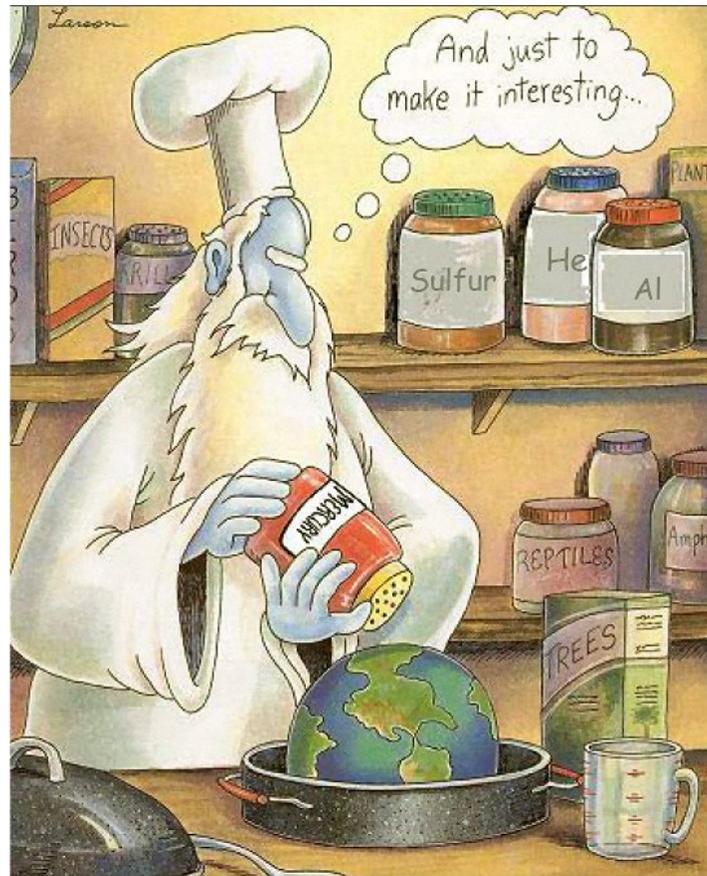


Emissions Inventory Preparation for Air Toxics





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Our Goals



- Explain what air toxics are, the history behind air toxics regulatory and inventory programs, and why it is important to develop an air toxics emissions inventory periodically
- Provide information on how to develop an air toxics inventory using detailed examples

Terminology



PBTs

CAA

CMVs

HAPs

MACT

NEI

NESHAP

NIF

NTI

PAH

PM

POM

RfC

TEQ

TRI

VOC

URE

VMT

10/25

Overview



- Introduction
 - Uses/ Reasons to Prepare Air Toxics Inventories
 - HAP Inventory Background
- Pollutant Definitions
- Source Category Definitions
- Point Sources
- Nonpoint Sources
- Mobile Sources
- Wrap Up!

Introduction



Air Toxics



- Pollutants capable of causing serious illnesses (e.g., cancer, birth defects) or even death
- Health effects are typically irreversible
- Health effects generally associated with years of exposure rather than hours or days
- Some persist in the environment, either remaining in the air or depositing on soil and in waterways
- Toxic in small amounts

Air Toxics



- We often think of air toxics and criteria pollutants as being separate (e.g., PM and VOCs)
- Air toxics comprise a significant percentage of criteria pollutants (e.g., volatiles and metals)

Concerns About “Urban Soup”



- Citizens are concerned about multiple source types or “urban soup” even before data are collected
- Most urban toxic “hot spots” are in non-attainment areas
 - criteria pollutants and air toxics affect the same populations

What Is an Air Toxics Emission Inventory?

Inventory - current comprehensive listing by sources of air pollutant emissions in a geographic area during a specific time period



Why Do We Need Air Toxics Inventories?



- Public interest in clean air
- To identify sources and problem areas
- As a baseline for future planning
- Tracking trends/progress towards cleaner air
- Determining compliance with regulations
- Projecting control strategy impacts
- For use in air quality modeling and risk assessments
- To help site ambient monitors

Risks from Air Toxics Are Widely Perceived as Smaller Than They Really Are

- Reason: Assessments subdivide risk into small pieces
 - Example: One facility's cancer incidence estimated at 0.02 per year
 - BUT
 - The lifetime incidence is $0.02 \times 70 \text{ years} = 1.4$
 - The incidence for 20 similar sources is $1.4 \times 20 = 28$
 - The incidence for all air toxics sources combined is about 10,000
 - The incidence for all sources of 188 air toxics = ??

Background of HAP Inventories



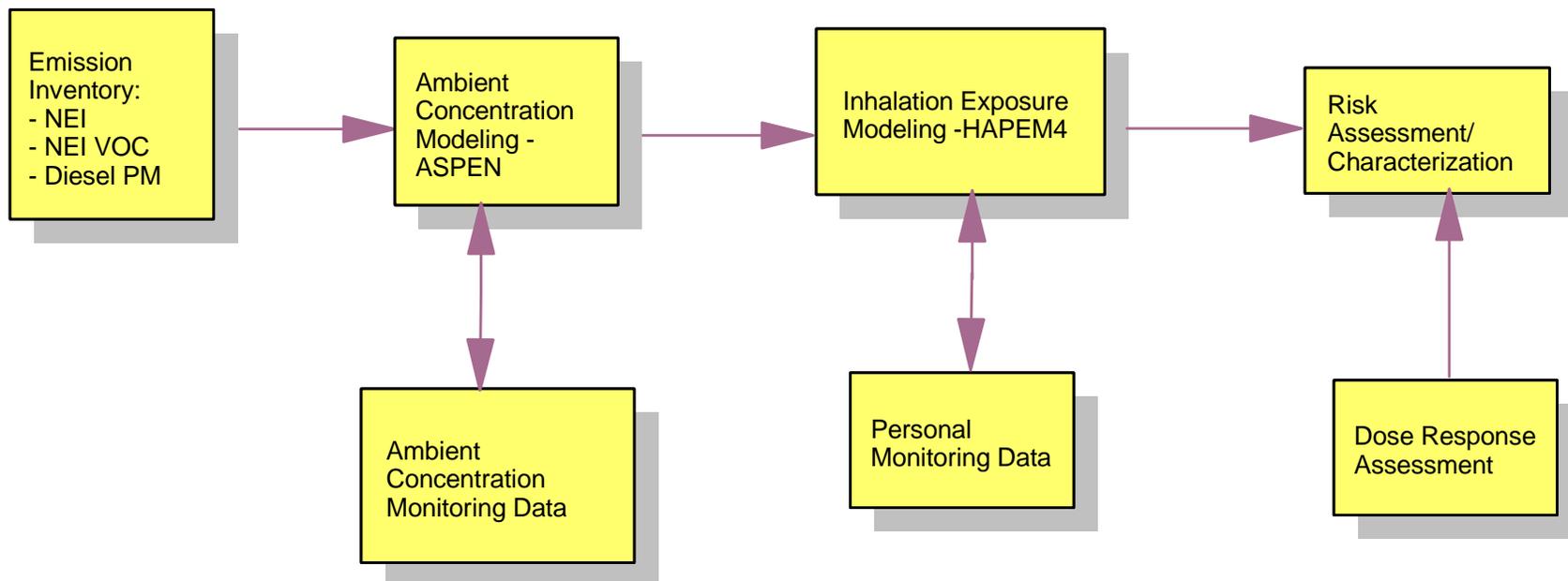
- 1977—EPA's NESHAP program created through Clean Air Act
- 1979—New Jersey Control and Prohibition of Air Pollution by Toxic Substances Act is passed
- 1987—EPA begins UATMP (Urban Air Toxics Monitoring Program)
- 1987—California implements Air Toxics "Hot Spots" Information and Assessment Act
- 1988—EPA's Toxic Release Inventory (TRI) Program created
- 1989—Texas passes Toxic Chemical Release Reporting Act
- 1990—EPA's MACT program created through Clean Air Act Amendments
- 1990—EPA's Urban Area Source program created through Clean Air Act Amendments

