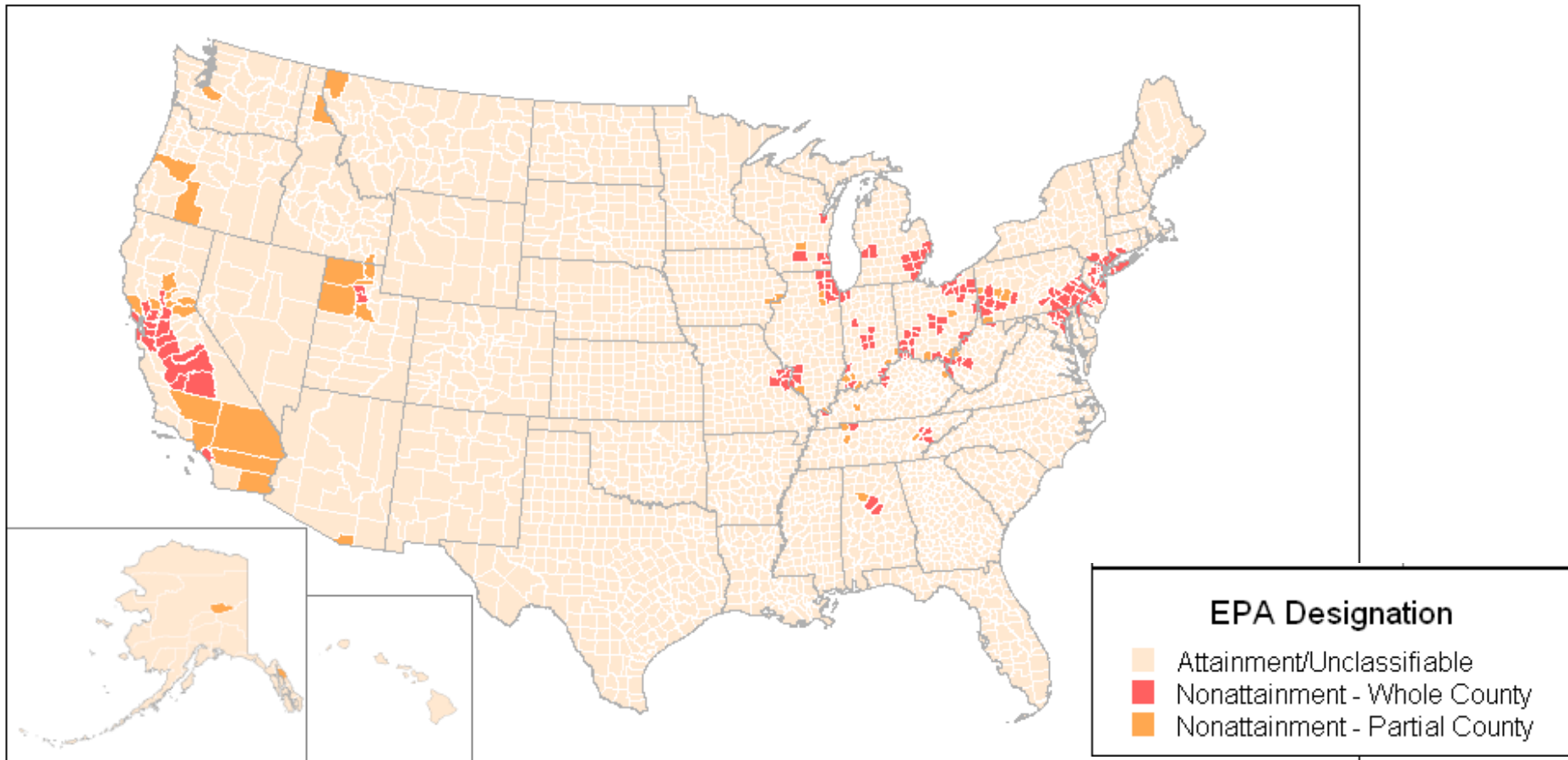


New Permitting Challenges: PM_{2.5} NAAQS and PSD Increment Modeling

Map of 24-Hour PM_{2.5} Nonattainment Areas

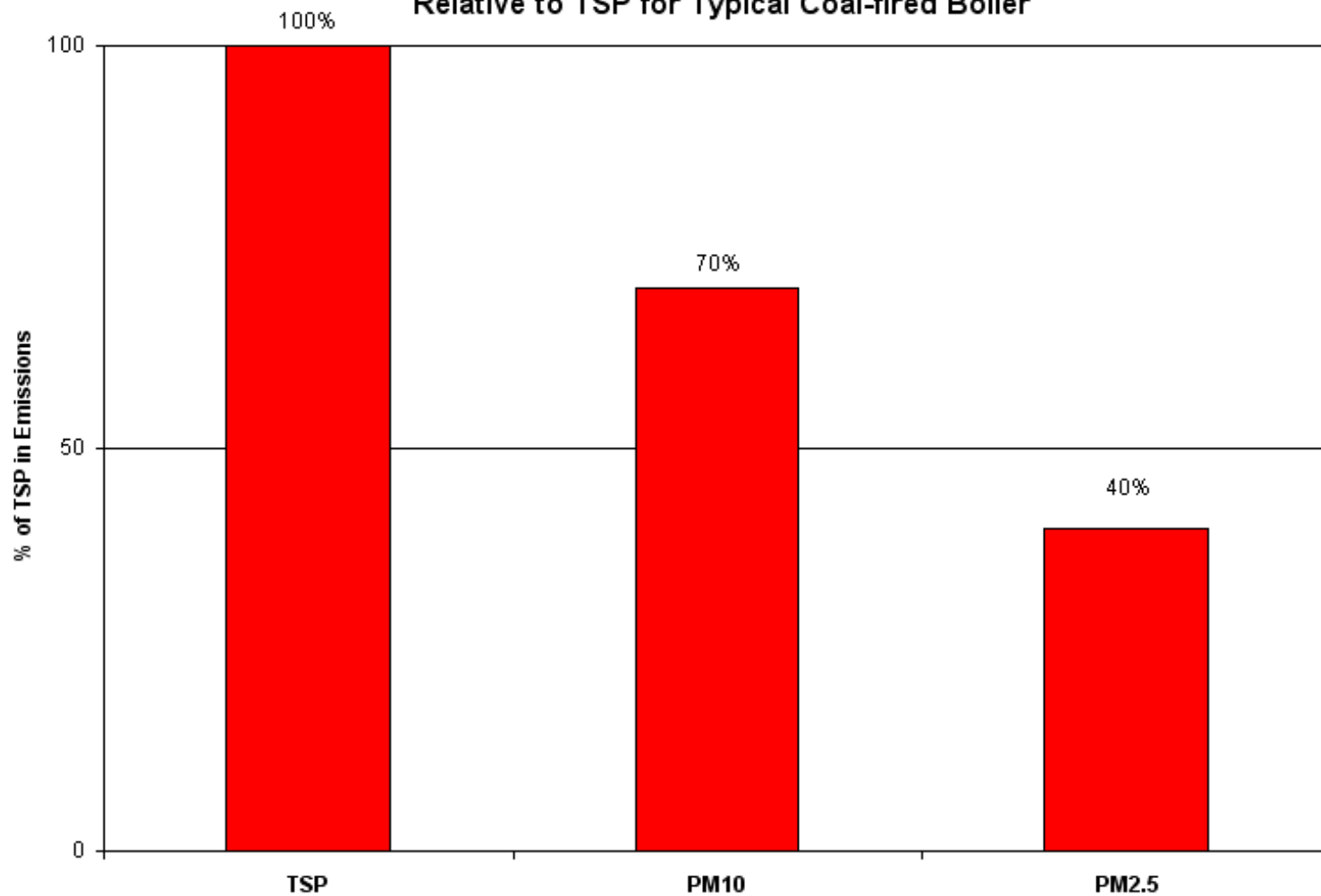


Bob Paine, AECOM (formerly ENSR)

Spring 2009 Update

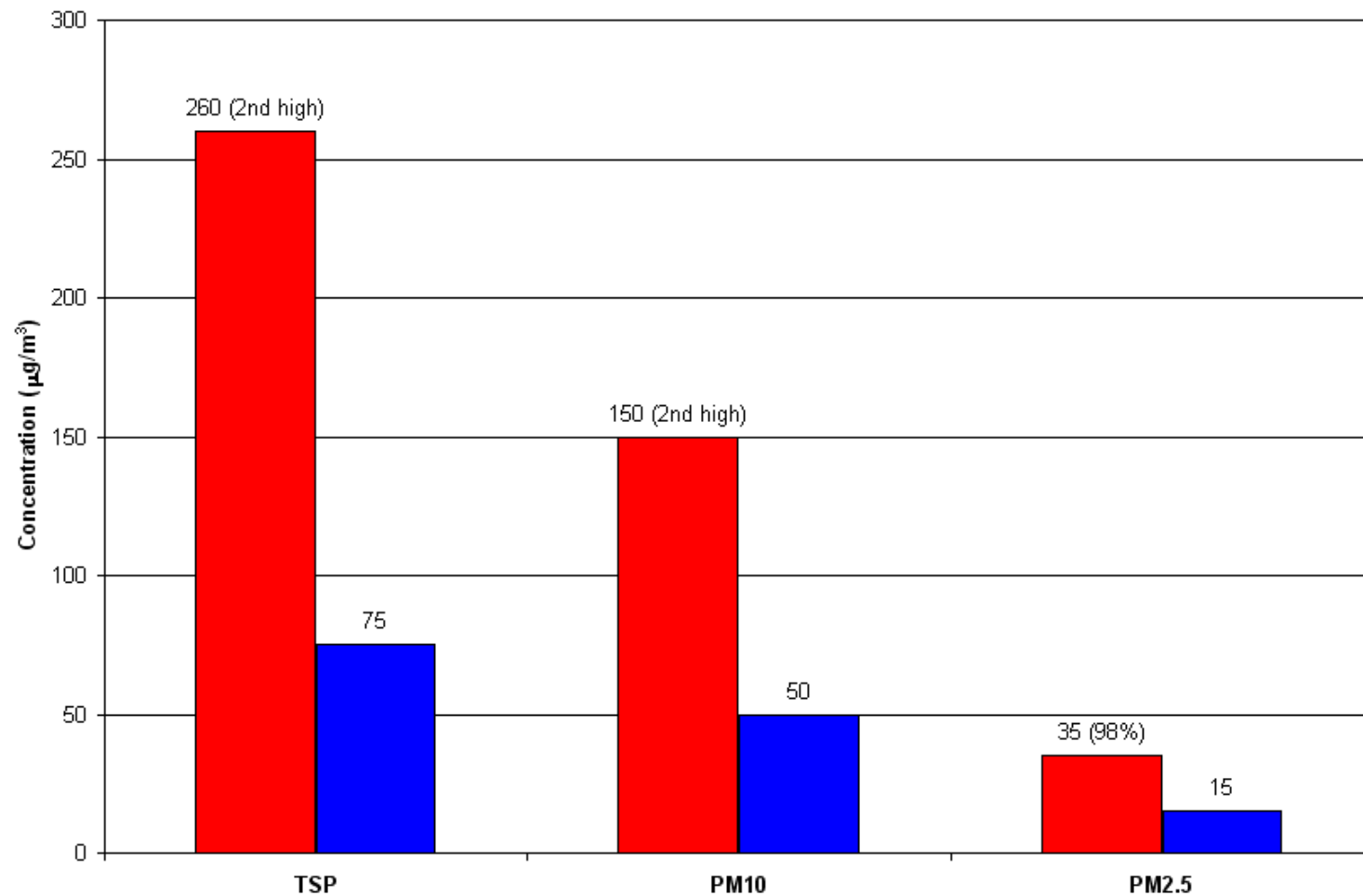
- Evolution of PM NAAQS
- Components of PM
- Surrogate PM₁₀ Policy / Transition to Modeling PM_{2.5}
- What does NSR Implementation Address?
- Proposed PM_{2.5} PSD Program
- PM_{2.5} Modeling Procedures
- Primary and Secondary PM_{2.5}
- Example of PM_{2.5} NAAQS Compliance Application
- Conclusions

