PM Augmentation Procedures for the 1999 Point and Area Source NEI

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OVERVIEW

Explain procedures used to populate NEI with PM10-PRI & PM25-PRI using:

- S/L/T data
- Particle-size-specific emission factor data:
  - AP-42
  - Factor Information REtrieval (FIRE) data system
  - PM Calculator

OVERVIEW

- Databases developed to support procedures
- Results
- Uncertainties
- Suggestions to S/L/T agencies for developing own PM_{10} & $PM_{2.5}$ inventories

BACKGROUND

- 1999 NEI Ver. 2 first national inventory where EPA carries both:
  - Filterable (FIL) & Condensible (CON) fractions of PM_{10} & $PM_{2.5}$
  - Primary (PRI) = FIL + CON
- Prior versions of the NEI include only FIL emissions

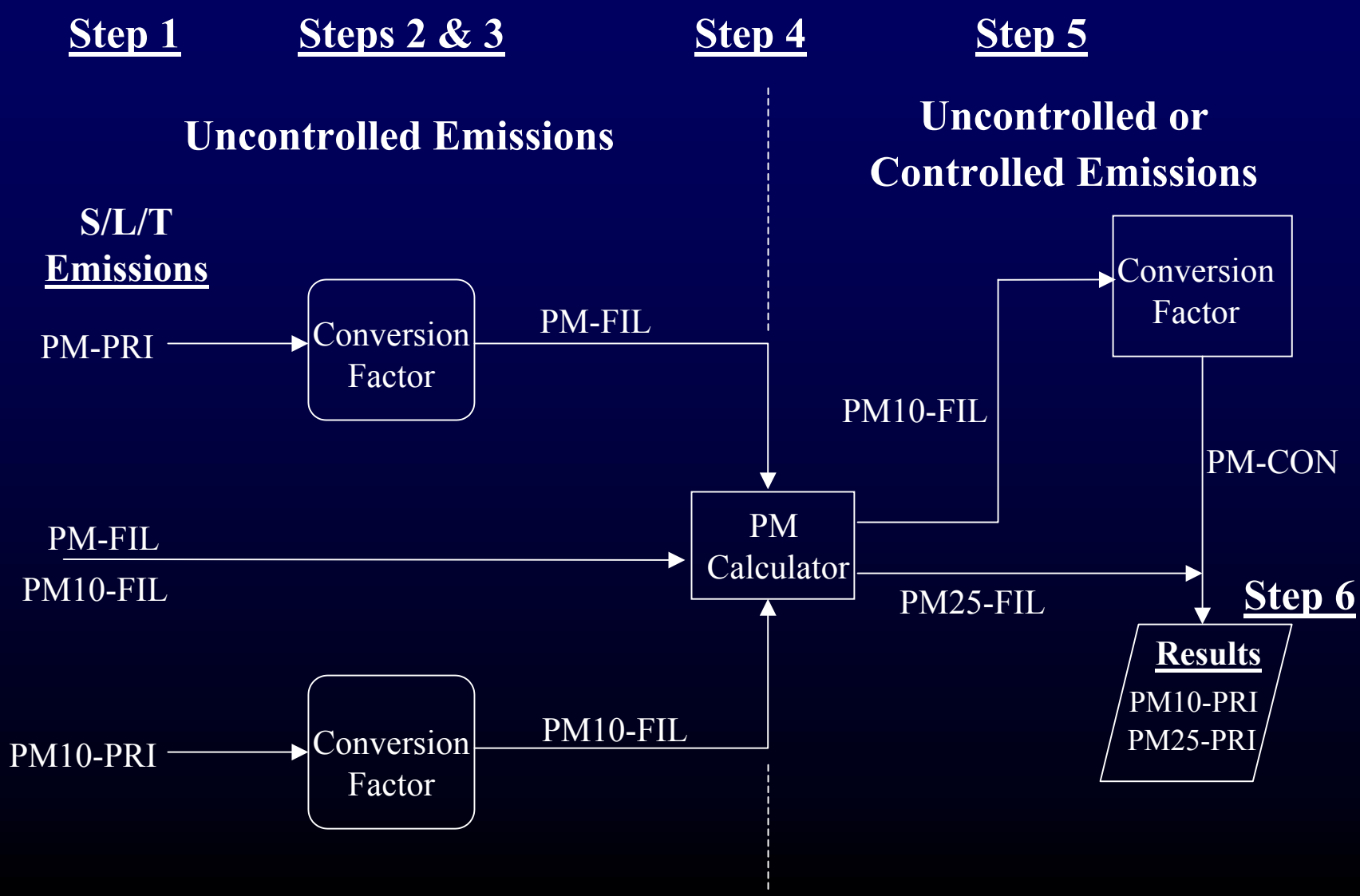
BACKGROUND

- Filterable Emissions:
  - Particles directly emitted as solid or liquid at stack or release conditions
  - Captured on the filter of a stack test sampling train
  - May be $PM_{2.5}$ or PM_{10} micrometers (µm)

BACKGROUND

- Condensible Emissions
  - Material that is vapor phase at stack conditions
  - Condenses and/or reacts upon cooling & dilution in the ambient air to form solid or liquid PM immediately after discharge from stack
  - Generally less than 1 μm in diameter

Point Source Procedures



PM CALCULATOR

- Inputs:
  - SCC
  - Control device codes (for 1 or 2 controls)
  - Uncontrolled PM-FIL or PM10-FIL emissions
- Outputs
  - Controlled PM10-FIL & PM25-FIL
  - Overall control efficiency

Step 1: Resolve QA Issues in S/L/T Inventories

Control Device (CD) Codes

- Corrected if possible
- Otherwise replaced with misc. CD code 099

SCCs not in EPA's master list

- Corrected if possible
- Otherwise replaced with generic SCC
  - Point generic SCC = 79900101
  - Area generic SCC = 2999001001
- Excluded from procedures

Step 1: Resolve QA Issues in S/L/T Inventories (Cont.)