1990 Clean Air Act Toxics Requirements



- www.epa.gov/ttn/atw/eparules.html
- MACT source category & HAP listing/delisting
- Section 112(k), Urban Area Source Program
- Section 112(c)(6)
- Section 112(f), Residual Risk Program
- Section 112(m), Great Waters Program
- Section 112(n), Special Studies, e.g., Hg

National Scale Air Toxics Assessment (NSATA)



Ambient Monitoring Helps to Inform



- Limited monitoring data already confirm that EPA's modeling results
 - Did not overestimate risks associated with gaseous pollutants
 - May have underestimated risks associated with particulate pollutants
- To be more comprehensive, EPA is expanding the air toxics inventory and monitoring programs, both locally and nationally



Your Agency's Air Toxics Rules, Standards, and Programs

Pollutant Definitions – Identifying HAPs



- Clean Air Act list of 188 HAPs
- Clean Air Act Section 112(k) 33 Urban HAPs
- Persistent Bioaccumulative Toxics (PBTs)
- State and local agency lists

33 Urban HAPs



Acetaldehyde
Acrolein
Acrylonitrile
Arsenic compounds
Benzene
Beryllium compounds
1, 3-Butadiene
Cadmium compounds
Carbon tetrachloride
Chloroform
Chromium compounds
Coke oven emissions
1, 3-Dichloropropene
Diesel particulate matter*
Ethylene dibromide
Ethylene dichloride
Ethylene oxide

Formaldehyde
Hexachlorobenzene
Hydrazine
Lead compounds
Manganese compounds
Mercury compounds
Methylene chloride
Nickel compounds
Perchloroethylene
Polychlorinated biphenyls (PCBs)
Polycyclic organic matter (POM)*
Propylene dichloride
Quinoline
1, 1, 2, 2-Tetrachloroethane
Trichloroethylene
Vinyl chloride

Persistent Bioaccumulative Toxics (PBTs)



- Alkyl-lead
- Dioxins
- Furans
- Mercury and compounds
- Octachlorostyrene
- Polychlorinated biphenyls (PCBs)
- Aldrin/Dieldrin
- Chlordane
- DDT, DDD, DDE
- Hexachlorobenzene
- Mirex
- Toxaphene



Your Agency's Air Toxics Definitions/List

Issues to Consider With HAPs



- Important to use CAS #s
- Keep in mind that toxicity varies by chemical
 - Carcinogens
 - Non-carcinogens
- Problematic HAPs

Chemical Abstracts Service (CAS) #s



- <http://www.epa.gov/ttn/chief/nif/index.html#ver3>
- <http://chemfinder.cambridgesoft.com/>
- EPA's Office of Environmental Information
"EPA Chemical Identifiers"

Carcinogens



- Chemical or physical agents capable of causing cancer
- Risks are usually reported as lifetime chances that a certain number of people in 1 million will contract cancer after continuous lifetime exposure
- The Unit Risk Estimate is the upper-bound excess lifetime cancer risk estimated to result from continuous exposure to an agent at a concentration of 1 $\mu\text{g}/\text{m}^3$ in air

Non-carcinogens



- Capable of causing damage to immune system, neurological, reproductive, developmental, and respiratory health problems
- Risks can be reported relative to a Reference Concentration (RfC), where there is no appreciable risk of effects after continuous lifetime exposure

Problematic HAPs



- Polycyclic organic matter (POM) & naphthalene
- Dioxins and furans
- Metals
- Cyanide compounds
- Glycol Ethers
- Xylenes
- Cresols
- Diesel PM

Polycyclic Organic Matter



- “Includes organic compounds with more than one benzene ring, and which have a boiling point greater than or equal to 100⁰ C”
- Examples include polycyclic aromatic hydrocarbons (PAHs), chrysene, benzo(a)pyrene, and naphthalene
- Naphthalene is unique in that it is listed as a separate HAP on the 188 list

7-PAH* and 15-PAH Compounds



Acenaphthene

Acenaphthylene

Anthracene

Benz(a)anthracene*

Benzo(a)pyrene*

Benzo(b)fluoranthene*

Benzo(ghi)perylene

Benzo(k)fluoranthene*

Chrysene*

Dibenz(a,h)anthracene*

Fluoranthene

Fluorene

Indeno(1,2,3-cd)pyrene*

Phenanthrene

Pyrene

Dioxins and Furans



- Dibenzofurans and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) are listed on the 188 list
- EPA inventories all dioxins and furans
- Compounds can be grouped by 2,3,7,8 TCDD Toxic Equivalents (TEQs)
- TEQs are multipliers for some dioxin and furan congeners to get to a common basis of toxicity

Metals



- Antimony
- Arsenic
- Beryllium
- Cadmium
- Chromium
 - Hexavalent and trivalent
- Cobalt
- Lead
 - Organic and inorganic
- Manganese
- Mercury
 - Particulate, gaseous elemental, and gaseous divalent
- Nickel
 - Nickel subsulfide and other nickel compounds
- Selenium

Cyanide Compounds



- Hydrogen cyanide
- Zinc cyanide
- Potassium ferrocyanide

Glycol Ethers



- "Includes mono- and di-ethers of ethylene glycol, diethylene glycol, and triethylene glycol...Polymers are excluded from the glycol category."
- Over 50 individual compounds in NEI pollutant code look up table
- <http://daq.state.nc.us/toxics/glycol/>

Xylenes and Cresols



- Xylenes: mixture of o-, m- and p- isomers
- Cresols: mixture of o-, m- and p- isomers, cresylic acid

Diesel PM



- Mixture of particles that is a component of diesel exhaust
- Cancer and noncancer health effects