Approximate Fraction of PM Emissions
Relative to TSP for Typical Coal-fired Boiler



NAAQS (Primary Standards)

- 24-hour
- Annual



- PM consists of two components:
 - “Filterable” or “front half” – collected on heated filter
 - “Condensable” or “back half” (CPM) – Lee Carlson has described the stack sampling procedures
- Original PM (TSP) did not include CPM (all $PM_{2.5}$)
- As PM size decreases, CPM role becomes more important
- Dispersion modeling in the past has not always included CPM

- In 1997, PM_{2.5} NAAQS was established
- EPA lacked methods for modeling compliance for PM_{2.5}
 - Modeling procedures not developed
 - Background monitoring data not available
 - Estimation of emissions not well established
- **Surrogate policy: compliance with PM₁₀ NAAQS means compliance with PM_{2.5} NAAQS**
- Surrogate policy established Oct 97, reaffirmed Apr 05
- PM_{2.5} NSR Implementation Rule effective July 15, 2008
- Final rule started transition period to end surrogate policy

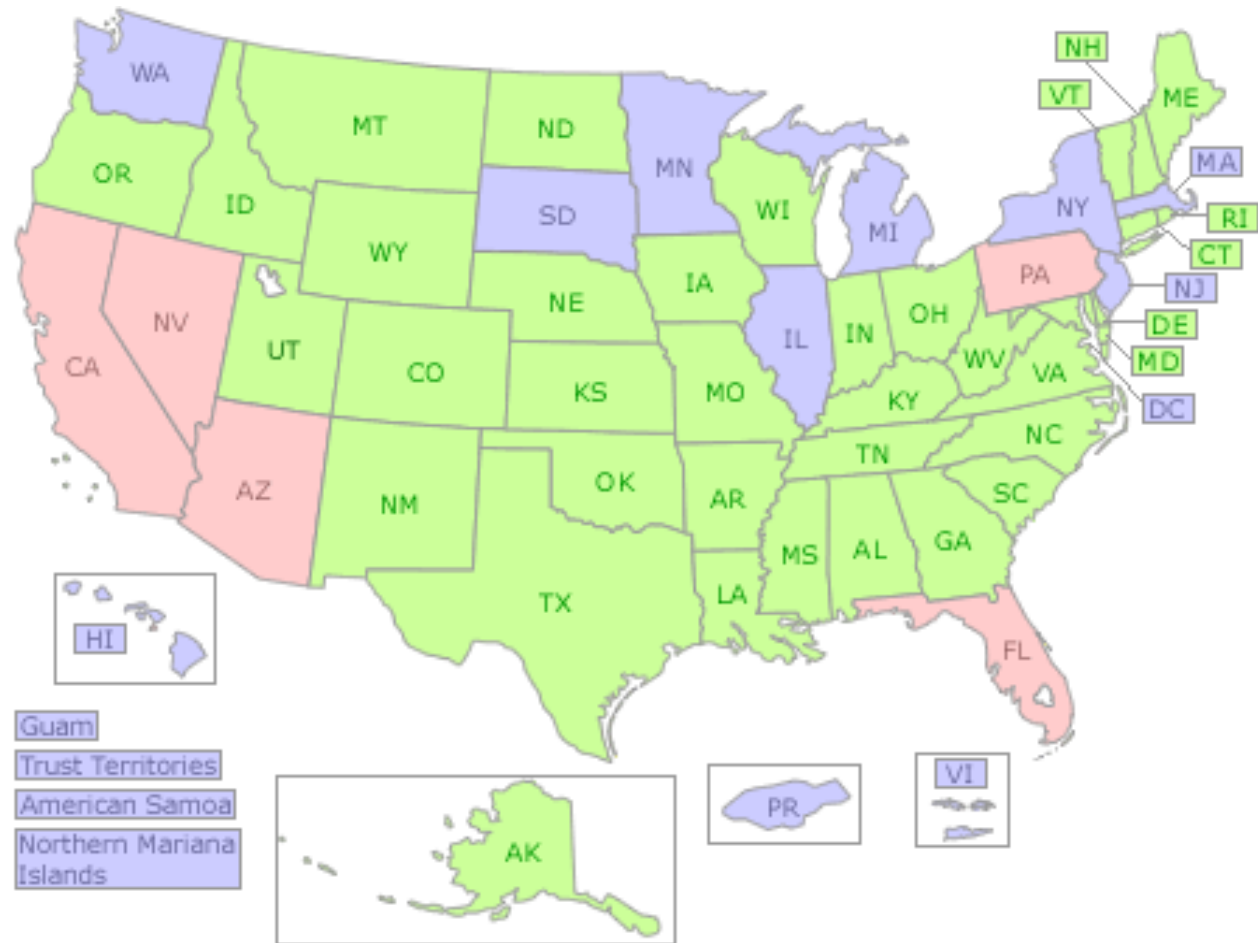
- Many areas in PM_{2.5} compliance generally have small margin below the NAAQS
- Leaves little margin for impacts from new sources if PM_{2.5} instead of PM₁₀ is to be modeled

- **PM_{2.5} precursor pollutants (SO₂, NO_x, VOC, NH₃)**
- Quantifying direct PM_{2.5} emissions
- Major source thresholds (100 or 250 TPY)
- Significant emission rates – 10 TPY
- BACT and LAER
- Pre/post-construction monitoring
- **Role of ambient concentrations and secondary formation of PM_{2.5} in permitting**

- Emission offsets in non-attainment areas
- Dispersion modeling procedures
- Separate rulemaking for PM_{2.5} increments, significant impact levels and monitoring concentrations
- Separate rulemaking for source testing methods
- PSD-delegated states - PM_{2.5} NSR provisions begin on effective date
- SIP-approved states – will have additional time (up to about 2 more years) to implement new provisions

