Module 6:

Nonpoint Source Emission Inventory Development

Nonpoint Source Definition

- Stationary emission sources that are too small, numerous, or dispersed to be handled individually as point sources
- Nonpoint sources are typically geographically dispersed
### Nonpoint Fuel Combustion Sources

- Stationary source fuel combustion
  - Residential heating and cooking
  - Industrial, commercial and industrial boilers
  - Biomass or waste-derived fuels
  - Portable generators or pumps

- Municipal waste (trash) burning

- Open burning:
  - Agricultural residues
  - Wildfires
  - Structures
  - Slash burning

### Nonpoint Fugitive Emission Sources - VOCs

- Domestic LPG usage
- Organic solvent utilization
  - Consumer products
  - Drycleaners
  - Surface coating
  - Solvent degreasing
- Fuel and organic material storage and distribution
  - Gasoline service stations
  - Storage and transport
  - Material storage and distribution
- Waste treatment, disposal, and transport
- Pesticide use
- Hospital sterilizers
Nonpoint PM and Ammonia Sources

- Particulate Matter (PM) sources:
  - Paved and unpaved roads
  - Agricultural tilling and harvest activities
  - Gravel and mining operations
  - Construction activities
  - Wind erosion
  - Cooking with wood

- Ammonia sources:
  - Livestock
  - Fertilizer usage

Potentially Important Nonpoint Sources in South Africa

- Open burning (forest and savannah fires)
- Residential coal and wood combustion
- Agricultural operations (tilling, fertilizer, and pesticide applications)
- Solvent evaporation sources
- Mining dust fall (silica dust)
- Reentrained road dust
- Construction activities
- Other ideas?
Point or Nonpoint?

- “Nonpoint” sources are activities where emissions are computed and maintained for the overall source category instead of individual emission sources (e.g., petrol stations, dry cleaners, unpaved roads, construction).

Is the Source Point or Nonpoint?

- Classification of sources as point or nonpoint vary inventory-to-inventory and agency to agency
  - May be driven by end uses of data
  - May use thresholds (e.g., 10 metric tons/year) of specific pollutants to distinguish between “point” versus “nonpoint” sources
  - Can be driven by type of inventory – e.g., GHG national inventories use nonpoint approaches for many combustion sources
  - May be driven by available emission estimation methods
  - May be driven by available resources
- Need to reconcile point source and nonpoint source data within the same source category
Building an Air Quality Plan

Nonpoint Source Inventory Planning

- Consider end uses of inventory
- Establish resource needs
- Define sources and categories to be included
- Define temporal resolution
- Specify emission estimation methods, data needs, data availability
- Select data collection methods
- Identify stakeholders to assist in data collection and verification
- Identify possible point source overlap
- Determine data management and reporting procedures
- Assess computer system capabilities
- Identify QA coordinator and establish QA/QC procedures
At What Level of Detail Are Nonpoint Source Inventories Compiled?

- Country
- District
- City
- Other jurisdictions such as neighborhood or community scale assessments

What Emissions Estimation Methods Should I Use for Nonpoint Sources?

- Applying point source methods to nonpoint sources (bottom-up; estimate each source individually)
- Applying a top-down approach
  > Applying average source test, regional, national, or international derived emission factor to the local level
  > Allocating national, regional, or state level emission estimates to the local level
How Do I Choose Emission Estimation Methods?

- Choice of methods depends on:
  - Pollutant and source category priorities
  - Intended use of the inventory
  - Resources
  - Availability of data
  - Compromise between method accuracy and cost to implement

Nonpoint Source Emission Inventory Development

1. Choose method
2. Obtain activity data and emission factors
3. Calculate emissions
4. Perform QA/QC
5. Make spatial/temporal adjustments and reconcile with point source inventory
6. Quantify effect of applicable controls, regulations
   - Rule effectiveness
   - Rule penetration
7. Finalize emissions inventory
Nonpoint Source Inventory Resources