HAP Toxicity Exercises

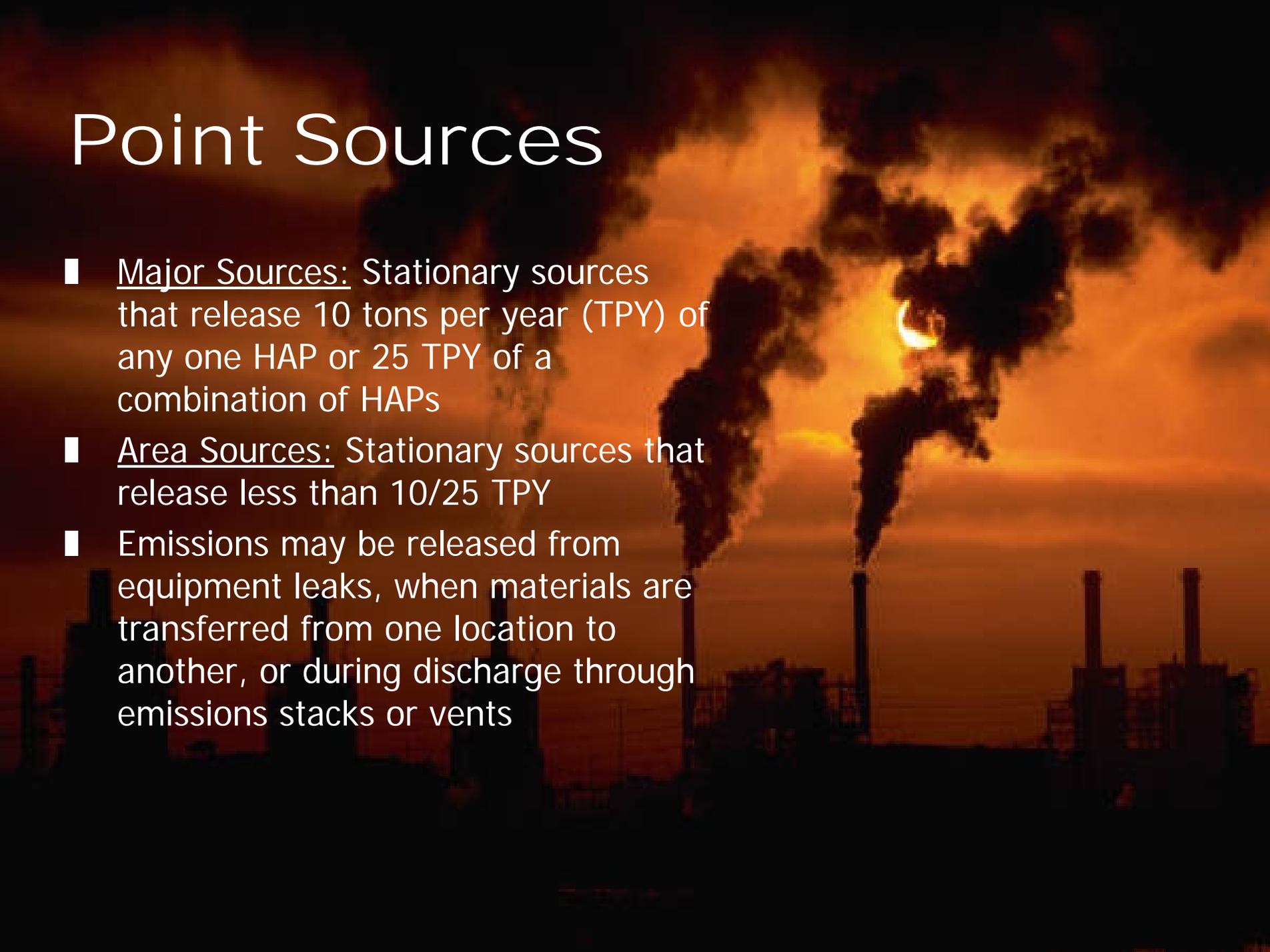


Source Category Definitions



Point, Nonpoint, and Mobile
Sources are Needed for a
Complete Air Toxics
Inventory

Point Sources

The background of the slide is a photograph of an industrial facility at sunset. Several tall smokestacks are visible, each emitting a thick plume of dark smoke that rises into the sky. The sun is low on the horizon, creating a bright orange and yellow glow that illuminates the smoke and the sky. The overall scene is dark and atmospheric, with the smokestacks silhouetted against the bright sky.

- Major Sources: Stationary sources that release 10 tons per year (TPY) of any one HAP or 25 TPY of a combination of HAPs
- Area Sources: Stationary sources that release less than 10/25 TPY
- Emissions may be released from equipment leaks, when materials are transferred from one location to another, or during discharge through emissions stacks or vents

Point Source Considerations



- Point source cutoffs/local thresholds
- Major vs area definition
- MACT vs non-MACT source categories
- Other federal regulations, state and local regs
- Detail needed:
 - Plant, unit, process, stack (emission release point)
 - Location, stack parameters, control device info, SCCS, NAICS

Nonpoint Sources

- Called “area” sources in a criteria pollutant inventory
- Include smaller point source facilities grouped by source category
 - ✓ Gasoline stations
 - ✓ Dry cleaners
 - ✓ Car painting shops
 - ✓ Small electroplaters



Other Nonpoint Sources

- Sources such as wildfires and prescribed burnings that may be more appropriately addressed by other programs rather than through regulations developed under certain air toxics provisions (section 112 or 129) in the Clean Air Act. For example, wildfires and prescribed burning are being addressed through the burning policy agreed to by the Interim Federal Wildland Policy.
- Other examples
 - Residential wood combustion
 - Residential combustion of household waste (backyard barrel burning)



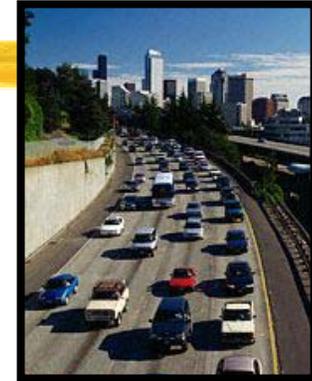
Nonpoint Source Considerations



- Includes source categories that overlap with point source inventory
- HAP point source inventories often include small sources such as dry cleaners and gas stations (treated as area sources in a criteria inventory)
- MACT vs non-MACT source categories
- Other federal regulations, state and local regs
- Detail needed:
 - County level
 - SCCs, NAICS

Mobile Sources

- **Onroad** - Vehicles found on roads and highways (e.g., cars, trucks, buses)
 - 20 volatile organic compounds and metals
 - Diesel particulate matter and diesel exhaust organic gases
- **Nonroad** - Mobile sources not found on roads and highways
 - 2/4 stroke engines in lawn mowers, construction vehicles, farm machinery
 - Aircraft
 - Locomotives
 - Commercial marine vessels



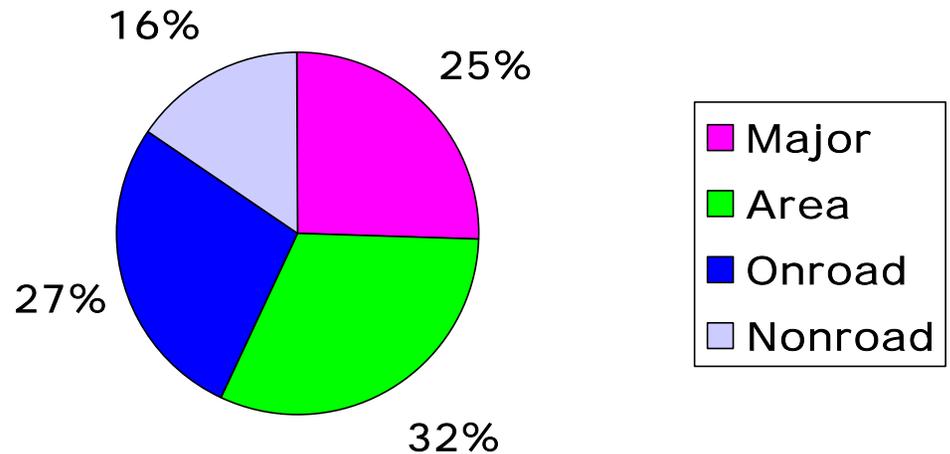
Mobile Source Considerations



- Contribution by source category varies geographically
- Federal, state, and local regulations
- Diesel PM