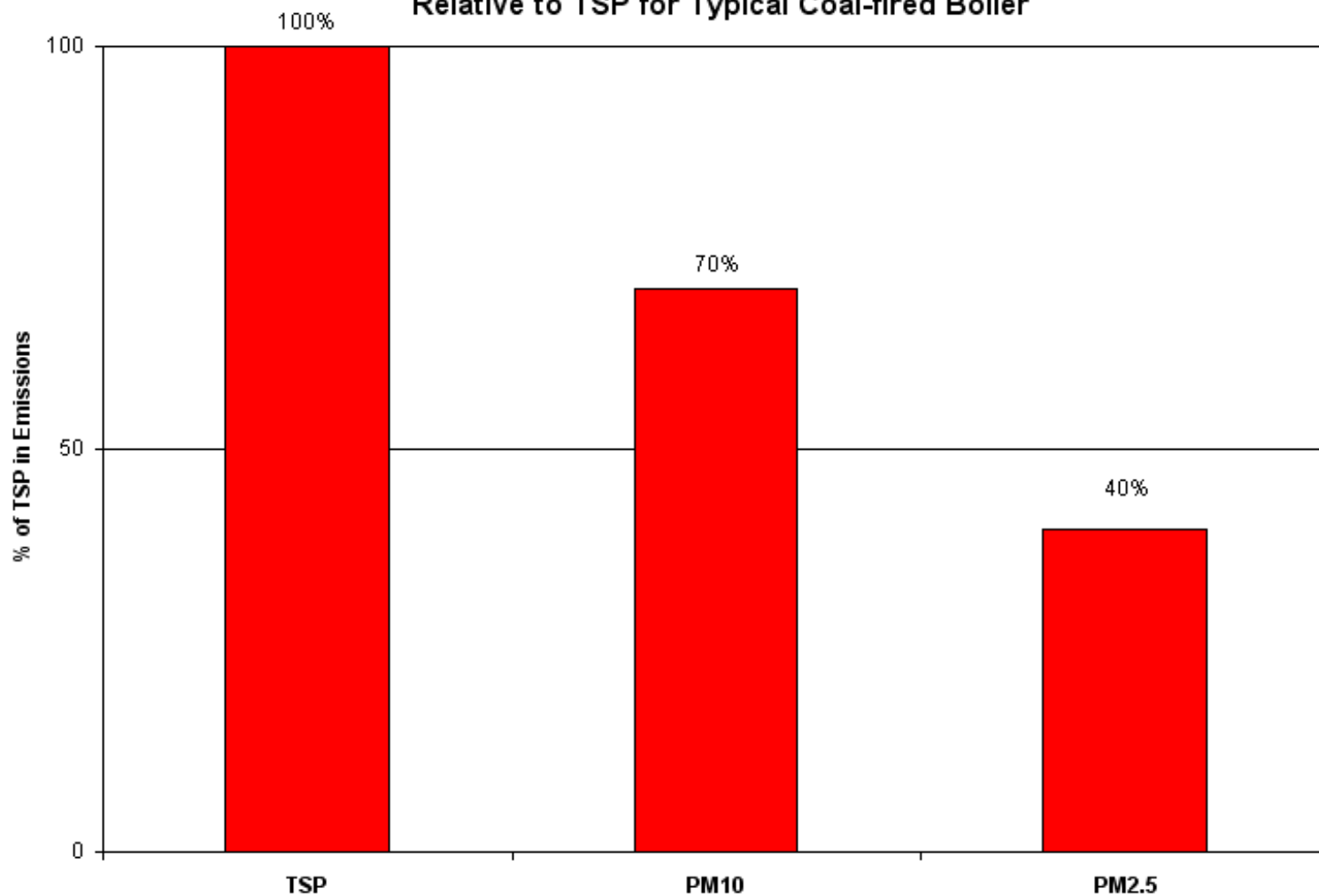
PSD Program Status Map - May 2007

- Green - SIP Approved Areas
- Blue - EPA or Delegated Areas
- Pink - Combination of SIP or EPA or Delegated Areas