- Most recent NEI documentation
  > http://www.epa.gov/ttn/chief/net/index.html
- Emission Inventory Improvement Program (EIIP) documents
- “Compilation of Air Pollutant Emission Factors, Volume I” (AP-42)
- These documents can be downloaded from U.S. EPA’s Clearinghouse for Inventories & Emission Factors (CHIEF) at:
  > http://www.epa.gov/ttn/chief/index.html
Nonpoint Source
Emission Estimation Methods

- Emission factors and activity data
- Material balance
- Extrapolation
- Mechanistic models

Methods: Emission Factors

- Locally-based
- Nationally-based
- Internationally-based
- Census-based
Locally-Based Emission Factors

- Preferred when literature or national-level emission factors do not account for local conditions or variations
- Applicable to locally-significant source categories
- May require source emissions testing to develop emission factors
- Emission factor development may require stakeholder, regulatory, and academic input
- Consider needed accuracy of estimate (e.g., mass balance for solvent emissions may be sufficiently accurate)

Nationally-Based Emission Factors

- National or literature emission factors can be used when:
  > No local emission factors exist
  > Mix of sources in category is similar to literature EF sources
  > The source category is low priority
- Literature EFs derived from a wide range of source tests
- Variability in individual emission sources or locations not accounted for in national or literature based emission factors
- Example PM emission factors from AP-42 (U.S.-based):
  > Commercial distillate fuel: 0.24 kg/1,000 liters
  > Agricultural residue burning: 6 kg/Mg of residue burned
Census-Based Emission Factors

- Best for sources with emissions that are not geographically or seasonally variable:
  - Consumer solvents
  - Automobile refinishing

- Example VOC emission factors (census-based):
  - Architectural surface coating: 2.9 kg/year/person
  - Consumer solvents 3.56 kg/year-person

*Census-based emission factors highly uncertain due to socioeconomic and cultural differences between regions*

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Calculate Emissions

\[
\text{Emissions} = \text{Process Rate (Activity)} \times \text{Emission Factor} \\
\text{Total Emissions} = \text{Number of Units} \times \text{Emissions per Unit}
\]
Example Calculation #1: Dry Cleaners

- Emission inventory objective: Estimate annual VOC (volatile organic compound) emissions from commercial dry cleaners

- Method: Local emissions data do not exist, so it is decided to use a census-based emission factor:
  > Emission Factor = 494 kg VOC/employee/year (EIIP, 1995)

- Activity data needed for EF:
  > Total number of people employed by commercial dry cleaners
  > Subtract the number of employees working at any large commercial dry cleaning facilities considered point sources

Methodology to estimate annual VOC emissions

Emissions = EF × Activity

Where:
- EF = emission factor (kg VOC/year/employee)
- Activity = activity data (# of employees)

Total number of employees in industry = 22,429
Total number of employees working at large facilities (point sources) = 5,000

VOC EF = 494 kg VOC/year/employee

Calculate annual VOC emissions (kg/year)

= 494 kg VOC/year/employee × (22,429 – 5,000) employees
= 8,609,926 kg VOC/year
Dry Cleaners (continued)

- Calculate daily dry cleaner emissions
  - Average operating schedule for all dry cleaners
    - 5 hours/day, 6 days/week, 50 weeks/yr
    - Operations do not vary by season
  - VOC emissions
    - \[ \frac{8,609,926 \text{ kg VOC/yr}}{50 \text{ wk/yr} \times 6 \text{ day/wk}} \]
    - \( = 28,700 \text{ kg/day} \)

Methods: Material Balance

- Emissions = Material in - Material out
- Applicable source categories
  - Industrial and commercial fuel consumption
  - Regional/national solvent utilization
- Used to check “reasonableness” of results obtained using other methods
Examples of Material Balance

- Fresh Solvent → Solid Waste → Waste Solvent
- Paint VOCs → VOC Emission

- Sulfur (S) in Fuel → Sulfur Dioxide (SO₂) Emissions

Assume all sulfur in a fuel is converted to SO₂ during the combustion process.
Assume all solvents in paint are evaporated.
Assume waste solvent is sent to a reprocessor and solid waste is sent to a treatment facility.