Developing a Mobile Source Inventory

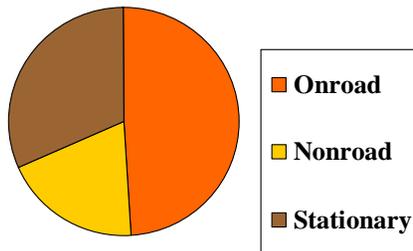
- 43% of toxic emissions in the 1999 NEI are attributable to mobile sources



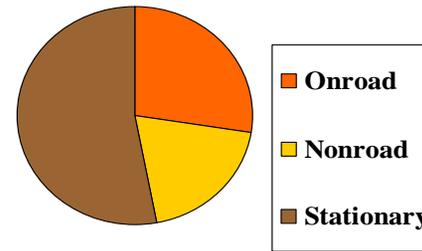
Mobile Source Contribution to 1999 Toxics Inventory

- Inventories of several major HAPs dominated by mobile sources

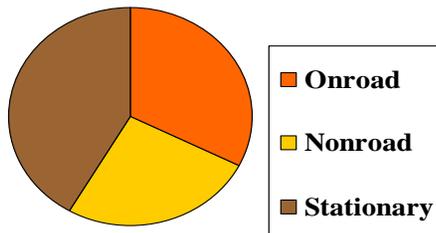
Benzene



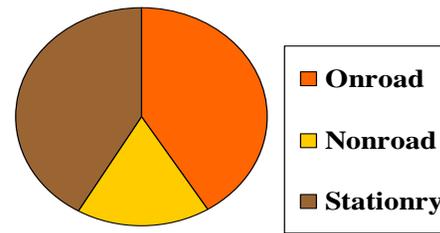
Formaldehyde



Acetaldehyde



1,3-Butadiene



Onroad Mobile Sources



- MOBILE 6.2 model
- Vehicle types
- Vehicle Miles Traveled (VMT)
- Fuels used

Nonroad Mobile Sources



- Nonroad Equipment
 - NONROAD model yields criteria pollutant estimates
 - Fuels used
 - Activity data
 - Emission factors
 - Speciation profiles

Aircraft



- Commercial air carriers, air taxis, general aviation, helicopters, and military aircraft
- FAA's Emissions and Dispersion Modeling System (EDMS) for commercial carriers
- Activity data
- Emission factors
- Speciation profiles

Locomotives



- Long haul, passenger, yard, and Commuter Class II/III trains
- GIS data available for long haul and passenger trains
- Need local data for yard and commuter trains
- Emission factors
- Speciation profiles

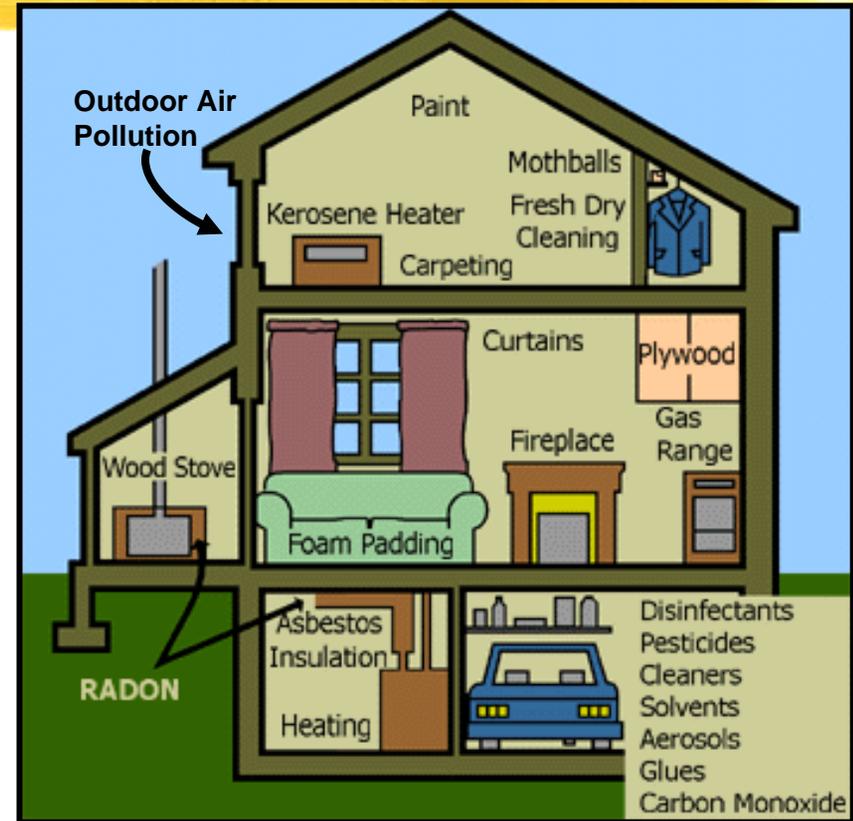
Commercial Marine Vessels



- Cruise ships
- Container ships
- Tankers
- Barges
- GIS data available for underway operations
- Need local data for ports
- Emission factors
- Speciation profiles

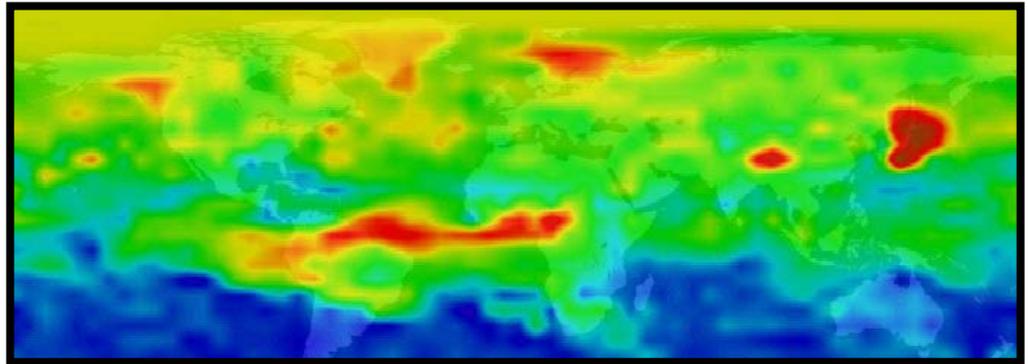
Indoor Sources

- Indoor air can become contaminated from numerous sources
- Indoor air can have significantly higher concentrations of air toxics than outdoor air
- EPA currently does not regulate indoor sources of air toxics



Other Types of Sources

- | There are a number of other important sources of air toxics that aren't so easy to categorize or count
 - | Accidents
 - | Long-range transport of air pollutants
 - | Historical background (CCl_4)



Questions, Discussion



- Need for HAP inventories
- Pollutant definitions
- Source category definitions
 - Point sources
 - Nonpoint sources
 - Onroad mobile sources
 - Nonroad equipment
 - Aircraft
 - Locomotives
 - CMVs

Developing A Point Source Inventory

- Planning
- Data Gathering
- Estimating Emissions
- QA/QC
- Data Augmentation
- Compiling the Database
- Case Studies, Examples



Why is Planning Important?



