Preparation of Control Strategies

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Presentation Overview

This presentation will answer the questions:

- How Do We Determine:
  - Geographic Areas for Analysis?
  - Pollutants to control?
  - Level of reduction needed?
  - Available control measures?
- How Do We Establish the Control Scenario for each Sector?
- How Do We Calculate Results?
  - Engineering costs
  - Emission reductions
  - Control case emission inventory

How Do We Determine Geographic Areas for Analysis?

- Begin with base case projected monitor values in year being analyzed. (ex. 2020)

- Determine which monitors violate the level of the standard being analyzed.

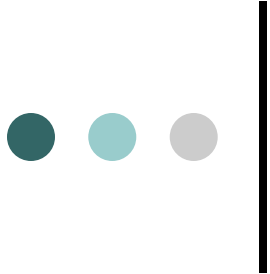- Determine which pollutants, sectors, and regions to apply controls

Example: 2020 Base Case Projected 8-Hour Ozone Design Values
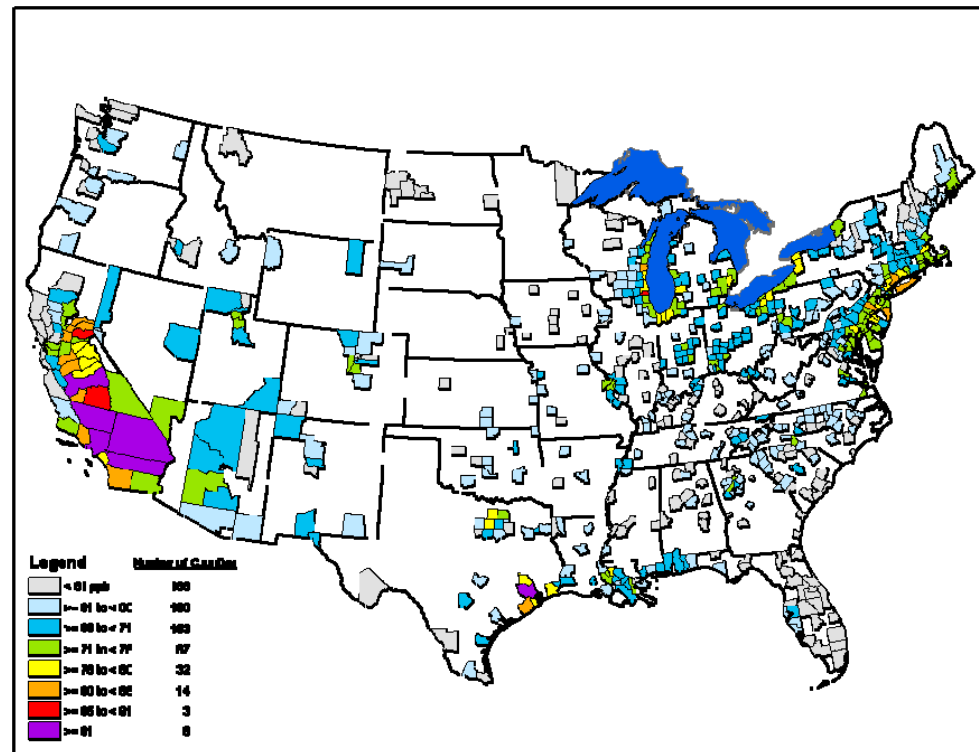
# How Do We Determine Pollutant Specific Geographic Areas?