Methods: Extrapolation

- Scaling emissions estimates to create another inventory using scaling parameters:
  > Land area
  > Number of employees
  > Population

- Extrapolation is most accurate when socioeconomic conditions between two or more geographical regions are comparable.
Example Calculation #2: Architectural Surface Coating

- Inventory objective: Estimate VOC emissions from architectural surface coatings
- Method
  > No data available within inventory Region B to estimate emissions using material balance or other method
  > Extrapolation is chosen to provide an initial estimate
- Activity data
  > Estimated VOC emissions from architectural surface coating in Region A = 2,350 Mg/yr
  > Population of Region A = 4,500,000
  > Population of inventory Region B = 500,000

Architectural Surface Coating (continued)

- Calculate annual VOC emissions (kg/yr)
  > VOC emissions (kg/yr for Region B)
    = (Inventory Region A) × (Region B Population)/(Region A Population)
    = 2,350 Mg/yr x (500,000/4,500,000)
    = 261 Mg/yr
Methods: Mechanistic Models

- Utilize chemistry and physics principles and understanding of process technology
- Tested and validated to be capable of estimating area source emissions to a high level of accuracy
- U.S. EPA has developed standard methods which are available as computer software

<table>
<thead>
<tr>
<th>Model Name</th>
<th>Description/Features</th>
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</thead>
<tbody>
<tr>
<td>WATER9</td>
<td>Estimates emissions from WWTF</td>
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<tr>
<td></td>
<td>Menu-drive computer program</td>
</tr>
<tr>
<td>LandGEM 3.02</td>
<td>Estimates landfill VOC, CH₄, CO₂, and toxic emissions</td>
</tr>
<tr>
<td></td>
<td>Computer model</td>
</tr>
<tr>
<td></td>
<td>Site-specific data can be entered; defaults provided</td>
</tr>
<tr>
<td>TANKS, version 4.09</td>
<td>Estimates organic chemical emissions from storage tanks</td>
</tr>
<tr>
<td></td>
<td>Variety of tank types included</td>
</tr>
<tr>
<td></td>
<td>Computer model</td>
</tr>
<tr>
<td></td>
<td>User enters site-specific data; defaults provided</td>
</tr>
</tbody>
</table>
Activity Data

- The measure of a source category that is a direct or surrogate indicator of emissions

Example of direct activity data:
- Amount of fuel burned
- Amount of solvent used
- Production rates (e.g., kg/clothes laundered)

Example of surrogate activity data:
- Population
- Number of employees
- Number of households
Activity Data: Sources

- Surveys
- Examination of local, state and national documents and databases
  - Population and housing data
  - Employment data
  - Mining, Agriculture, Electricity Production
  - Industry Association and Trade Data
- Online census databases (“StatsOnline”)
  - By economic sector, industry type, region

Activity Data: Collection

- Use surveys to obtain information from sources
- Collect information from published references, government agencies, trade associations
- Adjust national, province, or regional level data for use at the local level
- Use surrogate factors to estimate activity
- Conduct field studies to collect data need as input to emission estimation methods
## Where Do I Find Nonpoint Source Activity Data?

- Departments Of Labor
- Agriculture Offices
- Solid Waste Management agencies
- Fire marshals
- Port Authority
- Health Departments
- Miscellaneous statistical government & trade publications
- Departments of Transportation and Energy Offices
  - Energy Reports
  - Petroleum Marketing Annual
  - Natural Gas Annual
- Government-sponsored surveys
- Industry data
- Department of Commerce
  - Business Patterns
  - Census of Population
  - Census of Manufacturers
  - Census of Agriculture
  - City Data Book
  - Current Industrial Reports
  - Census of Retail Trade
Activity Data: Surveys

- Collect local activity data for use with locally and nationally based emission factors
- Desired when available data or census-based approaches would create high degree of uncertainty in the inventory
- Applicable to relatively significant source categories
- Work with stakeholders to develop best available information
- Examples of surveys and data to collect:
  > Amount of wood burned for heating or cooking
  > Petrol stations: amount/types of fuel dispensed, tank types, number of pumps, controls
  > Crops grown and number of operations per crop