- Emission inventories are the foundation of many decisions
- Develop an Inventory Preparation/QA Plan
- Specify data needs, database format
- Consider user needs, level of detail needed
- Mistakes early in the process interject errors in downstream calculations
- Redoing work is costly and embarrassing

How Are Point Sources Typically Categorized?



- Fuel Combustion
- Waste disposal
- Food and agriculture industry
- Metallurgical industry
- Petroleum-related industries
- MACT/Residual Risk categories
- Mineral products industry
- Chemical process industry
- Wood products industry
- Storage tanks

How Do I Identify Source Categories?



- Usually dictated by the pollutants of interest
- Past inventory efforts and historical knowledge of the inventory area can help identify categories
- EPA has identified many source categories associated with HAPs
- Consider time and budget constraints
- Document your decisions for the benefit of future preparers

How do I Identify HAPs to Include?



- State/local/tribal requirements
- Tie into inventory goals
 - Public interest in clean air
 - To identify sources and problem areas
 - Determining compliance with regulations
 - For use in air quality modeling and risk assessments
 - To help site ambient monitors

How Should I Research Possible Sources of HAPs?

Identify sources of HAPS

- 1999 NEI
- MACT data
- Other State/Local/Tribal inventories
- TRI data
- Permit files
- EPA documents/tools, e.g. EIIP, L&Es, AP-42
- Source test data, compliance data

Determine Point Source Threshold



- Report as many facilities as possible, both major and area, as point sources
- Report all major sources, both MACT and non-MACT as point sources
- Report all MACT facilities, both major and area, as point sources
- Document decisions on point source thresholds

At What Level of Detail Are Point Source Inventories Compiled?



- Plant = Secondary lead smelter
- Unit = Boiler
- Process = Surface coating operation,
coal-fired boiler
- Stack (emission release point)

What Data Elements Are Needed in the Inventory?



Source Identification

- Facility Name and ID

■ Source Location

- Latitude, Longitude
- Accuracy and Reliability of Latitude and Longitude Coordinates
- Physical Address
- State/County/Tribe

What Data Elements Are Needed in the Inventory?



■ Source Description

- Release Type- Stack or Fugitive
- Stack Parameters, Capacity
- Source Type – Major or Area

■ Process Description

- North America Industry Classification System (NAICS Code)
- Standard Industrial Classification (SIC) Code – optional, replace with NAICS
- Source Classification Code (SCC)
- MACT Code

What Data Elements Are Required in the Inventory?

- Activity
 - Operating schedule
 - Throughput
 - Temporal Data
- Control Device
 - Equipment Type
 - Efficiency
- Emissions By Pollutant Species (CAS number)
 - Amount
 - Emission type – Entire period, average weekday, etc.
 - Estimation calculation methods
 - Include emission factor if this method is used
 - HAP Emissions Performance Level - Actual, allowable, potential, maximum
 - Emissions reliability indicator

What Methods Are Used to Collect Data for Point Sources



- Surveys and questionnaires
- Permit applications or compliance files
- TRI and MACT databases
- State and local industrial directories
- State Departments of Commerce and Labor statistics
- National and state directories of manufacturers
- Data compiled by private research and development companies, e.g. SRI
- Trade and professional associations

Surveys

- Can be used to either:
 - Collect all information including emissions estimates and necessary data fields
 - Collect activity data and information about facility and its operations
- If emissions are not included as part of survey, agency develops emission estimates
 - EPA documents/tools, e.g. EIIP, L&Es,
 - AP-42
 - Source test data

Survey Steps



- Identify the facilities to be surveyed
- Prepare the mailing list
- Design and assemble the questionnaire
- Deliver the questionnaire
- Establish tracking systems to monitor the status of each step in the survey process
- Prepare data handling procedures
- Establish systems to respond to questions or concerns of survey recipients

Electronic Data Collection



- Used by many states and local agencies
- Example DE, SC, and TX instructions

Survey Elements



- Cover Letter
- Questionnaire Instructions
- Questionnaire Design
 - Emissions-Based Approach
 - Chemical Use Approach
 - Activity-Based Approach
 - Industry-Specific Approach
 - Tiered Approach

Compiling an Inventory from Available Data



- TRI database
- 99 NEI for HAPs
- MACT databases
- State, local, tribal criteria pollutant inventory
- Title V compliance reports
- Inspection reports—Major sources, fuel combustion, dry cleaners, solvent degreasers, chrome platers, landfills, gas stations, MSDS

Compiling an Inventory from Available Data



- Compile composite facility list
- Note closed facilities—MWIs, dry cleaners
- Facility name, address, IDs, coordinates, stack parameters, emission units, emission processes
- NAICS, SCCs
- Activity data—fuel usage, material throughput
- Control device information
- Compliance and inspection reports—applicable regulations

Should I Consider Rule Effectiveness?



- What is the nature of the regulation?
- What are the compliance procedures?
- What is the historical performance of the source in maintaining compliance over time?
- How is compliance determined?

What Is the Basic RE Equation?

$$E_c = A \times EF \times (1 - (CE \times RE))$$

where:

E_c = Emissions after control

A = Activity

EF = Emission Factor

CE = Estimated control efficiency
(expressed as a fraction)

RE = Rule effectiveness (expressed
as a fraction)

Data Augmentation



- CAS numbers
 - <http://www.epa.gov/ttn/chief/nif/index.html>
 - <http://chemfinder.cambridgesoft.com/>
- SCCs, SIC codes, NAICS
 - <http://www.epa.gov/ttn/chief/nif/index.html>
- MACT codes
 - www.epa.gov/ttn/atw/eparules.html
- Latitude/longitude coordinates
- Stack parameters
- NEI QA and Augmentation Memo
 - www.epa.gov/ttn/chief/emch/invent/

How Do I Augment Stack Parameters?



■ Stack releases

- | Height > Diameter; if not default all parameters
- | Calculate missing flow rate, diameter, or velocity if only one of the 3 parameters is missing
- | NEI default lookup tables generated by SCC and SIC Codes - if multiple defaults available, use default record with lowest stack height
- | If no SCC or SIC code are available, use national default values
 - Height - 10 ft
 - Diameter - 1 ft
 - Temperature - 72 degrees F
 - Velocity - 15 ft/sec
 - Flow Rate - 12 cu ft/sec

How Do I Augment Stack Parameters?



