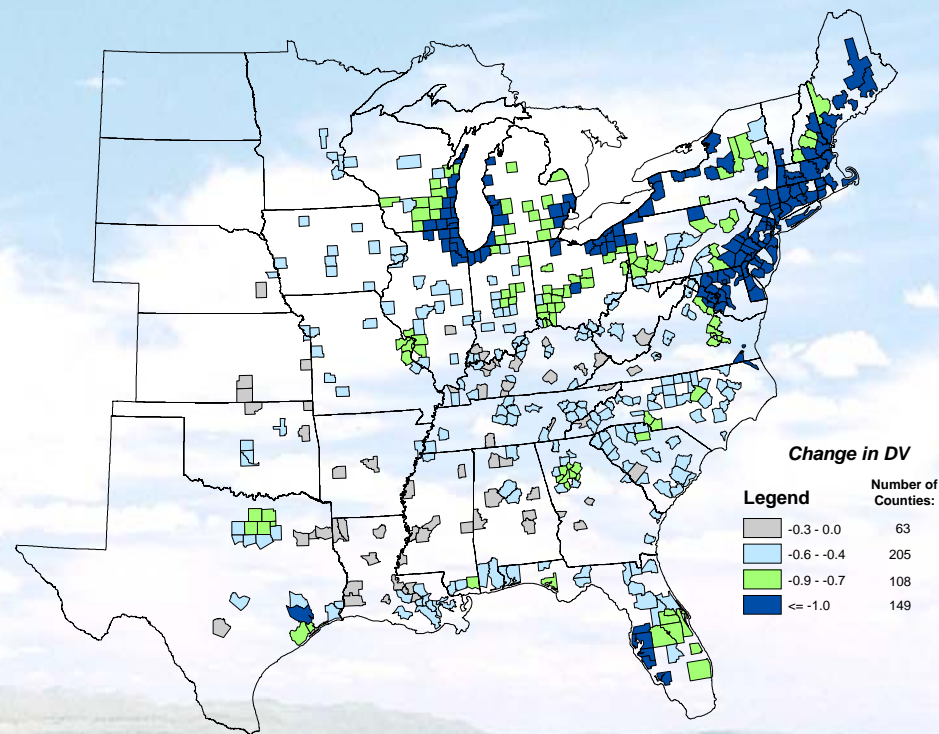


Supplemental Analyses and Weight of Evidence

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Questions to be answered in the next 30 minutes

- Why are supplemental analyses and weight of evidence needed for attainment demonstration purposes?
- What does the draft final ozone guidance say about supplemental analyses and weight of evidence?
 - Do attainment demonstrations have to include supplemental analyses?
 - How are supplemental analyses different from weight of evidence?
 - Are all analyses eligible for a weight of evidence attainment determination?
 - Specifically, what types of supplemental analyses should be completed as part of an attainment demonstration?
 - Do you have any examples of what a weight of evidence analysis might look like?
- What changes are being considered regarding weight of evidence resulting from comments on the draft final ozone guidance?
- What is the meaning of life? (*time permitting*)

Why are supplemental analyses and weight of evidence needed for attainment demonstration purposes?

- By definition, models are 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, the regional modeling community has evolved over the past decade:
 - from using models in an absolute sense w/ attainment “bright lines” (90s),
 - to using the model 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),
 - to using the modeling as the primary element in a suite of tools that assist in an assessment of present and future air quality trends (next round of attainment demonstrations).

Why are supplemental analyses and weight of evidence needed for attainment demonstration purposes?

- As part of their recommendations to transform the SIP process into one that is more performance-oriented, the CAAAC AQM workgroup recommended increased use of weight of evidence within State/Local attainment demonstrations.
- *“EPA, in conjunction with S/L/T and affected stakeholders, should modify its guidance to **promote weight-of-evidence** (WOE) demonstrations for both planning and implementation efforts. In particular, these demonstrations should reduce reliance on modeling data as the centerpiece for SIP/TIP planning, and should increase use of monitoring data and analyses of monitoring data, especially for tracking progress. Enhanced tracking and ambient monitoring data is a better use of available resources than intensive local modeling.”*
- Guidance notes that AQ models still represent best tool for integrating emissions and meteorological data with known chemistry.

What does the draft final ozone guidance say about supplemental analyses and weight of evidence?

- All attainment demonstrations should include supplemental analyses to assess the validity of the modeled attainment test projection.
 - Guidance suggests amount of supporting information should be greatest for those areas with modeled projections near the NAAQS.
- Three separate types of supplemental analyses should be considered within an attainment demonstration.
 - Additional air quality modeling evidence
 - Trends in ambient air quality and emissions
 - Other air quality analyses that can identify potential control targets

What does the draft final ozone guidance say about supplemental analyses and weight of evidence?