Emission Estimation Examples
Example Calculation #3: Unpaved Roads

- Emission inventory objective: Estimate PM$_{10}$ emissions from public unpaved roads
- Activity data needed:
  > South Africa-specific inputs if possible
  > AP-42 defaults available for some characteristics where necessary

Unpaved Roads

Emission Factor Equation

- Methodology to estimate PM$_{10}$ emission factor

\[
EF = k \times \left( \frac{s}{12} \right)^a \times \left( \frac{SPD}{30} \right)^b - C \\
(M/0.5)^c
\]

where:
- EF = size specific emission factor (lb/VMT)
- k, a, b, and c are empirical constants given in AP-42 by particle size (PM$_{10}$ and PM$_{2.5}$)
- s = surface material silt content (%)
- SPD = mean vehicle speed (mph)
- M = surface material moisture content (%)
- C = Constant to account for EF fraction that is vehicle fleet brake, tire, and exhaust (lb/VMT)
Unpaved Roads
Input and Activity Data

- Silt content (s)
  > Sample silt content of road surface material(s) according to methodology in AP-42, Appendices C.1 and C.2

- Mean speed on unpaved roads (SPD) and moisture content of soil on surface (M)

- Vehicle miles (or kilometers) traveled
  > Survey VKT over selected roads
  > Extrapolate for entire region = 10,000,000 VKT/year
  > Or estimate miles of unpaved road and assume number of passes per day, month, or year to compute VKT

Unpaved Roads
Assumed EF Inputs

- Calculate PM$_{10}$ emission factor
  > Assume the following values for example calculation:

  \[
  \begin{align*}
  k \text{ (constant)} & = 1.8 \text{ lb/VMT (for PM$_{10}$)} \\
  a \text{ (constant)} & = 1 \\
  b \text{ (constant)} & = 0.5 \\
  c \text{ (constant)} & = 0.2 \\
  \text{Silt content} & = 6 \% \\
  \text{Mean speed} & = 26.5 \text{ mph} \\
  \text{Surface moisture} & = 0.03\% \\
  \text{Exhaust/brake/tire} & = 0.00047 \text{ (lb/VMT)}
  \end{align*}
  \]

Constants from U.S. EPA AP-42 Emission Factor Equation Documentation
### Unpaved Roads

#### Calculating Emission Factor

- **Calculate PM$_{10}$ emission factor**
  - EF (lb/VMT)
    
    \[
    EF \text{ (lb/VMT)} = \frac{(1.8 \times (6/12)^1 \times (26.5/30)^{0.5}) / (0.03/0.5)^{0.2}}{0.00047}
    \]
    
    \[
    = \frac{(1.8 \times 0.5 \times 0.9399) / 0.5697}{0.00047}
    \]
    
    \[
    = 1.4848 - 0.00047
    \]
    
    \[
    = 1.4844 \text{ lb/VMT}
    \]
  
  - Convert from lb/VMT into g/VKT
    
    \[
    = 1.4844 \text{ lb/VMT} \times 281.9 = 418.4 \text{ g/VKT} = 0.418 \text{ kg/VKT}
    \]

---

### Unpaved Roads

#### Emissions Calculation

- **Calculate annual PM$_{10}$ emissions (kg/yr)**
  
  > PM$_{10}$ Emissions (kg/yr) = EF (kg/VKT) \(\times\) VKT/yr
  
  \[
  = 0.418 \text{ kg/VKT} \times 10,000,000 \text{ VKT/yr}
  \]
  
  \[
  = 4,180,000 \text{ kg/yr}
  \]
Example #4: Graphic Arts

Calculate annual VOC and air toxics emissions (kg/yr)

- Industry consists of many small facilities, with no emission controls
- Source category consists of many different printing technologies
- Hundreds of different inks, washes, and process solutions are used
- Surveyed facilities with support from industry trade associations
- Developed material consumption estimates for “model” plants
- Used solvent usage and material consumption estimates for model plants to develop emission estimate