- Fugitive releases - use lower end of parameter range; retain height if present
 - | Height - 10 ft
 - | Diameter - 0.003 ft
 - | Temperature - 72 degrees F
 - | Velocity - 0.0003 ft/sec
 - | Flow Rate - 0.0 cu ft/sec

How Do I Augment Stack Coordinates



- Verify all emission release points are within 3 km of one another
- Make sure coordinates are in correct county
- Fill in defaults for missing coordinates

NEI Input Format



NEI Input Format (NIF) –used to transfer data to EPA's National Emission Inventory (NEI) for HAPs and criteria air pollutants

For 2002, use NIF Version 3.0

www.epa.gov/ttn/chief/nif/

NEI Input Format, Version 3.0



- Point Source File – 8 Record Types
 - Transmittal (TR)
 - Site (SI)
 - Emission Unit (EU)
 - Emission Process (EP)
 - Emission Period (PE)
 - Emission Release Point (ER)
 - Control Equipment (CE)
 - Emission (EM)

NEI Input Format, Version 3.0

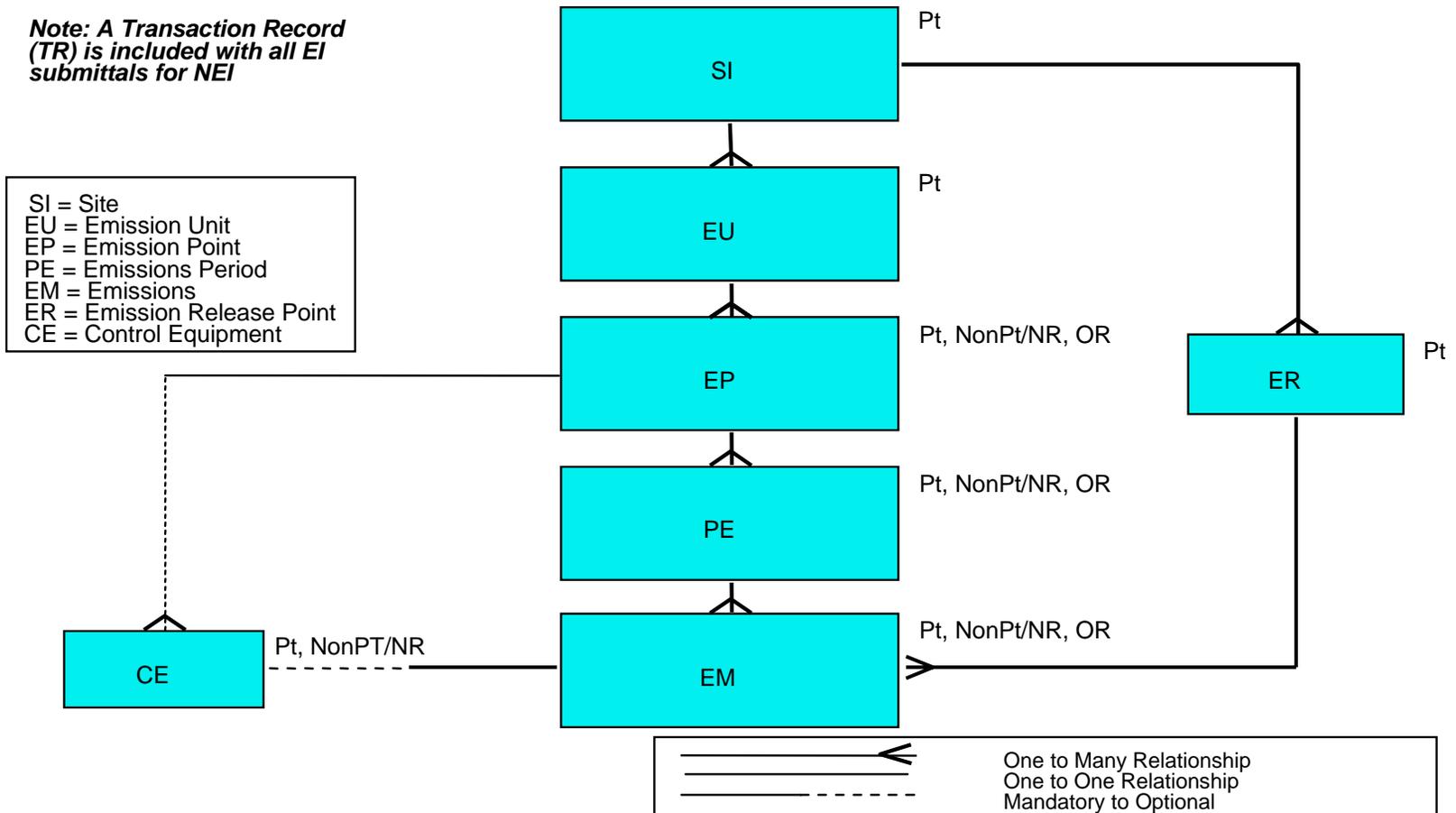


Record Type Descriptions

- Transmittal (TR) – organization submitting to EPA, data year, source types
- Site (SI) – plant location and IDs
- Emission Unit (EU) – unit or device generating point emissions
- Emission Process (EP) – operational process generating emissions
- Emission Period (PE) – activity data and time period for releases
- Emission Release Point (ER) – mechanism releasing emission to the air including stack parameters and geographic coordinates
- Control Equipment (CE) – control equipment and efficiency
- Emission (EM) – amount of emissions

NEI Input Format, Version 3.0 – EI Relationships

Note: A Transaction Record (TR) is included with all EI submittals for NEI



NEI Input Format, Version 3.0



Format Notes

- Prescribed data types, lengths, and positions
- Data types – character, numeric, date
- Key fields – indicated by bold italics
- Mandatory fields – mandatory for inventory
- Necessary fields – needed to complete dataset used in air quality modeling
- Data definitions – description of expected data for fields
- Instructions and conventions for using NIF code tables
- User convention notes – information on where to find valid code values and how to implement and express values of fields

Point Sources: Data Integrity

tblPointSI

State and County FIPS	Site ID
01001	1
01153	23
05890	45
06560	23
06560	11
06120	900

tblPointEU

State and County FIPS	Site ID	Unit ID
01001	1	A
01001	1	B
01001	1	C
01153	23	V
05890	45	DF
05890	45	DG
06560	23	N
06560	11	M
06560	11	K
06120	900	P

tblPointEP

State and County FIPS	Site ID	Unit ID	Process ID
01001	1	A	001
01001	1	A	002
01001	1	B	002
01001	1	C	005
01153	23	V	001
01153	23	V	002
01153	23	V	003
05890	45	DF	007
05890	45	DF	101
05890	45	DF	008
05890	45	DF	009
05890	45	DF	010
05890	45	DF	016
05890	45	DG	005
06560	23	N	007
06560	11	M	001
06560	11	K	012
06120	900	P	014

Every record is Unique. No unrelated records.