Inconsistent PM values reported

- Examples:
  - PM25-FIL > PM10-FIL
  - PM25-PRI > PM10-PRI
- Ask S/L/T agency to resolve, or
- Set PM25-FIL/PRI = PM10-FIL/PRI

Step 2: Prepare S/L/T PM & PM10 Emissions for PM Calculator

- Back-calculate uncontrolled emissions
  - Used default control efficiencies (CE) in PM Calc.

- S/L/T CE Data Issues:
  - Not always provided
  - CE values outside of expected ranges for given CD

Step 3: Prepare Conversion Factors

- SCC-specific factors to convert S/L/T-supplied
  - PM-PRI to PM-FIL
  - PM10-PRI to PM10-FIL
- Factors to calculate PM-CON from PM10-FIL
- Database of uncontrolled conversion factors available at:

  ftp://ftp.epa.gov/EmisInventory/draftnei99ver3/criteria/documentation/point/pm_aug/

Step 3: Prepare Conversion Factors (Cont.)

Factors prepared for:

- External combustion (SCCs start w/ 1)
- Internal combustion (SCCs start w/ 2)
- Industrial sources (SCCs start w/ 3)
- Petroleum & Solvent Evap. (SCCs start w/ 4)
- Solid Waste Disposal (SCCs start w/ 5)

Step 3: Prepare Conversion Factors (Cont.)

External & Internal Combustion

SCC-specific ratios calculated from uncontrolled AP-42 emission factors (EF)

- EFs converted to common units (lb/MMBtu) to calculate ratios
- Assumptions for coal EFs:
  - Sulfur content = 1%
  - Ash content = 8%

Step 3: Prepare Conversion Factors (Cont.)

External Combustion

Flue-gas Desulfurization (FGD) Scrubbers

- Only CD (with AP-42 factors) that affects PM-CON
  - Prepared separate factors to estimate PM-CON for FGD scrubbers

All other CDs had no affect on PM-CON

Step 3: Prepare Conversion Factors (Cont.)

Industrial Sources

- Calculated ratios from AP-42 & FIRE particle-size-specific EFs for individual SCC
  - Problem: very limited data

- Estimated from generic PM profiles in Apdx. B of AP-42

Step 3: Prepare Conversion Factors (Cont.)