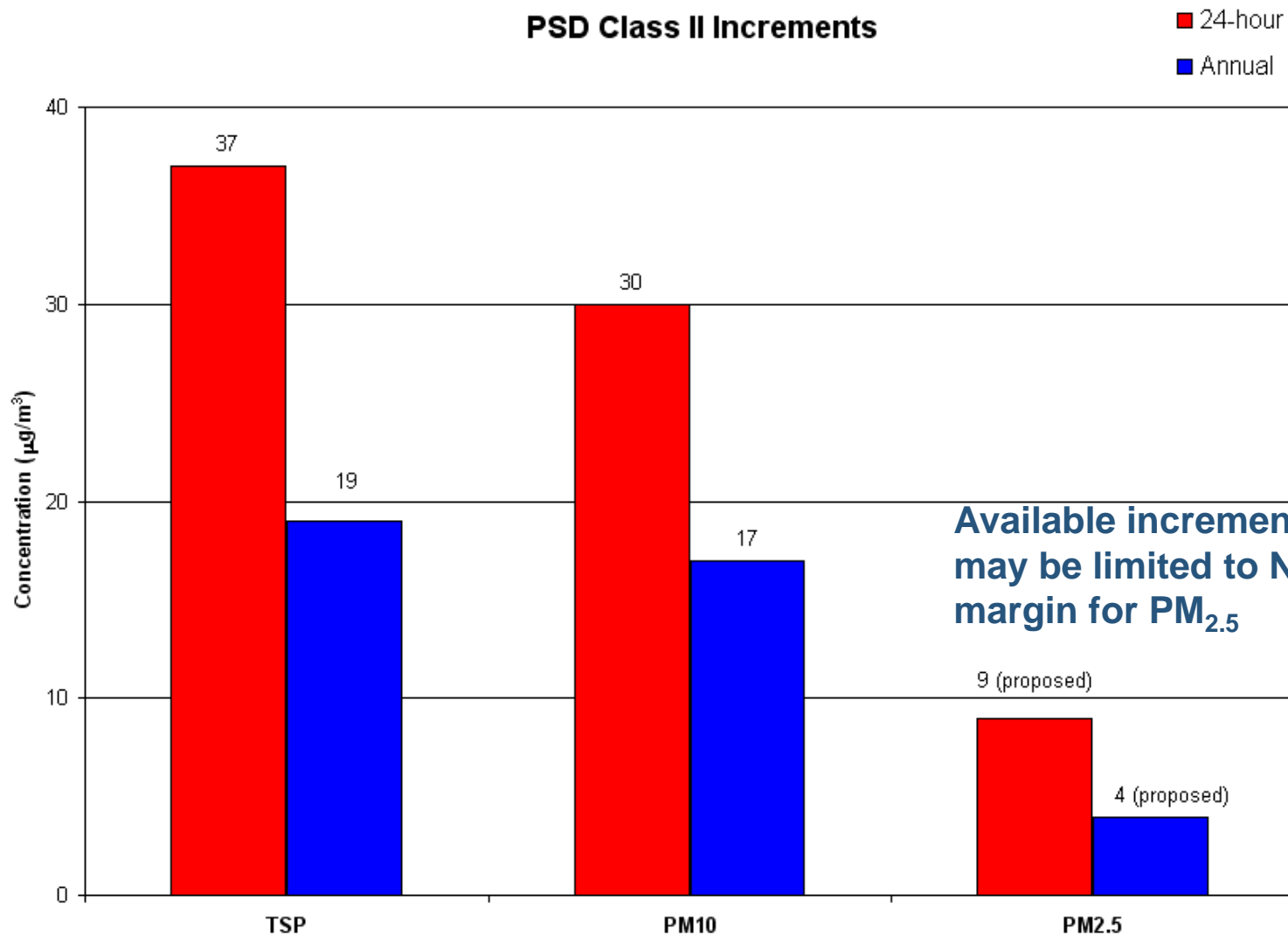


- **Comment period closed January 21, 2008; final rule expected by late summer 2009**
- **Some proposed levels proportionally lower than emissions fraction**
- **Many SIP-approved states will begin to draft revised SIPs only AFTER this rule becomes final**

Approximate Fraction of PM Emissions
Relative to TSP for Typical Coal-fired Boiler

