

# Weight of Evidence Approach to Support the Denver 8-hr Ozone SIP Modeling

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# Rationale for a Weight of Evidence (WOE) Analysis

- EPA's 8-hour ozone modeling guidance recommends a WOE analysis to support the modeled attainment determination if the maximum modeled 8-hour ozone future design value is between 0.082 ppm and 0.087 ppm at more than one monitor.
  - The future 2010 base year model analysis had four monitoring locations (Rocky Flats North, Fort Collins West, Chatfield and NREL) that had modeled design value concentrations that fall into the 0.082-0.087 ppm range.

# Why is a weight of evidence needed for attainment demonstration purposes?

- Models are necessary and reasonable but simplistic approximations of complex phenomena.
- Model inputs (emissions, meteorological, IC/BC, landuse, etc.) and model code are subject to uncertainty.
- In recognition of these uncertainties, ozone modeling has evolved:
  - from using models in an absolute sense w/ attainment “bright lines” (90s),
  - to currently using models in a relative sense to project an expected change in ozone which can be used to assess whether attainment will be reached in the future via a “bright line” determination (recent national rules and guidance),
  - The future is to use modeling as the primary element in a suite of tools that assist in an assessment of present and future air quality trends (75 ppb standard attainment demonstrations).

# What is a Weight of Evidence Analysis?

- **Weight of evidence differs from supplemental analyses in that:**
  - WOE is a set of supplemental analyses for areas whose attainment test results indicate future AQ levels near the NAAQS.
  - WOE combines and weighs the various supplemental analyses with the results of the attainment test
  - The goal of the WOE is to present an aggregate, weighted, and subjective conclusion as to whether a set of control strategies will yield attainment by the relevant future year.

# Elements of the Supplemental Analyses for the for the Denver SIP WOE

- Review of the ozone conceptual model for the north front range
- Use other modeled metrics to assess the changes in ozone levels in the NAA from 2006 base case to 2010 base case to 2010 control case
- Alternative attainment test methodologies
- Air quality related trends
- Assess the efficacy of SIP, state-only and voluntary control strategies

# Ozone Conceptual Model for the North Front Range

- A conceptual model describes the local meteorological conditions and associated large-scale weather patterns experienced during periods of high ozone
- Review the understanding of the meteorology, geography, inventory and chemistry related to ozone production in the Denver/NFR region
- Back trajectory analysis
- Emission trends vs. monitored VOC levels
- VOC/NO<sub>x</sub> ratios
- Meteorological analysis including 500 mb trends analysis, temperature effects, etc.
- Ozone trend analysis eliminating the effects of meteorology
- Weekend-weekday effects
- Further analyze the base-year model performance

# Alternative modeled metrics to assess the changes in ozone levels in the NAA

- Supplemental analyses and additional modeling metrics that could be used to assess the changes in ozone levels:
  - % change in total ozone  $\geq 85$  ppb,  $\geq 80$  ppb, etc.
  - % change in grid cells  $\geq 85$  ppb  $\geq 80$  ppb, etc.
  - % change in grid cell hours  $\geq 85$  ppb  $\geq 80$  ppb, etc.
  - % change in maximum modeled 8-hr ozone  $\geq 80$  ppb, etc.

# Alternative Attainment Test Methodologies

- Supplementary analysis that could be used for the attainment test:
  - Use EPA's recommended average of the three Design Value average over a 2004-2008 timeframe
    - Currently using a single 2005-2007 design value
  - Use different thresholds for selecting days for the relative response factor (RRF) calculation

# Emissions and Air Quality Trends

- Supplementary trend analysis
  - Emissions Trends
  - Trends in monitored 1<sup>st</sup> maximum and 4<sup>th</sup> maximum ozone values
  - Trends in three year design values

# Assess the Efficacy of SIP, State-only and Voluntary Control Strategies

- Address the potential reduction in ozone due to a variety of emissions reduction scenarios using tools such as:
  - The suite of sensitivity tests
  - The ozone source apportionment technology analysis which assesses the impact of various emissions source categories on key monitors

## Conclusions for the WOE

- The WOE will combine and weigh the various supplemental analyses with the results of the attainment test resulting in an aggregated, qualitative and quantitative conclusion as to whether the proposed set of control strategies will result in the Denver Front Range reaching attainment by 2010.