- “Weight of evidence” differs from “supplemental analyses” in that:
 - 1) WOE is a set of supplemental analyses for areas whose attainment test results indicate future AQ levels near the NAAQS.
 - 2) WOE combines and weights the various supplemental analyses with the results of the attainment test ... the end result being **an aggregate, weighted, and ultimately subjective conclusion** as to whether a set of control strategies will yield attainment by the relevant future year.

What does the draft final ozone guidance say about supplemental analyses and weight of evidence?

- Can all attainment demonstrations use weight of evidence aggregations to “reverse” the conclusion from the modeled attainment test?
 - Yes, in both directions
 - model projects attainment, yet WOE suggests nonattainment; or,
 - model projects nonattainment, yet WOE suggests attainment
 - However, the further the attainment projection is from the NAAQS, the more compelling the contrary evidence produced by corroboratory analyses must be to draw a conclusion differing from that implied by the modeled attainment test results.

What changes are being considered regarding WOE as a result of comments on the draft final ozone guidance?

- Table 2.1: Guidelines for WOE determinations
 - Several commenters suggested lowering the suggested concentration range where a WOE “reversal” would be most applicable.
 - Many felt 90 ppb was too high.
 - Several commenters felt that WOE should also be applied below 85.
 - Upon further review ...
 - Based on recent modeling for CAIR and other rules, we know that to reduce 8-hour ozone by ≥ 3 ppb requires a large amount of emissions reductions.
 - **Proposal: change the table’s range from 85-90 to 83-87 ppb.**
 - Guidance will be made more clear that monitors with values just below the standard also need to make a case for why they should be considered attainment.

Specifically, what types of supplemental analyses should be completed as part of an attainment demonstration?

Element 1: Additional AQ Modeling

- In some cases, there is still a role for the absolute model predictions to show the degree of expected AQ improvement in the future.
 - Limited to modeling applications that feature solid performance.
 - Several metrics could be considered:
 - % change in total ozone \geq 85 ppb w/in nonattainment area
 - % change in grid cells \geq 85 ppb w/in nonattainment area
 - % change in grid cell hours \geq 85 ppb w/in nonattainment area
 - % change in maximum modeled 8-hr ozone w/in nonattainment area
 - There are no thresholds in these metrics that are necessarily indicative of attainment.

Specifically, what types of supplemental analyses should be completed as part of an attainment demonstration?

Element 1: Additional AQ Modeling

- Example of Ozone WOE discussion:
 - 1) Absolute modeling metrics indicate substantial improvement in future-year O₃ \geq 85 ppb;
 - 2) Yet, there remains a small set of monitors/cells that the attainment test shows will remain nonattainment;
 - 3) However, there is demonstrable reason to believe that the model response is less certain in this area (e.g., poor performance).

8-hour Ozone Projections (2010)	Base	Controlling cell	All cells
Projected Design Value	93.0	86.7	N/A
Average change in 2002-2010 projected ozone DV	N/A	6.3	11.3
% Reduction in 2010 total nonattainment	N/A	84.2%	97.5%
% reduction in pop-weighted 2010 total NA	N/A	84.2%	97.8%
% reduction in NA area exceedance counts	N/A	73.1%	86.9%
% reduction in NA area exceedance days	N/A	75.0%	87.5%
Absolute maximum modeled ozone in NA areas	91.0	90.3	86.1

Specifically, what types of supplemental analyses should be completed as part of an attainment demonstration?

Element 1: Additional AQ Modeling

- Use of available regional (or other local) AQ modeling projections
 - In order for SA/WOE usage, one would need to make the case that the regional modeling was appropriate for use in the local area (e.g., episodes, base/future emissions, performance, etc.)
- Multiple AQ Models / Input Data Sets (aka, alternative basecases)
 - There may be different, technically-plausible combinations of models, model physics options, and model input data sets that yield acceptable base year model performance.
 - Focus on the sensitivity of estimated relative reduction factors to variations in inputs or model formulations
- Use of same modeled attainment demonstration but w/ DV_F values calculated in an alternative manner than in Guidance
 - Requires strong justification for why approach is equally valid

Specifically, what types of supplemental analyses should be completed as part of an attainment demonstration?