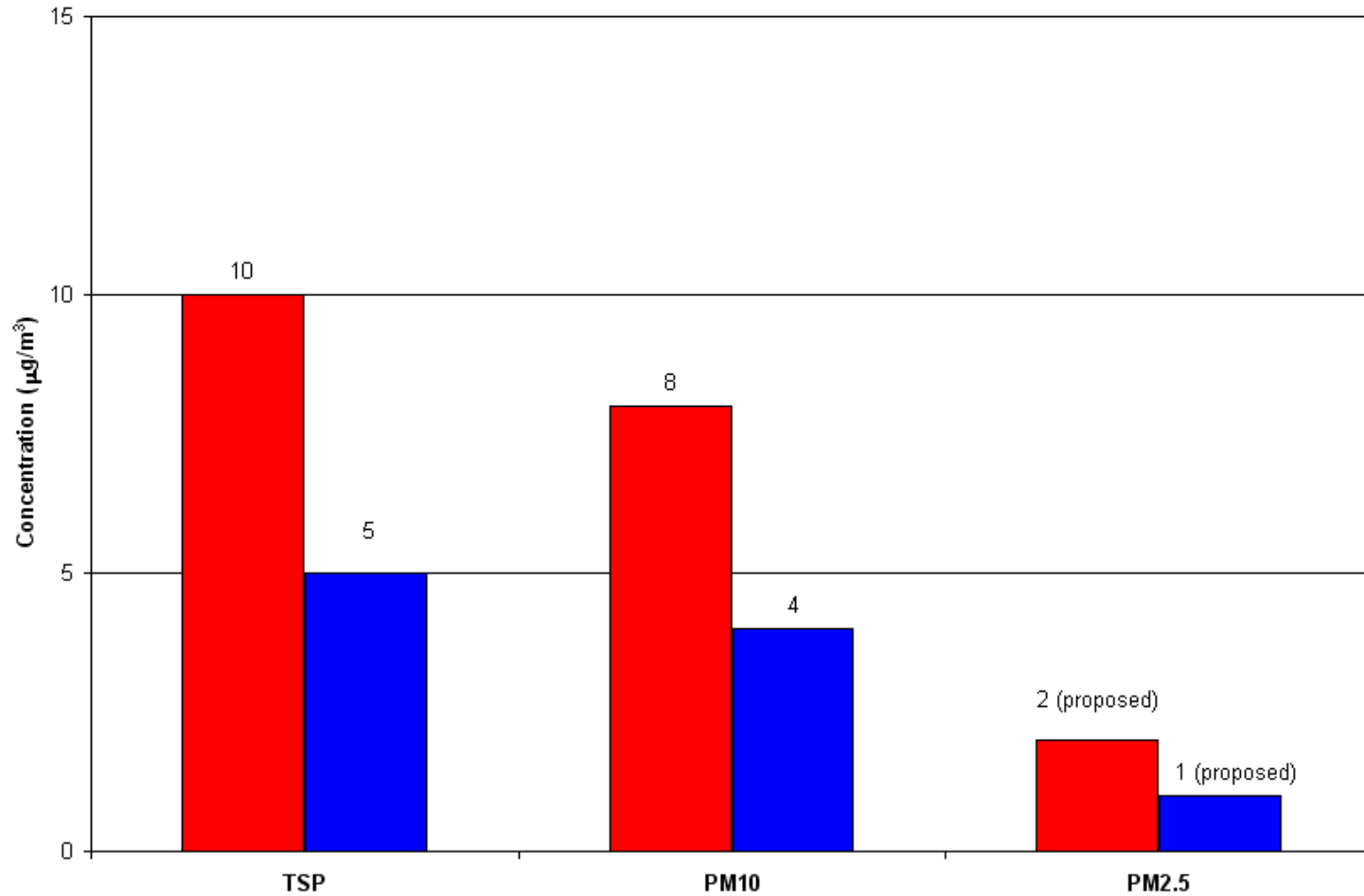


PSD Class II Increments



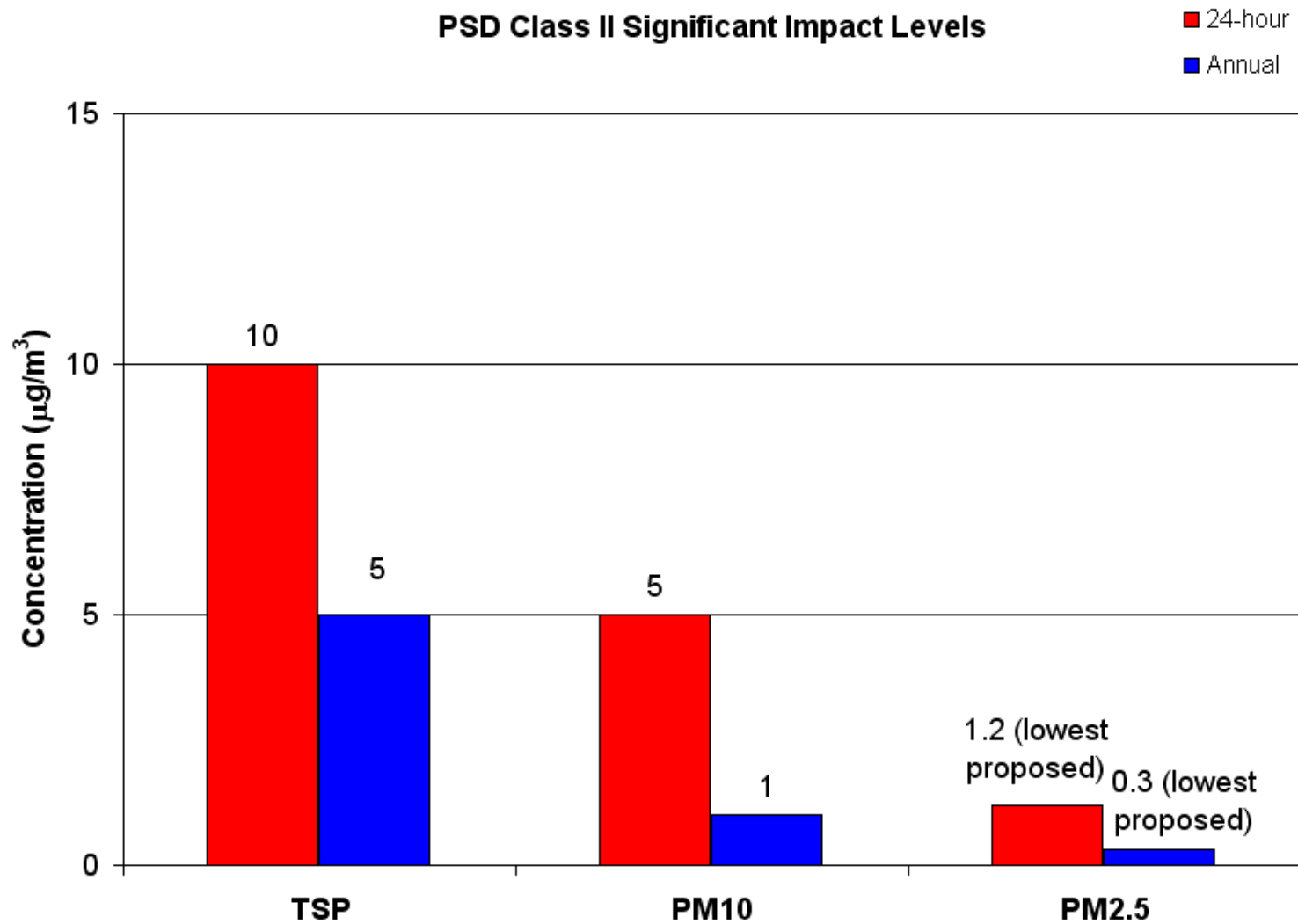
PSD Class I Increments

■ 24-hour
■ Annual



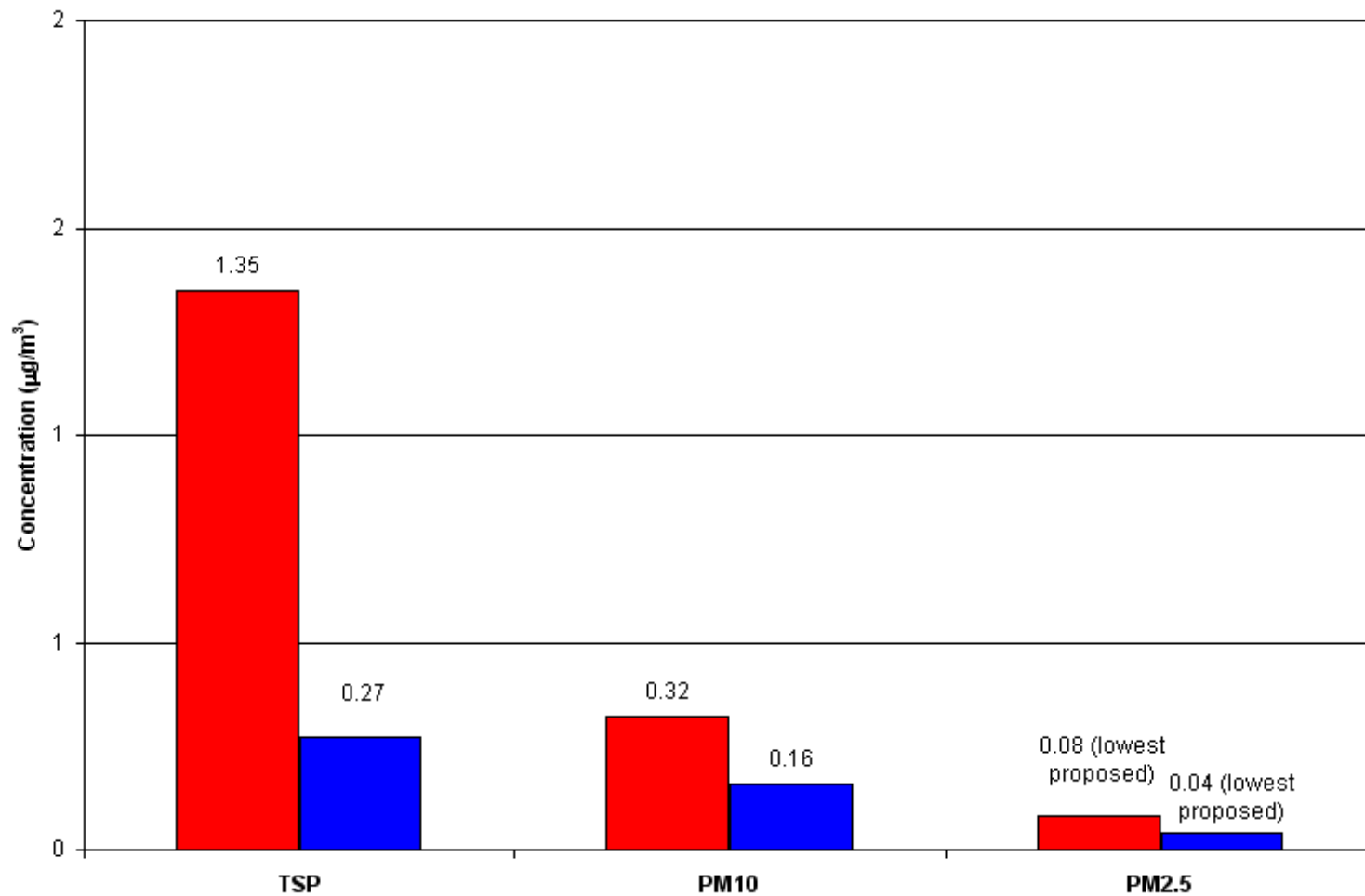
- **Well-controlled projects could have impacts less than SILs**
- **No interactive source modeling required if project predicted impacts are less than SILs**
- **Project is then presumed not to cause or contribute to violation**
- **Therefore, EPA's final selection of SIL values is very important**