- Where controls are applied is determined by:
  - Pollutant precursors
    - PM2.5 (Direct PM2.5, NH3, NOx, VOC, SO2)
    - Ozone (NOx, VOC)
  - Emissions sector
    - EGU, NonEGU Point, Area, Onroad, Nonroad
- Air quality modeling expertise, previous analysis, screening-level tools, and policy can help guide the definition of geographic boundaries.
- Includes air quality impact of emission reductions and general costs of controls (impact/ton and cost/impact)
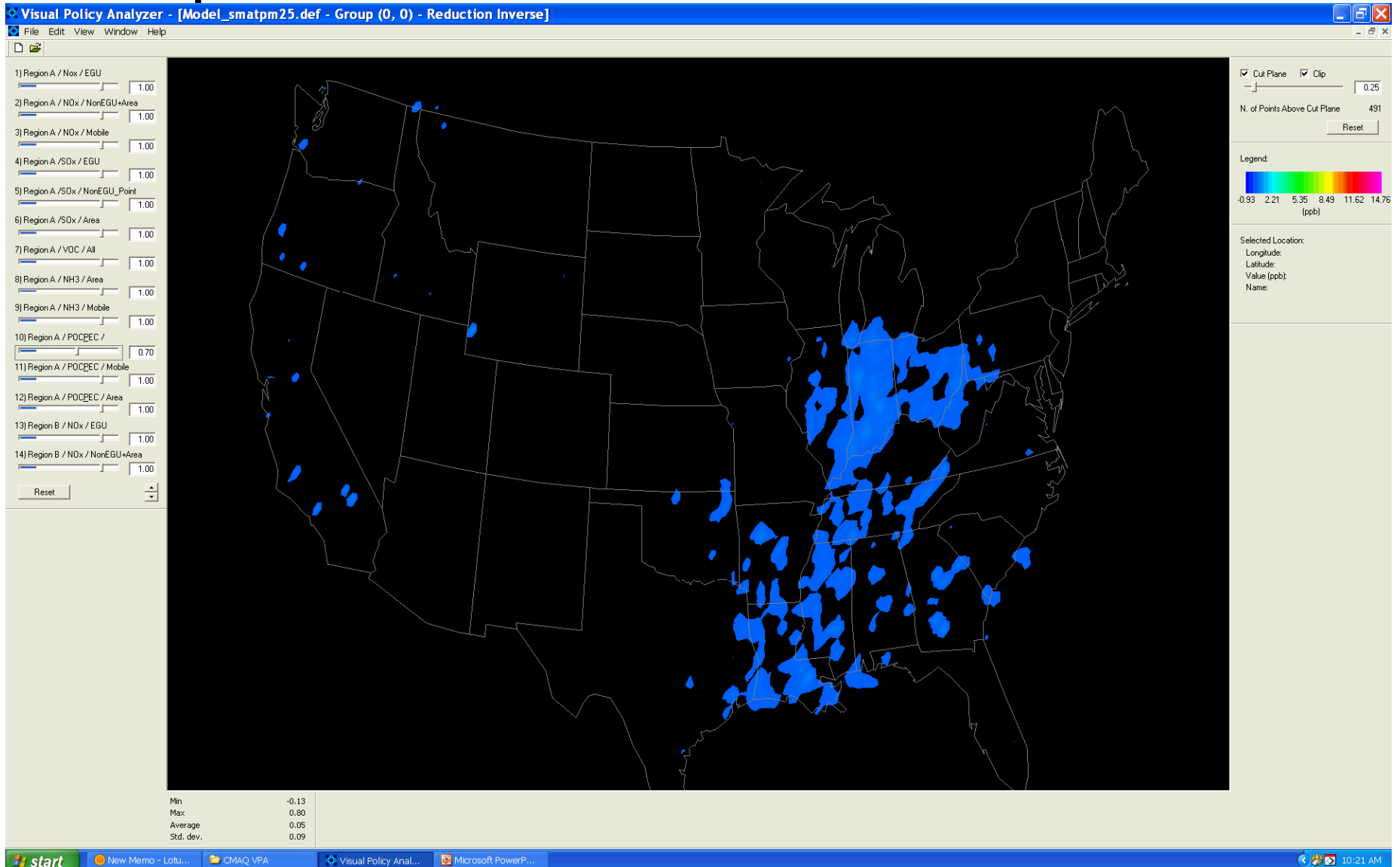
Pollutant Specific Geographic Areas - PM2.5 Example

- Utilized the Response Surface Model (RSM) to screen different pollutant/sector combinations.
- Cost information used to establish which pollutant/sectors to control first.
  - Cost and impact information calculated for each area predicted to violate the PM2.5 Standard in 2020.
  - We selected all of the controls available for the pollutant/sector with the lowest cost/impact.
    - Impact per ton calculations from RSM indicated which pollutant/sector was the most effective to reduce.
    - Usually direct PM was most efficient to control (versus NOx, VOC, SO2)
    - Established subregions for some pollutant/sector combinations.
- Examples:
  - Ammonia
    - Area source reductions were more effective at a regional level.
    - A sub region of Midwest states was established to apply area ammonia controls.
  - Direct PM2.5:
    - Point source reductions were more effective at a local level.
    - Controls were applied to MSA's and local areas surrounding violating monitors.