Example #5: Houston Electroplating

Calculate annual HCl and Hexavalent chromium emissions (kg/yr)

- Developed a nonpoint top down emission inventory using business data and emission factor - based on risk assessment, it was decided to refine estimates
- City of Houston surveyed 58 metal plating facilities by phone, mail, visits. Facilities identified by SIC code 3471.
- Information gathered enabled calculation of chromium, HCl emissions using emission factors
- Adjusted estimates based on response rate to survey, etc.
Example #6: Land Clearing Debris Burning

Emissions = Acres x FL x EF
- Acres are acres cleared for Construction
- FL is fuel loading factor
  > Fuel loading factors from Forest Service for hardwoods, softwoods, and grass
    - Hardwood: 99
    - Softwood: 57
    - Grass: 4.5
  > Adjusted USFS fuel loading factors by 1.5 to account for additional mass (tree roots)
- EF is emission factor
  > PM10 = PM2.5
  > 17 lbs PM2.5/ton of fuel

Example #7: Fugitive Dust from Construction Activities

- Construction Categories
  > Residential
  > Road
  > Non-residential (commercial, industrial, government, public works)

- Adjustments made for
  > Soil Moisture
  > Silt Content
Example #8: Fugitive Dust from Road Construction Activities

Construction: Road

- \( E = EF \times \$ \times f_1 \times f_2 \times m \)
- \( EF \) = emission factor
- \( \$ \) = District Expenditures for road construction
- \( f_1 \) = $ to miles conversion
- \( f_2 \) = miles to acres conversion
- \( m \) = duration (12 months)

Roadway Construction

1. District $$ for Roads
2. Convert to Miles
3. Convert to acres
4. Compute Emissions
5. Project Duration
Roadway Construction

- District Expenditure Data for Capital Outlay for Roadways
  - Interstate; urban
  - Interstate; rural
  - Other arterial; urban
  - Other arterial; rural
  - Collectors; urban
  - Collectors; rural

Roadway Construction

- $$$ to Miles (US data)
  - $4 million/mile for interstates
  - $1.9 million/mile for arterial and collectors

- Miles to Acres
  - 15.2 acres/mile for interstates and urban arterial
  - 12.7 acres/mile for rural arterial
  - 9.8 acres/mile for urban collectors
  - 7.9 acres/mile for rural collectors

- Assumption: Does not include privately constructed roads
Example #9: Fugitive Dust from Building Construction Activities

Construction: Non-Residential Construction

- \( E = EF \times \$ \times f \times m \)
- \( EF \) = Emission factor (tons/acre/month)
- \( \$ \) = district $ \\
- \( f \) = dollars-to-acres conversion (1.6 acres/million dollars (1992 value adjusted for inflation to 2004))
- \( m \) = duration (12 months)

Inventory Adjustments and Refinements

Spatial Allocation
Temporal Allocation
Rule Effectiveness and Rule Penetration
Point Source Reconciliation
Finalizing Nonpoint Source Inventory

- Calculate emissions
- Reconcile with point source inventory
- Make temporal and spatial adjustments
- Perform final QA activities
- Add rule effectiveness and rule penetration if needed
- Prepare documentation

Inventory Adjustments: Spatial Allocation

- Spatial allocation is the adjustment of activity levels or emission estimates to a smaller or larger geographic area than the area for which the activity levels or emission estimates were prepared
Spatial Allocation: Process

Process: Spatial adjustments to allocate emissions or activity data to area

> Obtain direct activity data for the area
   – Local activity level data
   – National data
   – Population data
   – Employment data

> Allocate based on spatial surrogates
   – Can use surrogate factors which relates emissions to some other parameter, then spatially allocates emissions based on the appropriate surrogate