PSD Class II Significant Impact Levels



Proposed PSD Class I Significant Impact Levels

■ 24-hour
■ Annual



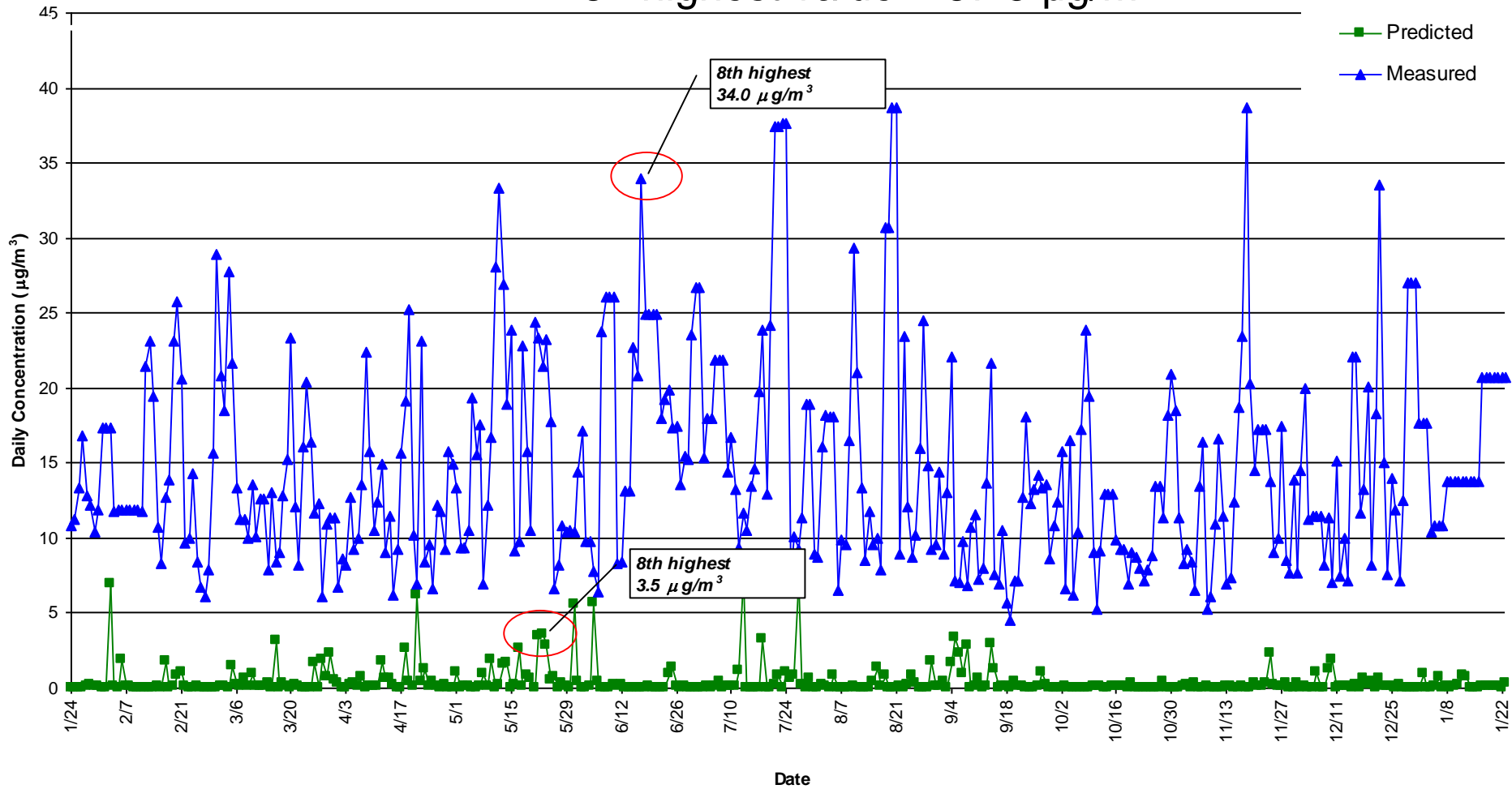
- EPA has not added new discussion in Appendix W
- Issue was not on the agenda for 2008 EPA annual modelers workshop, nor at the 9th EPA modeling conference (Oct 08)
- Short-range models (e.g., AERMOD) only deal with direct PM_{2.5} emissions
- Approved long-range model (CALPUFF) has been critiqued for simplistic secondary PM chemistry
- EPA approves CALPUFF for secondary particulate concentrations for visibility (BART), but not for PSD increment calculations
- More sophisticated regional models are CMAQ, CAMx
 - Not evaluated for single source modeling
 - Have significant resource requirements for applications in modeling
- There is no approved EPA model for secondary PM_{2.5} simulations!