Example of PM2.5 formation from Area Ammonia
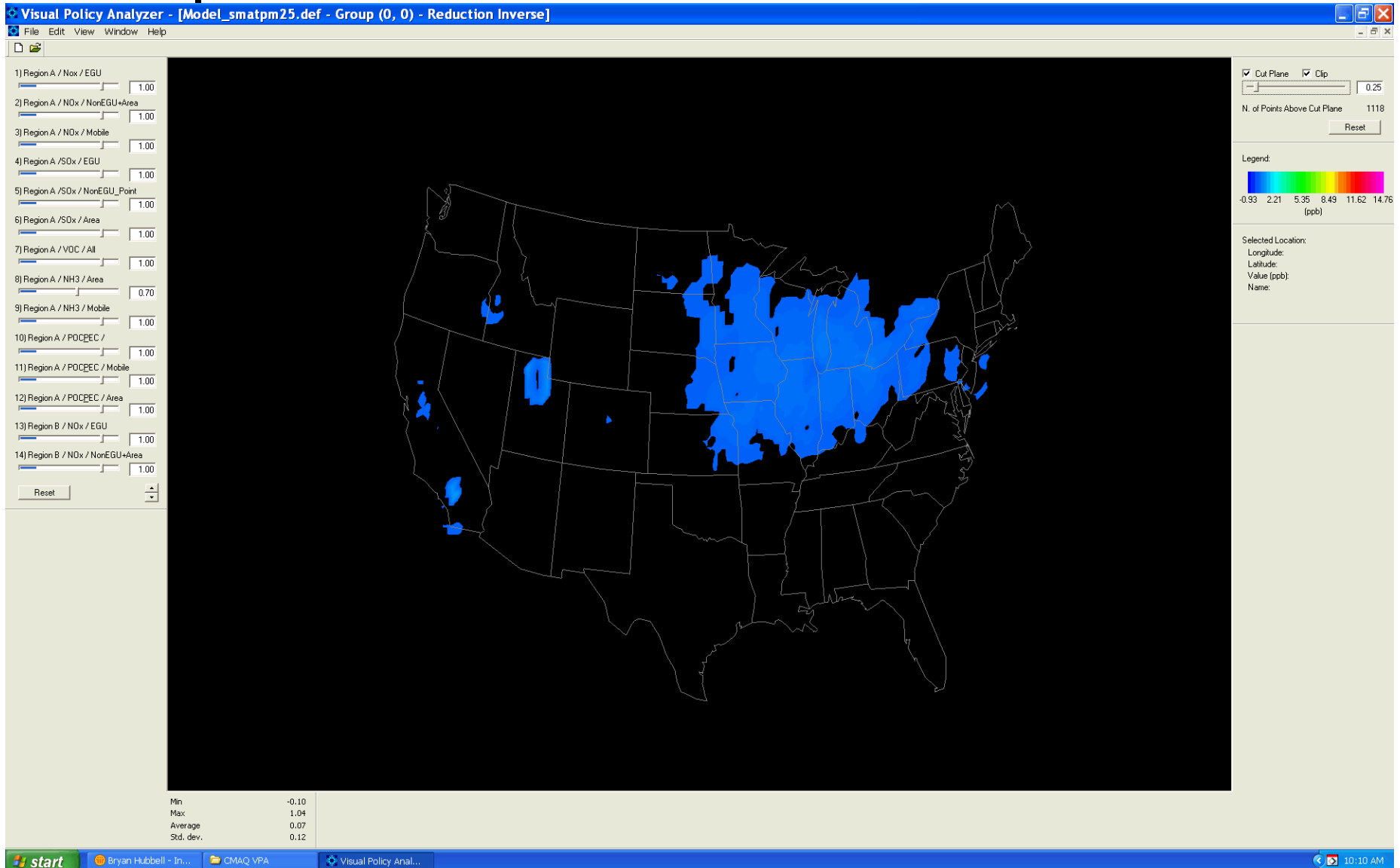