Element 1: Additional AQ Modeling

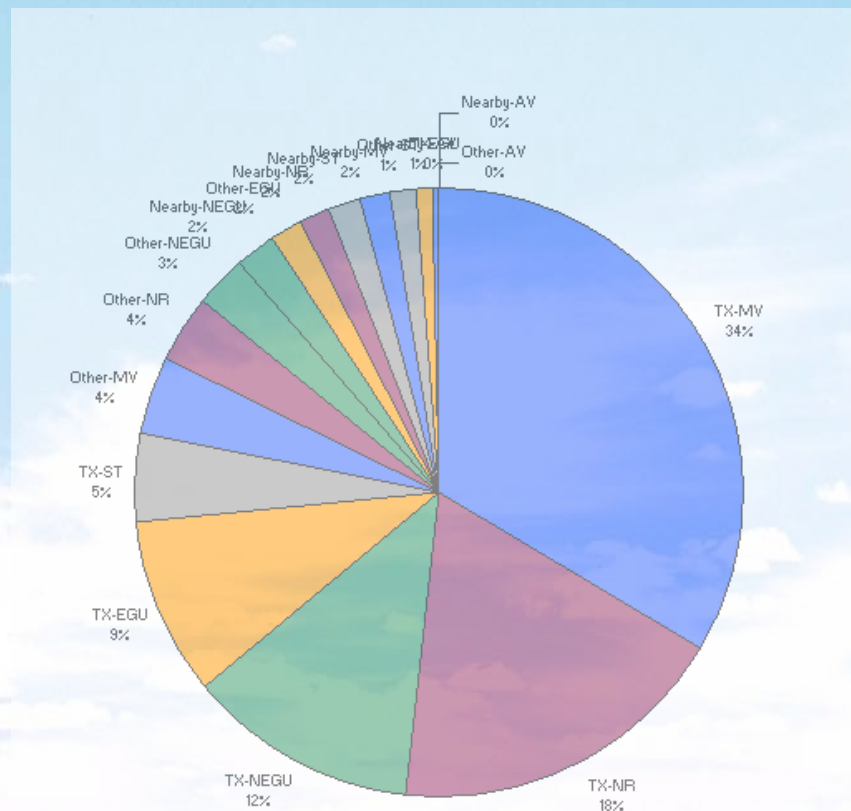
- Example of Ozone WOE discussion:
 - 1) CAIR modeling for the area projects a 2010 value of 83.5.
 - 2) There is evidence that the regional modeling is an equally valid future projection.
 - 3) Sensitivity analyses have shown that CB4 (used in base case) and SAPRC mechanisms are equally valid and perform equally well, but can cause small variations in future DV projections.

8-hour Ozone Projections (2010)	Base (CB4)	Base (SAPRC)	CAIR
Projected 2010 Design Value	86.7	84.4	83.5
Appropriate Episodes	Yes	Yes	somewhat
Appropriate Emissions (base/future)	Yes	Yes	mostly
Average model bias in base year	3.2%	-4.7%	-2.1%
Average model error in base year	18.4%	19.6%	21.2%
Subjective confidence in results	high	high	medium

Specifically, what types of supplemental analyses should be completed as part of an attainment demonstration?

Element 1: Additional AQ Modeling

- Use of alternate AQ modeling techniques to help explain why attainment should (or should not) have been demonstrated.
 - Source apportionment
 - Response surface modeling
- There may be other technically defensible ways to utilize modeling results to show attainment beyond those shown here.



Specifically, what types of supplemental analyses should be completed as part of an attainment demonstration?

Element 2: Emissions and AQ Trends

- May be possible to extrapolate future trends in 8-hour ozone based on measured historical trends of air quality and emissions.
- Several complicated elements to these analyses
 - Must normalize historical AQ data trends to account for year-to-year meteorological variations.
 - Must have a solid conceptual model of PM/O₃ formation in the area of interest (e.g., which PM species dominate, how are they formed)
 - Must have an accurate accounting of year-to-year changes in actual emissions that lead to high PM/O₃ over a given area.
- Goal is to develop a curve that relates past emissions changes to differences between historical and current AQ.
 - Curve can then be extrapolated to account for expected changes in relevant emissions by the attainment year.

Specifically, what types of supplemental analyses should be completed as part of an attainment demonstration?

Element 2: Emissions and AQ Trends

- Example of PM_{2.5} WOE discussion:
 - 1) For hypothetical area in question, sulfates and carbonaceous mass are known to comprise the majority of the PM.
 - 2) Meteorologically-adjusted AQ trends indicate that sulfate and carbon trends are downward in a period of declining EC and SO_x emissions (not shown).
 - 3) Assume that a linear extrapolation of observed past correspondence between monitored data and estimated emission changes will describe future air quality.

