vertical O_3 profiles
  - Network of O_3 LIDAR vertical profiles (NASA TOLNET pilot study)
  - More ground based O_3 and precursor measurements in rural areas
  - Large-scale field experiments coordinated with NASA TEMPO project
- Perform comprehensive model evaluation studies using new monitoring data to assess contributions to background O_3.
  - Do global models accurately estimate BC inflow?
  - Do regional models accurately simulate natural sources of O_3 from wildfires and biogenic precursors?
  - Do regional models accurately simulate vertical mixing of O_3?
  - ***Need improved projections of future emissions for uncontrollable sources as well as trends in global O3***.
- Increase state/federal & planner/researcher collaborations to improve modeling and data analysis for O3 transport, wildfires, and stratospheric intrusion.

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