Industrial Sources

Assumptions for generic PM profiles:

- Emissions $\leq$1 µm are PM-CON
- Emissions $\leq$10 µm are PM10-PRI
  - Includes PM-CON & PM10-FIL
  - PM10-FIL wt. % = PM10-PRI – PM-CON wt. %
- PM-PRI wt. % is 100%
  - PM-FIL wt. % = PM-PRI – PM-CON wt. %

Step 3: Prepare Conversion Factors (Cont.)

Combustion & Industrial Sources

Gap Filling:

- Many SCCs do not have AP-42 particle-size-specific EFs for controlled sources and PM-CON

- Conversion factors based on average factor calculated for similar SCCs for which EFs or generic profiles are available

Step 3: Prepare Conversion Factors (Cont.)

Petroleum & Solvent Evaporation

- Processes
  - Fuel-fired equipment
  - Coating oven heaters
- Particle-size-specific EFs limited (especially for PM-CON)
- Conversion factors based electric utility boiler factors
  - Matched on fuel type

Step 3: Prepare Conversion Factors (Cont.)

Solid Waste Disposal

- Particle-size-specific EFs limited (especially for PM-CON)

- Conversion factors based external & internal combustion factors
  - Matched on fuel type

Step 4: Factors from PM Calculator

Generic PM Calculator Output Database

- Ran PM Calc. to create database for calculating ratios to apply to S/L/T emissions

- PM Calculator Inputs:
  - 100 tons uncontrolled PM
  - Every SCC & CD combination available in PM Calc.

- Database available at: ftp://ftp.epa.gov/EmisInventory/draftnei99ver3/criteria/documentation/point/pm_aug/

Step 5: Algorithms to Estimate Emissions from S/L/T data

Algorithm Inputs:

- S/L/T emissions for specific form of PM
  - 14 algorithms for all uncontrolled & controlled scenarios
- Ratios from PM Calculator output database
  - Example, if S/L/T supplied uncontrolled PM25-FIL, ratios were applied to calculate uncontrolled PM10-FIL
- PM-CON factors from Step 3 applied to PM10-FIL emissions

Step 6: Review & Update NEI with Results

- All PM25-FIL/PRI must be < PM10-FIL/PRI
- Negative emission values set to zero
- S/L/T emissions maintained in NEI
- Inserted EM records for missing pollutants
- Flagged records with data source codes:
  - AUG-C for PM Calculator method (point & area sources)
  - AUG-R for ratio method (area sources only)

Step 6: Review & Update NEI with Results (Cont.)

- If S/L/T SCC is controlled:
  - Inserted CE records that correspond to inserted EM records, but
  - Used PM Calc. CD code & overall control efficiency on inserted CE records

  - CE records not inserted for PM-CON

AREA SOURCE PROCEDURES

Two General Categories:

- CON & FIL estimated for:
  - External & internal combustion
- Only FIL estimated for:
  - Fugitive dust sources
    - Roads / construction
    - Not sources of PM-CON
  - Fire & open burning sources
    - No data to estimate PM-CON

AREA SOURCE PROCEDURES (Cont.)

Condensible Emission Sources

- Area SCCs matched to point SCCs by fuel type
- Applied point source augmentation procedures to estimate emissions

AREA SOURCE PROCEDURES (Cont.)