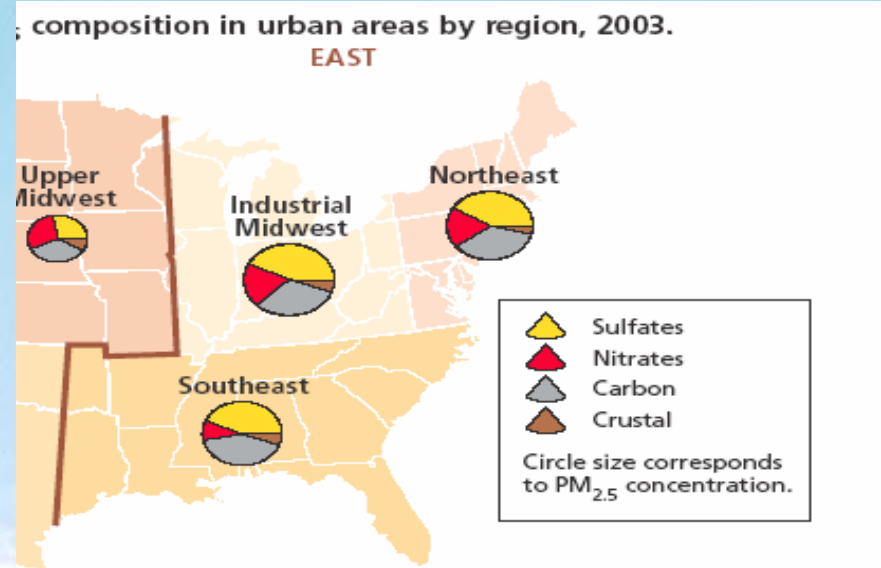
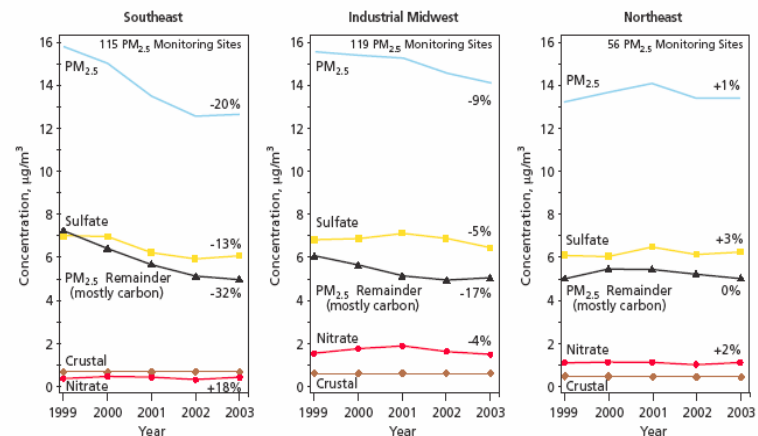


Figure 16. Trends in PM_{2.5} and its chemical constituents, 1999–2003.



Specifically, what types of supplemental analyses should be completed as part of an attainment demonstration?

Element 3: Other AQ analyses

- Observational models can take advantage of monitored data to draw conclusions about the relative importance of different types of PM_{2.5} emissions or ozone precursors emissions.
 - Strength of evidence is proportional to the completeness of the ambient data base
- Possible AQ analyses for ozone attainment demonstrations
 - Indicator species (VOC/NO_x limitation)
 - Trajectory modeling
- Possible AQ analyses for PM_{2.5} attainment demonstrations
 - Receptor modeling (CMB, PMF)
 - Hybrid models
 - Indicator species

Weight of Evidence/Supplemental Analyses: Summary

- All attainment demonstrations should include supplemental analyses to corroborate the modeling results. Supplemental analyses may include:
 - Emissions trends
 - Ambient data analysis and trends (including meteorologically adjusted trends)
 - Receptor-based and/or observational model analyses
- For those areas where attainment test projections are close to the NAAQS, an aggregate weight of evidence determination should be made subjectively based on the results of the supplemental analyses
 - For ozone, “close to the NAAQS” is defined as 83-87 ppb.
 - For PM_{2.5}, “close to the NAAQS” will be defined in the guidance.
- For those areas w/ projections further removed from the NAAQS, WOE can still be used, but it is less likely to “reverse” the modeling test results.

Weight of Evidence/Supplemental Analyses: Summary

- The weighting factors associated w/ each of the individual supplemental analyses should weigh each type of analysis according to:
 - the credibility of the analysis, as well as
 - its ability to address the question being posed (i.e., is the strategy adequate for meeting the ozone NAAQS by a defined deadline?).
- The conclusions derived from the weighted supplemental analyses are combined to make an overall assessment as to whether meeting the air quality goal is likely. This last step is an **unavoidably qualitative** one involving some subjectivity.
 - Pressure will be on EPA to ensure regional consistency
- Per separate CAAAC recommendations, EPA is considering a more formal requirement for a “tracking/accountability plan”.
 - Plan would include detailed data and emissions tracking and analyses as well as a monitoring plan.
 - May include the need to deploy additional monitors in an effort to better characterize and track air quality