- Primary PM_{2.5} will provide highest near-field impacts
- Secondary PM_{2.5} would be important only at large distances
- Would probably not contribute at location of highest primary impact
- CALPUFF is the only readily available tool for predicting secondary particulate formation from single source, but it is not approved nor adequately evaluated
- Therefore, even for Class I modeling, only primary PM_{2.5} (filterable + condensable) emissions can be modeled

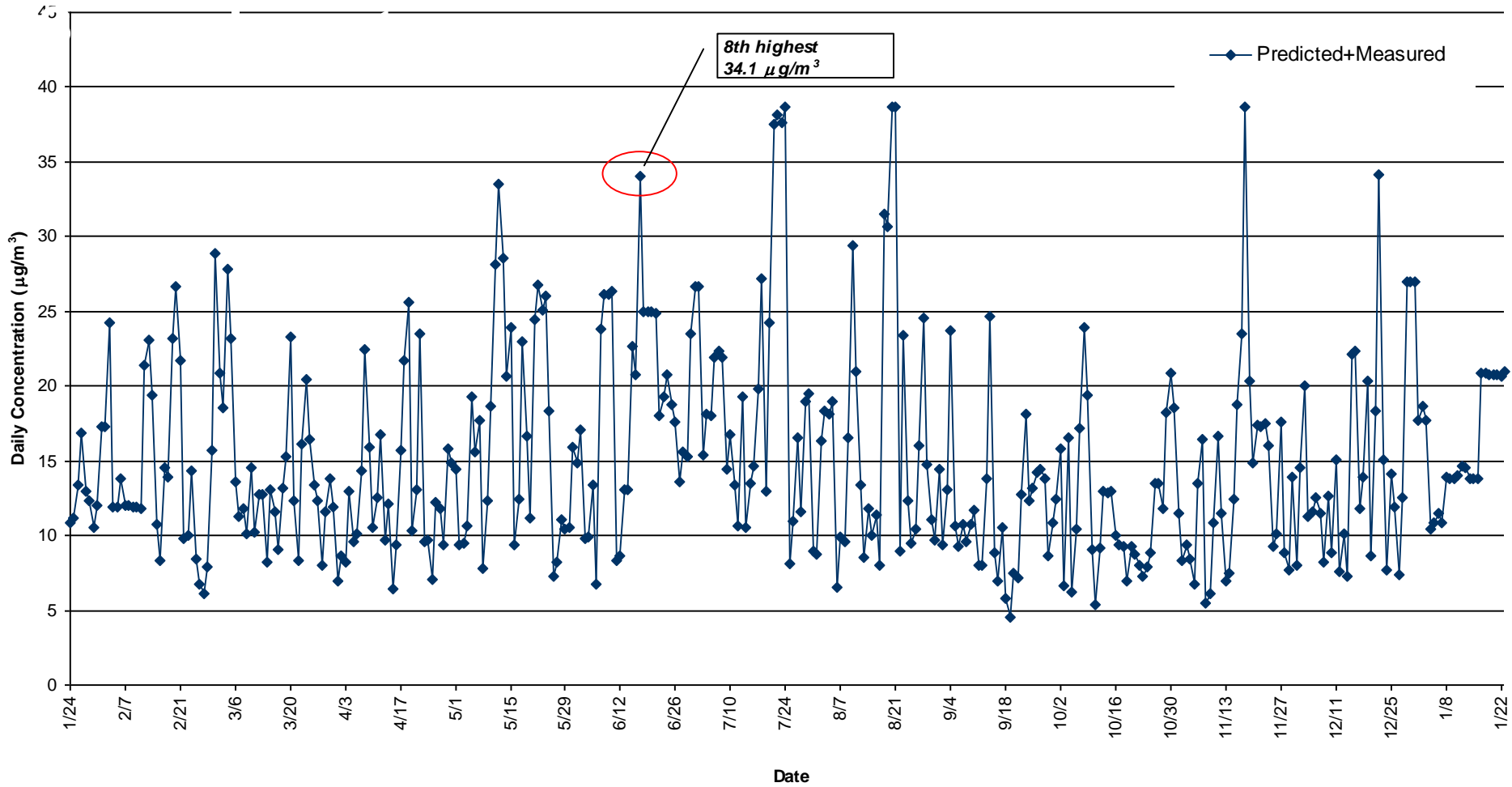
Example Modeling Challenge: Compute Total PM_{2.5} NAAQS Impact: Background + Source Impact

- Screening approach: add peak percentile source impact to peak percentile background, unpaired in time
- Unlikely that these two components happen at the same time
- Refined approach adds concurrent daily background and source impact concentrations
- If daily background concentrations not available, suggest filling in missing days from higher of two bounding values

8th highest value = 37.5 $\mu\text{g}/\text{m}^3$



8th highest value = 34.1 $\mu\text{g}/\text{m}^3$



- Concurrent daily monitoring and modeling data are necessary
- May require filling in missing monitoring data – backup site may be needed
- Take average of 98th percentile over modeled years
- Source not causing or contributing to violation if impacts are below SILs on 8th highest days
- Future PM_{2.5} background is predicted to be lower after 2009-2010 and 2015 emission reductions in the East

- **Choice of models**
 - AERMOD has most extensive evaluation
 - CALPUFF has some near-field and long-range evaluation
 - CMAQ/CAMx have no known single source evaluation
- **PM size distribution important to quantify PM_{2.5} emissions**
- **Diurnal patterns of emissions should be considered**
- **All aspects of emission estimates need to be reviewed, especially CPM emissions**

- **PM₁₀ surrogate policy will transition to PM_{2.5} modeling after increments and SILs are final**
- **Existing PM_{2.5} measurements indicate limited room for new source growth**
- **Fortunately, future background measurements will be lower**

- Besides model selection, refined modeling approaches include:
 - selection of background concentrations
 - procedure for summing impacts
 - depiction of emission rates
- Modeling of precursor emissions of $PM_{2.5}$ should not be required, and no approved modeling tool is available
- Future $PM_{2.5}$ SILs are important to determine whether modeled impacts contribute to predicted violations
- Extensive cumulative modeling analyses needed if predictions are above SILs
- Conducting site-specific $PM_{2.5}$ monitoring can be beneficial for existing and future facilities

AECOM Environment

environmental sustainability for the world's
built, natural, and social environments

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