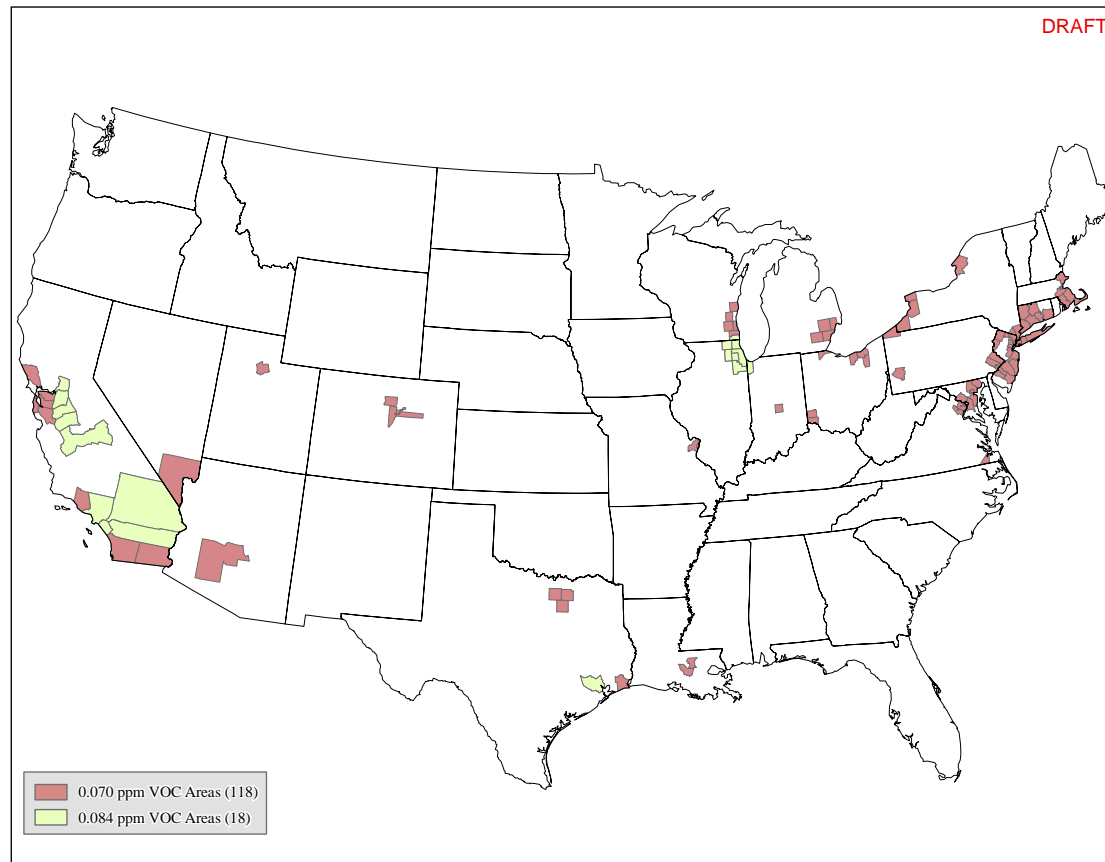# Example of PM2.5 Formation From Point Source Direct PM