Point Sources: Data Integrity Lost

tblPointSI

State and County FIPS	Site ID
01001	1
01153	23
07100	89
08230	2111
05890	45
06560	11
06120	900

Widows

tblPointEU

State and County FIPS	Site ID	Unit ID
01001	1	A
01001	1	B
01001	1	C
01153	23	V
05890	45	DG
06560	23	N
06560	11	M
06560	11	K
06560	520	AA
06120	900	P

Widows & Orphans

tblPointEP

State and County FIPS	Site ID	Unit ID	Process ID
01001	1	B	002
01001	1	C	005
01153	23	V	001
01153	23	V	002
01153	23	V	003
05890	45	DF	007
05890	45	DF	101
05890	45	DF	008
05890	45	DF	009
05890	45	DF	010
05890	45	DF	016
05890	45	DG	005
06560	23	N	007
06560	11	M	001
06560	11	K	012
06120	900	P	014

Orphans

Point Sources: Data Integrity Restored

tbIPointSI

State and County FIPS	Site ID
01001	1
01153	23
07100	89
08230	2111
05890	45
06560	23
06560	11
06120	900
06560	520

tbIPointEU

State and County FIPS	Site ID	Unit ID
01001	1	A
01001	1	B
01001	1	C
01153	23	V
05890	45	DF
05890	45	DG
06560	23	N
06560	11	M
06560	11	K
06560	520	AA
06120	900	P
07100	89	OC
08230	2111	LM

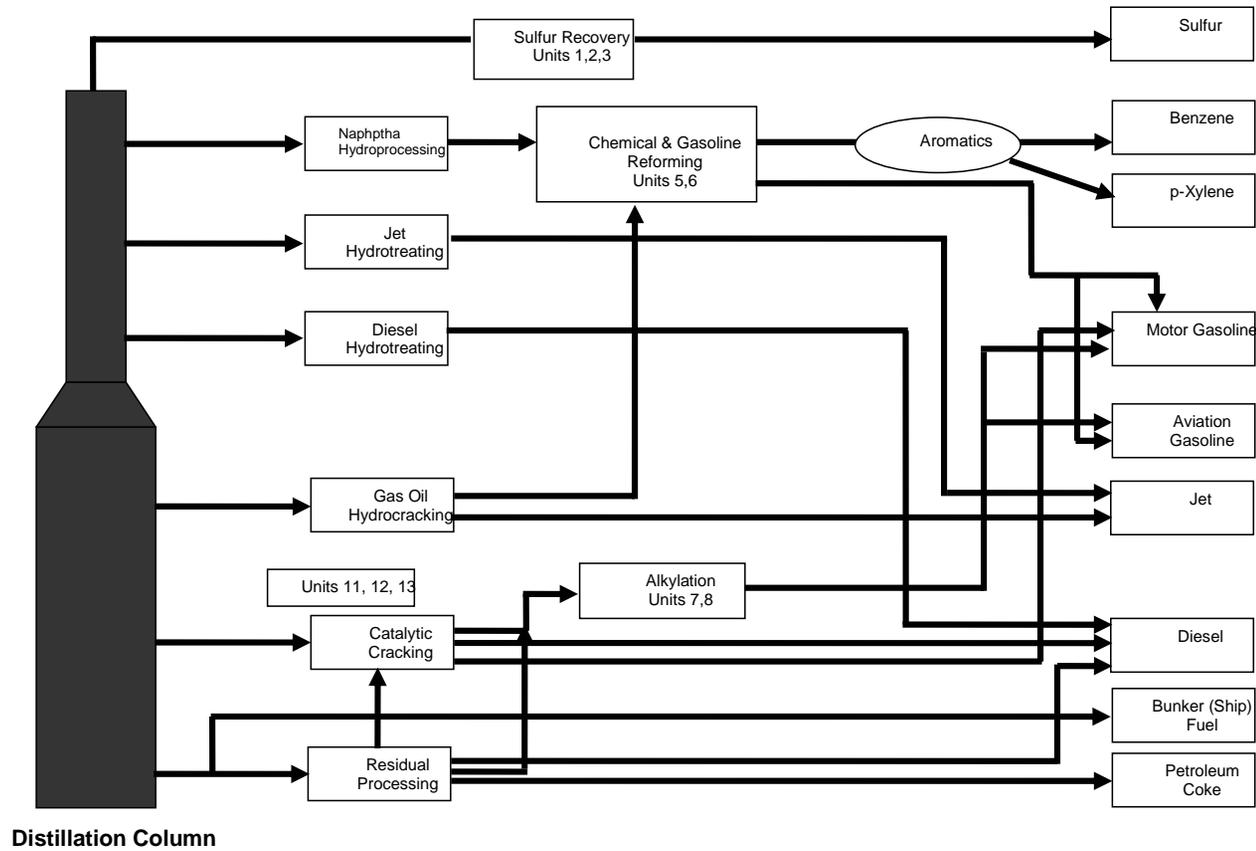
tbIPointEP

State and County FIPS	Site ID	Unit ID	Process ID
01001	1	A	XX
01001	1	B	002
01001	1	C	005
01153	23	V	001
01153	23	V	002
01153	23	V	003
05890	45	DF	007
05890	45	DF	101
05890	45	DF	008
05890	45	DF	009
05890	45	DF	010
05890	45	DF	016
05890	45	DG	005
07100	89	OC	89
08230	2111	LM	90
06560	23	N	007
06560	11	M	001
06560	520	AA	HHJ
06560	11	K	012
06120	900	P	014



Point Source Case Studies and Exercises

Petroleum Refinery --> NEI Format Version 3.0



Petroleum Refinery --> NEI Format Version 3.0

- Putting Data into NIF 3.0 - Point Source
- Map fields in original data to NIF fields
 - Fill in plant ID, unit, process IDs where given; fill in with “dummy” IDs as necessary
 - Fill in required elements
 - Address; lat/long coordinates, SIC, SCC, ERP type, units
 - Use available information and additional references
 - Translate descriptive text into NIF codes
 - Important codes = Pollutant Codes, Units, SCCs, ERP Type
 - Parse data into NIF tables & run the *Basic Format & Content Checker**
- (See Handouts for example).

* Formerly known as the QA/QC Tool

QA/QC



- Technical reviews
- Peer review
- Accuracy checks
- Reality checks
- Completeness checks
- Best implemented with standardized checklists, EPA's NIF *Basic Format & Content Checker*

What Types of Errors Are Typically Found?



- Missing facilities
- Duplicate facilities
- Closed facilities
- Improper facility locations
- Missing operating or technical data
- Erroneous technical data
- Inconsistent point and nonpoint source size designation
- Double counting
- Errors in calculations
- Data entry and transposition errors; data coding errors



Point Source *Extended QC* *Tool** Exercises

QC Tool Software: If you have not already done so, you will need to install the software now.

**Formerly known as the QC Tool*

Point Source Questions, Discussion



Developing a Nonpoint Source Inventory



Emission Inventory Improvement Program



- <http://www.epa.gov/ttn/chief/eiip/index.html>
- Area Sources
 - | Introduction to Area Source Emission Inventory Development
 - | RWC, Arch Surface Coating, Dry Cleaning, Consumer and Commercial Solvent Use, etc.
- Point Sources

Developing a Nonpoint Source Inventory



- Planning
- Data Gathering
- Estimating Emissions
- QA/QC
- Compiling the Database
- Case Studies, Examples

What Planning is Needed for a Nonpoint Source Inventory?



- Decide which source categories to include
- Specify emission estimation methods, data needs, data availability
- Consider user needs, level of detail, priorities
- Identify possible point source overlap
- Temporal considerations

How Are Nonpoint Sources Typically Categorized?