Example Spatial Allocation Surrogates

<table>
<thead>
<tr>
<th>Emissions Category</th>
<th>Surrogate Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential fuel combustion</td>
<td>Housing type and density</td>
</tr>
<tr>
<td>Commercial/Institutional fuel combustion</td>
<td>Urban land use</td>
</tr>
<tr>
<td>Unpaved roads</td>
<td>District area land use type</td>
</tr>
<tr>
<td>Forest wildfires</td>
<td>Composite forest land use type</td>
</tr>
<tr>
<td>Dry cleaning</td>
<td>Population, employment</td>
</tr>
<tr>
<td>Autobody repair</td>
<td>Population, employment</td>
</tr>
<tr>
<td>Miscellaneous industrial manufacturing</td>
<td>Population, employment</td>
</tr>
<tr>
<td>Asphalt paving</td>
<td>Road length, VKT (vehicle km traveled)</td>
</tr>
</tbody>
</table>
Example of Dry Cleaner PERC Emissions
Spatially Allocated By Population

Inventory Adjustments:
Temporal Allocation

- Temporal allocation is needed to adjust reported emissions to time period of interest
- Temporal adjustments
  > Seasonal variations may be important
    - Ozone seasons = warmer months
    - Carbon monoxide seasons = colder months
  > Operating schedule is needed to calculate daily emissions
    - Hours/day, days/week, weeks/year
Inventory Adjustments:
Rule Effectiveness and Rule Penetration

- Rule effectiveness (RE) is the measure of the ability of a regulatory program to achieve emissions reductions possible by full compliance with applicable regulations by all sources at all times
  - Reflects the assumption that regulations typically are not 100% effective
  - Addresses reduced effectiveness due to malfunctions and shutdowns
- Rule penetration (RP) is the percentage of the nonpoint source category that is covered by the applicable regulation
  - \[ RP = \frac{\text{Uncontrolled source emissions covered by regulation}}{\text{Total uncontrolled source emissions}} \times 100 \]
- Both RE and RP are applied to entire source categories

Rule Effectiveness (RE)

- Rule effectiveness for uncontrolled sources = 0%
- Rule effectiveness for irreversible process changes that eliminate use of a pollutant (e.g., VOCs) = 100%
- Methods for calculating inventory RE
  - Use a default value (e.g., 80%)
  - Use a study specific to a category and geographic area
What Should You Consider in Estimating Rule Effectiveness

- Nature of the emissions reduction regulation
- Nature of the compliance program and procedures
- Performance of the source in maintaining compliance over time
- Performance of the implementing agency in assuring compliance
- Rule Effectiveness and Rule Penetration are often applied as separate adjustment to the baseline, uncorrected emissions

Example: RE/RP Calculation for Nonpoint Sources

- Assumptions: Operating Parameters Stage I Gasoline Marketing
  > Total county throughput: 500,000 gal/day
  > Tank filling method: splash filling
  > Filling method central efficiency: 95%
  > Stage I gasoline marketing emission factors: 11.5 lb/1,000 gallon throughput (from AP-42, Table 5.2-7)
  > Rule Effectiveness (RE) is assumed to be 80%
  > Rule Penetration (RP) is assumed to be 93% (fraction of throughput that will be subject to control)
Basic Emission Calculation with Rule Effectiveness and Rule Penetration

\[ E = A \times EF \times (1 - [C \times RE \times RP]) \]

Where:
- \( E \) = Emissions
- \( A \) = Activity data
- \( EF \) = Uncontrolled emission factor
- \( C \) = Control efficiency
- \( RE \) = Rule effectiveness
- \( RP \) = Rule penetration

Emissions Uncontrolled (EU) = \( A \times EF \)
- EU = 500,000 gal/day \( \times \) 11.5 lbs VOC/1,000 gal
- EU = 5,750 lbs VOC/day

Emissions Controlled (EC) = EU \( \times \) \( 1 - (CE \times RE \times RP) \)
- EU = Uncontrolled Emissions
- A = Activity data = 500,000 gal/day
- EF = Uncontrolled emission factor = 11.5 lbs VOC/1,000 gal
- C = Control efficiency = 95%
- RE = Rule effectiveness = 80%
- RP = Rule penetration = 93%