Pollutant Specific Geographic Areas - Ozone Example

- Previous source apportionment air quality modeling was utilized to look at transport areas for NOx. This aided in defining geographic areas for NOx control measures to be applied.
- Air quality modeling expertise as well as emissions and air quality screening were used to establish counties where VOC controls would be most effective.
- Emissions inventories for the analysis year were mapped by pollutant to examine the density of pollutants near nonattainment monitors.
- Previous policy guidance on rate of progress (i.e. 200km for NOx reductions and 100km for VOC reductions) is also considered when defining areas.
- Policy helps to guide intrastate and interstate control areas.
  - California current nonattainment areas do not cross into any other states, therefore we can assume in the future nonattainment areas will be intrastate.
  - Charlotte's current nonattainment area includes counties in SC, we can therefore reasonably assume any future designation will be interstate.
- Emissions sectors are also a consideration when defining geographic areas.
  - EGU Point geographic areas incorporate the cap and trade program in the eastern portion of the county.
  - Mobile geographic areas may be broad due to the nature of the transportation sector.
    - Some controls are applied nationally, statewide, or to local areas.
  - Most NonEGU Point and Area geographic areas may differ on source size or cost of application of the control.
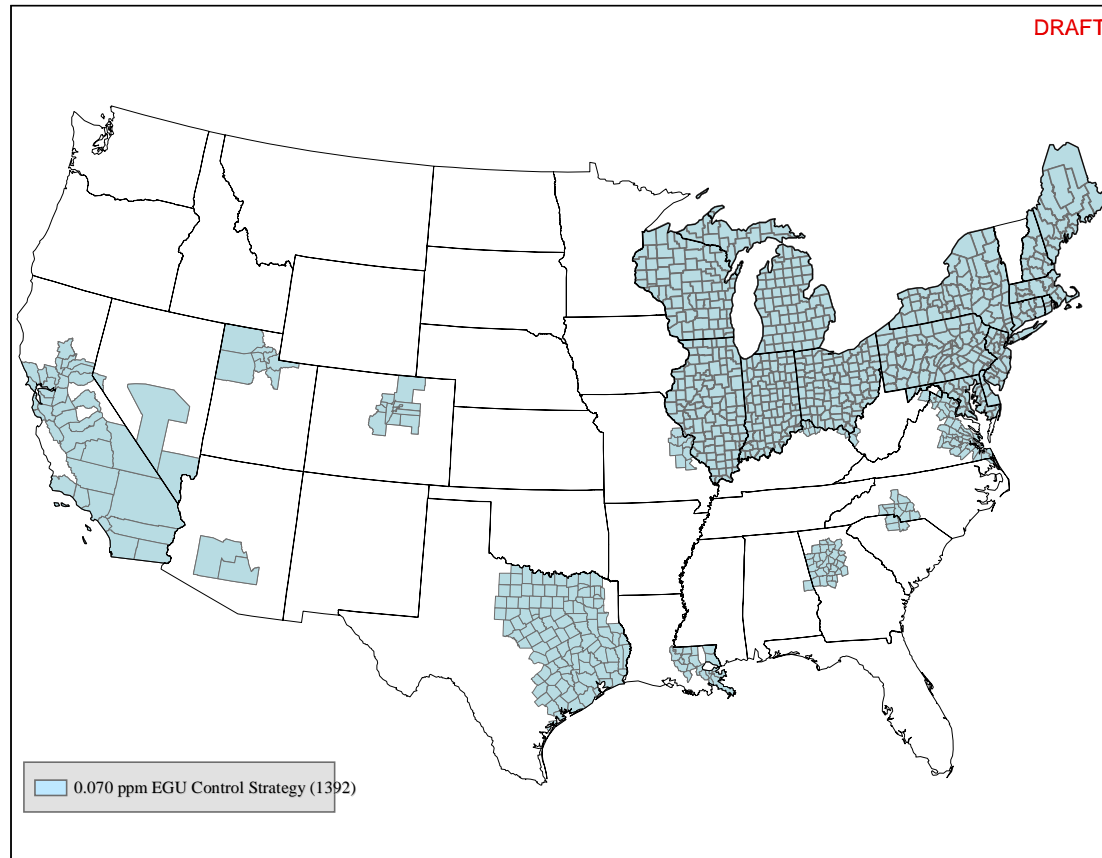
Example Geographic Areas VOC NonEGU Point and Area

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Legend:
- 0.070 ppm VOC Areas (118)
- 0.084 ppm VOC Areas (18)

Example Geographic Areas NOx EGU Point

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0.070 ppm EGU Control Strategy (1392)