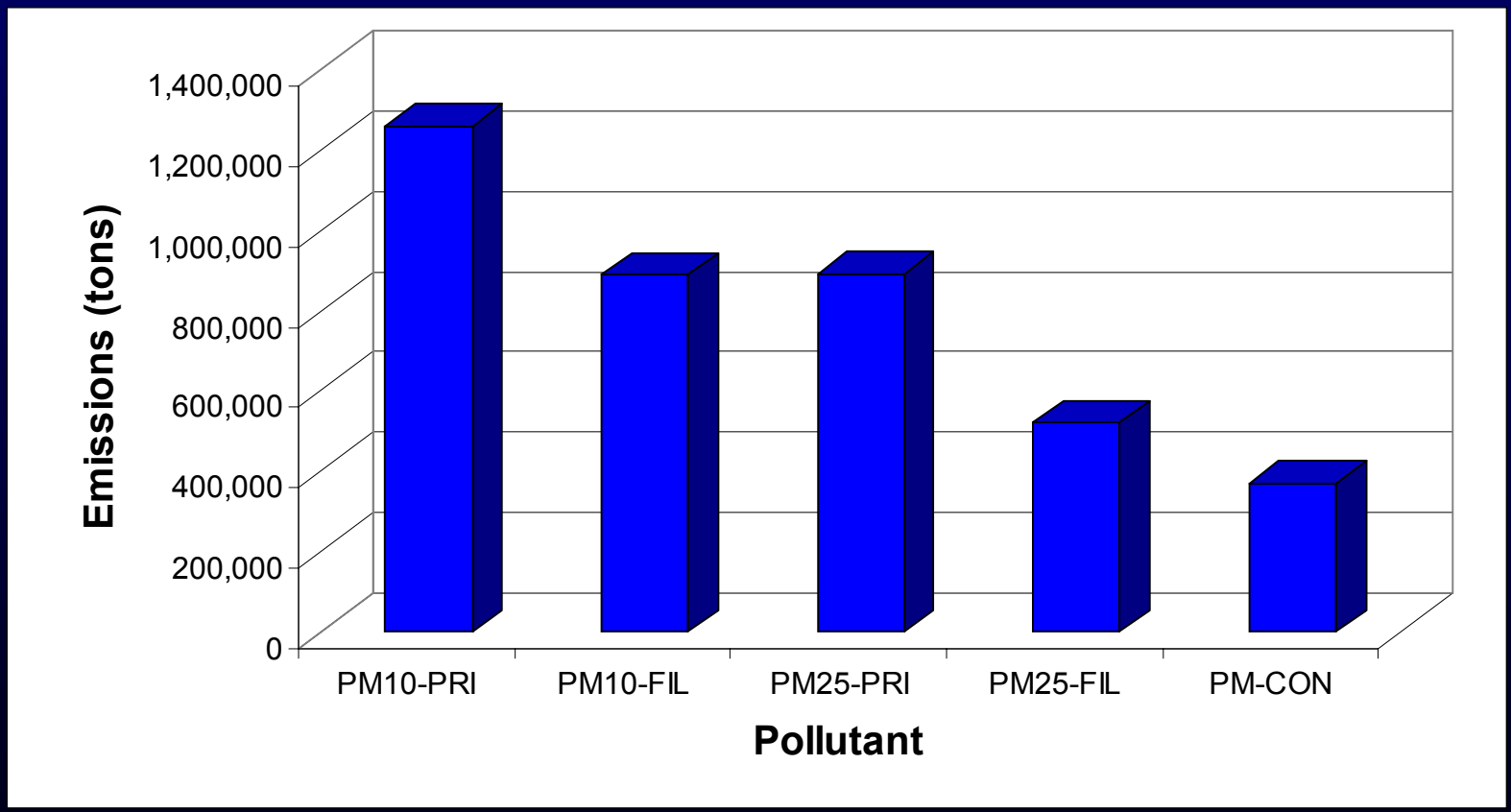
Filterable Emission Sources

- Ratios developed to calculate:
  - PM25-FIL from S/L/T-supplied PM10-FIL
  - PM25-FIL & PM10-FIL from S/L/T-supplied PM-FIL
- Ratios available at:

  ftp://ftp.epa.gov/EmisInventory/draftnei99ver3/criteria/documentation/area/

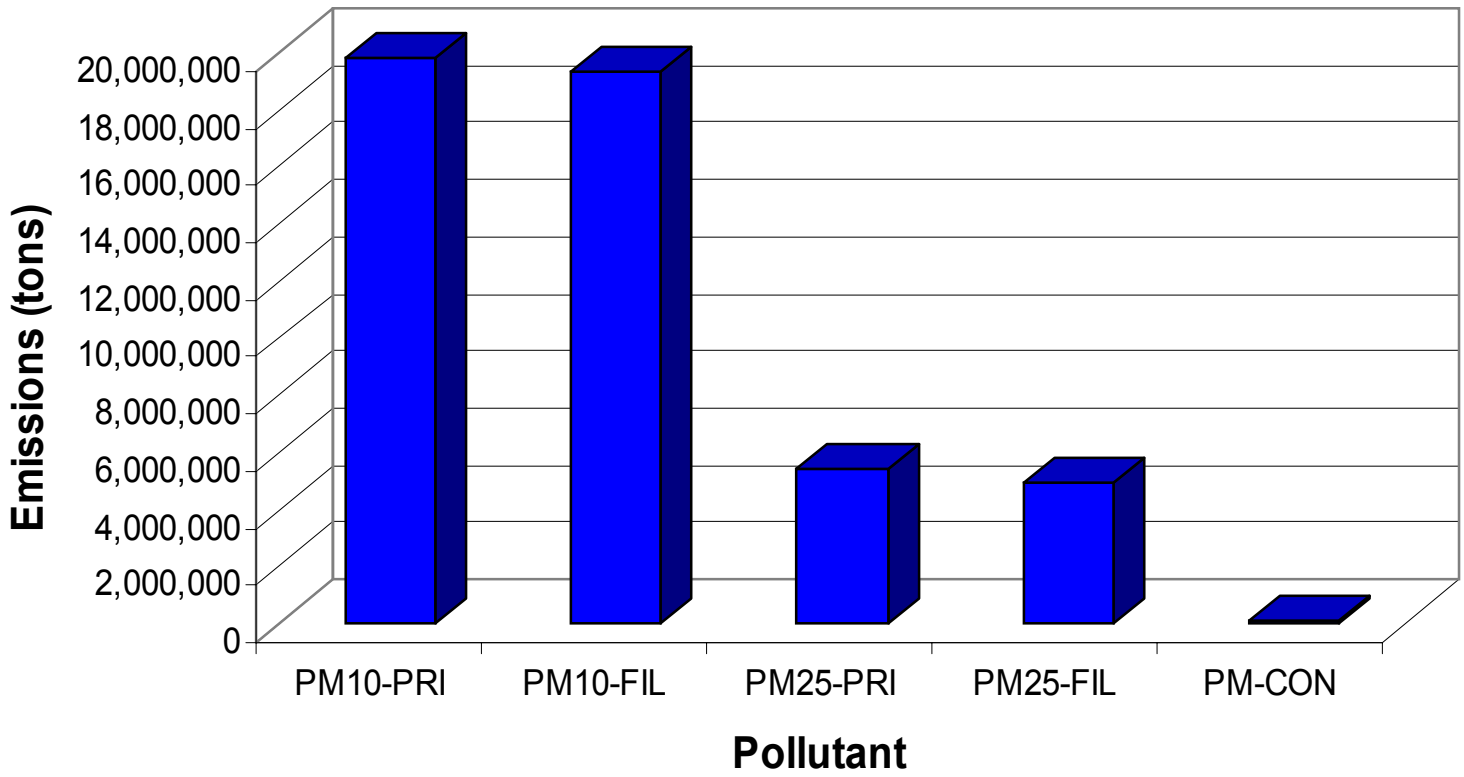
RESULTS

Point national annual emissions (NEI Version 2)



RESULTS

Area national annual emissions (NEI Version 2)



UNCERTAINTIES

Lack of particle-size-specific emission factors for:

- PM10-FIL & PM25-FIL for controlled sources
- PM-CON

Industrial Point SCCs: Procedures calculate CON for sources with no CON emissions:

- Paved & unpaved roads, material handling operations
- EPA will correct this

UNCERTAINTIES

PM Calculator

- Not as accurate as using emission factors, throughput, & control efficiencies

- S/L/T SCCs & Controls missing from PM Calculator
  - Matching to PM Calc SCCs & controls creates uncertainties in estimates

UNCERTAINTIES

- S/L/T Inventory Issues
  - Form of PM in S/L/T not specified
  - Control efficiencies not reported or not accurate
  - If PM or PM_{10} not reported; PM_{10} & $PM_{2.5}$ not calculated

CONCLUSIONS

- Procedures provide starting point for improving PM-related pollutant emissions in point & area source inventories
- Procedures have many limitations & create uncertainties in the emissions estimates
- S/L/T agencies should develop their own methods to improve emissions estimates

RECOMMENDATIONS

- Identify SCCs with PM_{10} & $PM_{2.5}$
- Use emission factors, throughput, & control efficiency data
- If throughput data not available:
  - Use PM Calc. to estimate FIL emissions
  - Apply ratios of emission factors to estimate CON emissions
- QA emissions to ensure consistent results

PM Augmentation Procedures for the 1999 Point and Area Source NEI

End of presentation