EC = 5,750 \( \times \) \( 1 - ((0.95)(0.8)(0.93)) \)
EC = 1,686 lb of VOC/day (emissions adjusted for RE and RP)
Point Source Reconciliation

- Prevents double-counting of emissions in point and nonpoint source inventories
- Point source reconciliation methods
  - Adjust activity levels before emission factors are applied
  - Adjust nonpoint source uncontrolled emissions after they have been calculated by subtracting uncontrolled point source emissions
- Apply RE and RP after the point source adjustment is made

Example: Point Source Reconciliation

- Adjust nonpoint source VOC emissions for surface coating to account for emissions calculated for industrial point sources
  - Determine the total amount of surface coatings used within the inventory area
  - Determine the amount of surface coatings used only by individually inventoried Point Sources
  - Reconcile nonpoint source usage with point source usage:
    Nonpoint source usage (liters/yr) =
    Total usage (liters/yr) - Point Source usage (liters/yr)
Emission Inventory Documentation

- Methods used
- Sources of data
- Assumptions
- Calculations
- Conversions
- Results
- Limitations of Results

Data Collection & Management

1. Collect Data
2. Calculate Emissions
3. Quality Assurance
4. Documentation
5. Data Handling System
6. Reports

- Reports
- Annual Average
- Seasonal
- Forecasted
- Gridded
Getting Started: Preliminary Screening Study for Nonpoint Sources

Conduct Preliminary Screening Study to:

> Determine most significant pollutants emitted by source categories within the geographic area
> Perform an initial informal survey to evaluate which sources are likely to be significant in the region of interest
> Decide which source categories to estimate as point vs. nonpoint sources

Getting Started
Preliminary Source Ranking

- Rank sources in your region from 1-10, with 10 being the most important sources, and 1 being the least important
- Ranking based on guesses about:
  > Estimated magnitude of emissions
  > Importance based on policy, health effects, public perception, and other issues
  > Potential for regulation both technologically and politically
  > Availability and quality of existing emissions data
  > Availability of input data for computing emissions
- Focus on highest ranking sources first, but ultimately will need to estimate emissions for most major sources
## Getting Started

### Nonpoint Emission Estimates

#### Areawide Sources

<table>
<thead>
<tr>
<th>Areawide Sources</th>
<th>Responsibility (primary, secondary)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paved Road Dust</td>
<td></td>
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<tr>
<td>Unpaved Road Dust - Non-Agricultural</td>
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<tr>
<td>Unpaved Road Dust - Agricultural</td>
<td></td>
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<tr>
<td>Agricultural Operations (land preparation &amp; harvest)</td>
<td></td>
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<tr>
<td>Trash Burning</td>
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<tr>
<td>Dung Burning (cooking/heating)</td>
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<tr>
<td>Agricultural Burning</td>
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<tr>
<td>Cooking - Commercial</td>
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<tr>
<td>Cooking - Street Vendor &amp; Homeless</td>
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<tr>
<td>Cooking - Residential, LPG</td>
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<tr>
<td>Agricultural Burning</td>
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<tr>
<td>Managed Forest &amp; Brush Burning</td>
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<tr>
<td>Construction</td>
<td></td>
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<tr>
<td>Woodstoves &amp; Fireplaces</td>
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</tbody>
</table>

#### Other Areawide Sources

<table>
<thead>
<tr>
<th>Other Areawide Sources</th>
<th>Responsibility (primary, secondary)</th>
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</thead>
<tbody>
<tr>
<td>Additional Categories for Consideration</td>
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<tr>
<td>Pesticides</td>
<td></td>
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<td>Consumer products</td>
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<td>Architectural coatings</td>
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<tr>
<td>Refrigerants</td>
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<td>Solvent evaporation</td>
<td></td>
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<tr>
<td>Windblown dust from agricultural lands</td>
<td></td>
</tr>
<tr>
<td>Structure and car fires</td>
<td></td>
</tr>
<tr>
<td>Asphalt paving / roofing</td>
<td></td>
</tr>
<tr>
<td>Portable generators</td>
<td></td>
</tr>
<tr>
<td>Agricultural pumps</td>
<td></td>
</tr>
<tr>
<td>Utility equipment (forklifts, etc.)</td>
<td></td>
</tr>
</tbody>
</table>