Example Geographic Areas Local Mobile – VOC & NOx

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Legend:
- Local Counties with OTC Statewide (1300)
- 0.084 ppm Local Counties (206)
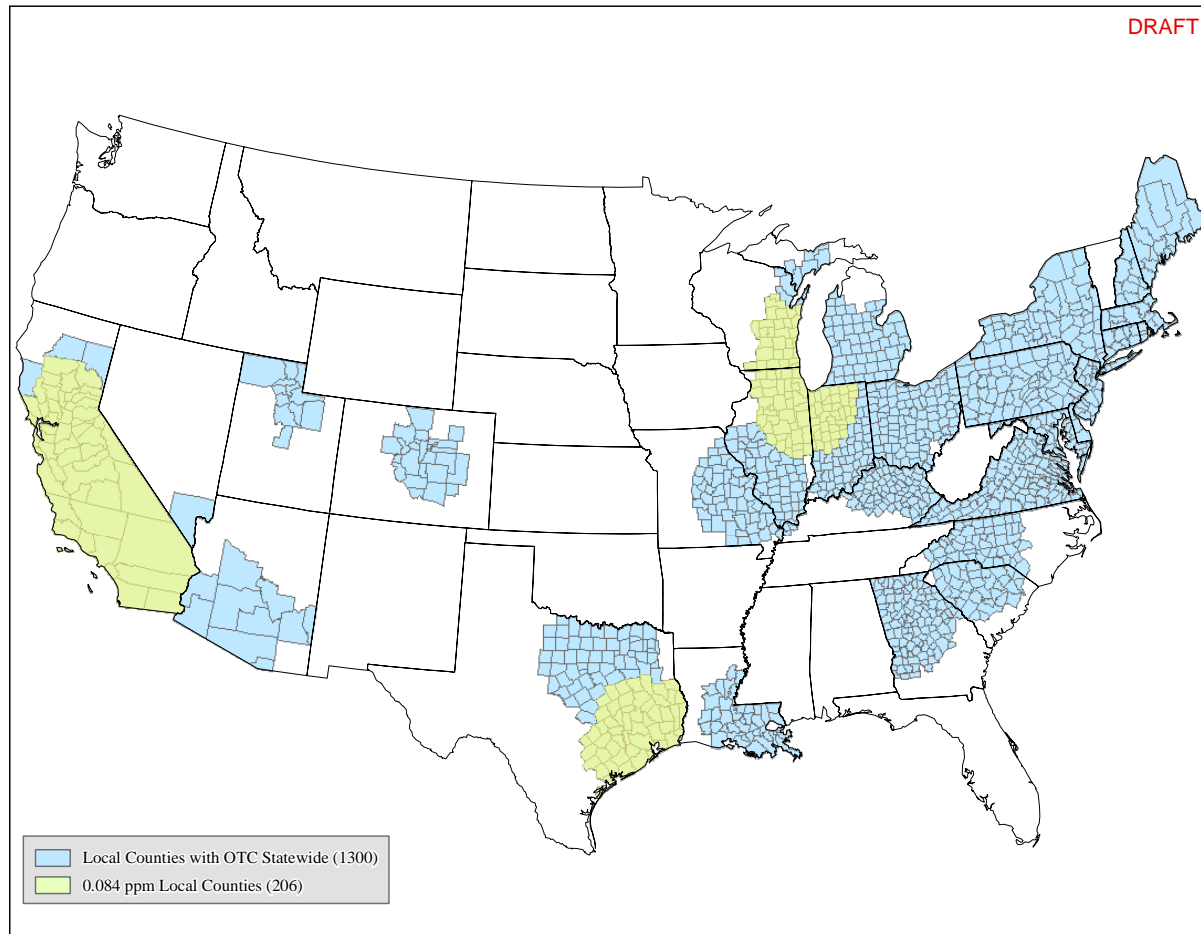
How Do We Determine Tons of Reduction Needed?

- PM NAAQS:
  - Used RSM to approximate tons needed for each area to attain standard.
  - Applied controls as mentioned on slide 5.
  - Included benefit/ton estimates as a cut point for applying controls.
- Ozone NAAQS:
  - Due to severity and widespread nature of ozone controls were applied to large geographic areas.
  - Applied maximum emissions reductions strategies for most sectors
  - Evaluated marginal costs of known controls
    - For example: NOx NonEGU and Area controls above $23,000/ton were making up 2% of the reductions and 17% of the costs.
    - Based upon marginal cost curves we established $23,000/ton as the cut point for controlling NOx from these sources.

How Do We Determine Available Control Measures?

○ Establish baseline (current standard) controls, all alternative standards analyzed are incrementally applied to the baseline.

○ Evaluate viability of all available control options, focusing on pollutants and sectors of greatest interest

How Do We Establish a Control Scenario for EGUs?

How Do We Establish the Control Scenario for NonEGU Point & Area?

- AirControlNET (ACN):
  - Used to develop the NonEGU Point and Area control strategies for NAAQS.
  - Links EPA emissions inventories and pollutant specific control measures.
  - Control Measures
    - Control Measures are assigned to sources by Source Classification Codes (SCC) and applied to specific sources within the emissions inventory.
    - Control Measure data is obtained from the EPA Control Cost Manual, EPA reports and other sources (RPO and State technical reports).
    - Control measures in ACN have been used by many RPO's and some States and have undergone internal peer review within EPA (Regional office staff).
- AirControlNET is the predecessor to the Control Strategy Tool (CoST) that we will be using for future NAAQS RIA analysis.

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NonEGU Point & Area Control Strategy Example

- Ozone NAAQS example:
  - AirControlNET was used to run a maximum emissions reduction strategy at least cost.
    - For each NonEGU Point and Area source in the 2020 emissions inventory ACN looked for a NOx measure and VOC measure to apply that would achieve the highest level of reduction at the least cost.
    - Control Measures were only applied to the specific geographic area of analysis.
    - The results were source specific control measure data (control efficiencies) that are applied to the emissions inventory. In addition the total engineering cost and emission reductions of each control measure is calculated.
  - Alternative Standard analyses are developed incrementally to the current standards to avoid double counting of emission reductions or costs.
    - Example: 0.070 ppm analysis is calculated incrementally to the 0.084 ppm current standard.

How Do We Establish Control Scenario for Mobile?

- Compile available control measure information for:
  - Upcoming national rules
  - Available national control options
  - Control measures available to State and Local agencies
- Based on previous assessment steps, identify appropriate types and level of controls needed

How Do We Calculate Engineering Costs & Emission Reductions?

- In AirControlNET, some area source data is simply a control efficiency (CE) and a cost per ton (cpton).
  - Example:
    - Clark County emits 50 tons of NOx from residential sources of natural gas combustion.
    - ACN applies the control measure =
      - water heater + low nox burner
      - CE = 7%
      - cpton = $1,783
    - Emission Reduction = 3.5 tons/year
    - Total Cost = $6240.50

Engineering Costs & Emission Reductions (cont.)

- AirControlNET calculates point source data using equations to calculate the total annual compliance cost (TACC).
- Example:
  - In Clark County, a coal-fired industrial boiler with a fluidized bed combustor emits 100 tons of NOx.
  - ACN applies the control measure SNCR (urea injected)
  - Annualized cost equation is annualized cost $= 3059.2*x^{0.6}$, where x = boiler capacity (mmBTU/hr)
  - CE = 75%
  - Therefore, emission reduction is 75 tons
  - Thus, assuming a 1000 mmBTU/hr industrial boiler, the cost of reducing these 75 tons of NOx is $193,000

How Do We Prepare the Control Case Emissions Inventory?

- Once all control strategies are developed, controls are sent to the emissions modelers
- Emissions Modelers apply the controls to the projected baseline emission inventory for the analysis
- Exceptions:
  - For Mobile, we apply the control reductions to the projected baseline inventory and calculate the control case emission inventory for the air quality modelers
- The controlled emissions are then gridded, speciated, and temporally allocated for input to the air quality model

Questions?

○ NOTE: Its all iterative.