- What is missing for your region?
# Milestones for Paved Road Dust Estimate

<table>
<thead>
<tr>
<th>Areawide Sources</th>
<th>Responsibility (primary, secondary)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Paved Road Dust</strong></td>
<td></td>
</tr>
<tr>
<td>Identify Staff</td>
<td>[ ]</td>
</tr>
<tr>
<td>Evaluate Methodologies</td>
<td>[ ]</td>
</tr>
<tr>
<td>Select Methodology</td>
<td>[ ]</td>
</tr>
<tr>
<td>Evaluate Emission Factors</td>
<td>[ ]</td>
</tr>
<tr>
<td>Calculate Emission Factors</td>
<td>[ ]</td>
</tr>
<tr>
<td>Evaluate Available Activity Data</td>
<td>[ ]</td>
</tr>
<tr>
<td>Develop Activity Data</td>
<td>[ ]</td>
</tr>
<tr>
<td>Develop Spreadsheet</td>
<td>[ ]</td>
</tr>
<tr>
<td>Calculate Emissions</td>
<td>[ ]</td>
</tr>
<tr>
<td>Check Assumptions &amp; Calcs</td>
<td>[ ]</td>
</tr>
<tr>
<td>Format Emissions for Database</td>
<td>[ ]</td>
</tr>
<tr>
<td>Load &amp; Validate Data</td>
<td>[ ]</td>
</tr>
<tr>
<td>Document Methodology &amp; Assumptions</td>
<td>[ ]</td>
</tr>
<tr>
<td>Identify Areas for Improvement (spatial, temporal, EFs, activity, etc.)</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

---

# Example Nonpoint Source Planning Matrix for Emission Estimation

<table>
<thead>
<tr>
<th>Selected Category</th>
<th>Activity Data: Type</th>
<th>Activity Data: Source</th>
<th>Methodology: Emission Factor</th>
<th>Methodology: Alternative</th>
<th>Explanatory Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel combustion (residential biomass)</td>
<td>Fuel usage</td>
<td>Local officials</td>
<td>AP-42, Section 1.9 and 1.10</td>
<td>Fuel equivalence method</td>
<td>Heating use will vary regionally</td>
</tr>
<tr>
<td>Solvent usage (commercial and consumer solvent use)</td>
<td>Type and amount of solvent used: user population</td>
<td>Local agencies, national product sales</td>
<td>EIIP Chapter 5 for per-capita factors</td>
<td>VOC losses for types of local usage and practices</td>
<td>Spatial allocation may require surrogate factors</td>
</tr>
<tr>
<td>Livestock animals</td>
<td>Livestock population</td>
<td>Agricultural agency</td>
<td>Radian, 1997; Batyce et.al., 1994</td>
<td></td>
<td>Considerable regional variability</td>
</tr>
<tr>
<td>Petrol distribution</td>
<td>Fuel distribution statistics</td>
<td>Energy agency, fuel companies</td>
<td>Fuel specific AP-42, Chapter 5; EIIP Chapter 11</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Air Monitoring

Emissions Inventory

Source Apportionment

Identification of the Sources, Magnitude, and Effects of the Air Pollution Problem

Control Strategy Development

Implement Air Quality Improvement Plans

Evaluate Effectiveness of Implemented Controls

Air Quality Modeling

Cost Benefit Analysis

Health Study and Impact Analysis

Summary: Nonpoint Sources

- Nonpoint sources are stationary, geographically dispersed
- Inventory characteristics are based on end uses
- Selecting methods depends on end uses, and available resources and data
  - Mechanistic models
  - Emission factors, surveys
  - Material balance
  - Extrapolation
- Must reconcile with point source inventory to prevent double-counting of emissions
- RE/RP may be applicable
Questions or Comments?

END

Module 6: Nonpoint Source Emission Inventory Development