- Fuel Combustion
- Chemical and allied products manufacturing
- Metal processing
- Petroleum and related industries
- Other industrial processes
- Solvent utilization
- Storage and transport
- Waste disposal and transport
- Material storage/distribution
- Cooling towers
- Fires - prescribed burning, forest fires, structural fires, ag burning
- Hospital sterilizers
- Gasoline service stations
- Dry cleaners

Preliminary Screening Study for Nonpoint Sources



Conduct Preliminary Screening Study to:

- Determine pollutants emitted by source categories within the geographic areas
- Determine which source categories to inventory as point vs. nonpoint sources in specific geographic areas

At What Level of Detail Are Nonpoint Source Inventories Compiled?



- State
- County
- Tribal jurisdiction
- Other jurisdictions for which activity surrogates are available, e.g. community scale assessments

What Data Elements Are Required in the Inventory?



- Source Identification
 - Source Category
- Source Location
 - State/County/Tribe
- Source Category Description
 - Source Type – Area or Nonroad mobile
 - Source Classification Code (SCC)
 - MACT Code
 - North America Industry Classification System (NAICS Code)
 - Standard Industrial Classification (SIC) Code – optional, replace with NAICS

What Data Elements Are Required in the Inventory?



- Activity
 - Throughput
 - Temporal Data
- Control Device
 - Equipment Type
 - Efficiency
- Emissions By Pollutant Species (CAS #)
 - Amount
 - Estimation calculation methods
 - Include emission factor if this method is used
 - Emission Type - Actual, Allowable, Potential, Maximum
 - Emissions reliability indicator

How Do I Choose Emission Estimation Methods?



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

What Emissions Estimation Methods Should I Use for Nonpoint Sources?



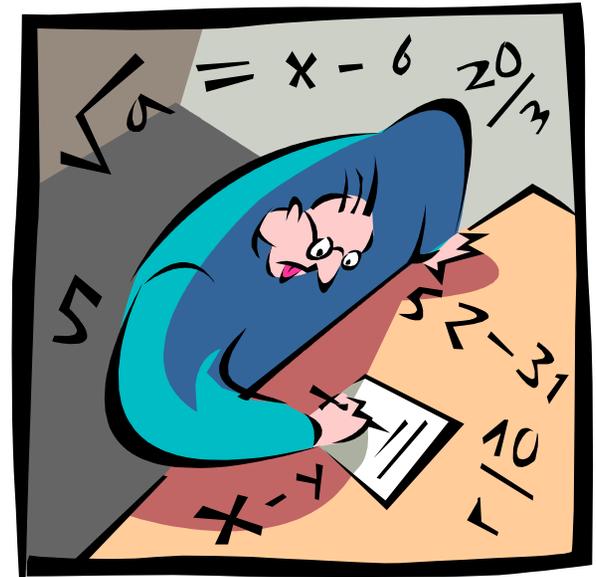
- Applying point source methods to nonpoint sources (bottom-up)
- Conducting local activity level surveys (bottom-up)
- Applying a top-down approach

What are the Characteristics of a Top-Down Approach?

- Typically used to inventory nonpoint sources
- Requires minimum resources
- Used when:
 - Local data are not available
 - The cost to gather local information is prohibitive
 - The end use of the data does not justify the cost
- Emission factors/national estimates used to estimate emissions in state or county based on surrogate parameter
- Loss of accuracy

Estimation Methods

- Surveys and questionnaires
- Material balance
- Emission factor x activity factors
- Emission models



What Methods Are Used to Collect Data for Nonpoint Sources?

- Surveys
- Examination of local, state and federal documents and databases
- Examination of trade association reports, journals, and databases

Applying The Top-Down Approach to Nonpoint Sources

- Applying source test or national (or regional) derived emission factor to the local level
- Allocating national, regional, or state level emission estimates to the local level

What is Spatial Allocation?



- 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

How Do I Make Spatial Adjustments for Nonpoint sources?



- Make adjustments based on:
 - Local activity level data
 - State or national data
 - Population data
 - Employment data

Allocating Nonpoint Source Emission Estimates



- Can use representative surrogate factors- uses surveys of representative subsets of the source category and then scales subset to entire inventory area
- Disadvantage - accuracy lost in the allocation process

Where Do I Find Applicable Activity Parameters (Nonpoint)?

- Sources of Area Source Activity Data
 - Regional planning commissions
 - Agency-sponsored surveys
 - State Depts. of Transportation and State Energy Offices
 - US DOE
 - State Energy Reports
 - Petroleum Marketing Annual
 - Natural Gas Annual

Where Do I Find Applicable Activity Parameters (Nonpoint)?

■ Sources of Area Source Activity Data

■ US Dept of Commerce

- | County Business Patterns
- | Census of Population
- | Census of Manufacturers
- | Census of Agriculture
- | County and City Data Book
- | Current Industrial Reports
- | Census of Retail Trade

Where Do I Find Applicable Activity Parameters (Nonpoint)?

- Sources of Area Source Activity Data
 - State Departments Of Labor
 - State Agriculture Offices and USDA
 - State Solid Waste Management agencies
 - Fire marshals
 - Port Authority
 - State Health Departments
 - Miscellaneous statistical government & trade publications

How Do I Make Temporal Adjustments?



- Collect emission rate and activity data
 - Collect activity data for each specific time period represented by the inventory
 - Conduct a survey to collect nonpoint source information (include seasonal emission rate variations)
 - Collect information from indirect sources such as business and labor statistics

What Is Rule Penetration for Nonpoint Sources?



The percentage of an nonpoint source category that is covered by an applicable regulation

$$\text{Rule Penetration} = \left[\frac{\text{Uncontrolled emissions covered by the regulation}}{\text{Total uncontrolled emissions}} \right]$$

Example of RE/RP Calculation for Nonpoint Sources

- Assumption Operating Parameters Stage I Gasoline Marketing
 - Total county throughput: 500,000 gal/day
 - Tank filling method: slash filling
 - Filling method central efficiency: 95%
 - Stage I gasoline marketing emission factors: 11.5 lb/1,000 ga throughput (from AP-42, Table 5.2-7)
 - RE is assumed to be 80%
 - RP is assumed to be 93% (fraction of throughput that will be subject to control)

Example of RE/RP Calculation



$$E = ACT \times EF \times (1 - (CE \times RE \times RP))$$

$$E = 500 \times 11.5 \times 1 - ((0.95)(0.8)(0.93))$$

$$= 1,685 \text{ lb of VOC/day}$$

Special Issues to Resolve in Preparing HAP Inventories

- Categories to include as point sources
- Double counting between point source data and emission estimates using nonpoint source methods
- Overlap between two nonpoint source categories

What Is Double Counting and How Do I Avoid It?



- Double counting occurs when the emissions from one source are included twice in the same inventory
- Causes
 - Overlap between point and nonpoint sources
 - Overlap between nonpoint source categories

How Do I Adjust Nonpoint Source Inventories for Point Source Contributions?

Nonpoint Source Activity =

Total Emissions of Source Category
- Sum of Point Source Emissions

QA/QC



- Technical reviews
- Peer review
- Accuracy checks
- Reality checks
- Completeness checks
- Best implemented with standardized checklists, EPA's NIF *Basic Format & Content Checker*

NEI Input Format, Version 3.0



- Nonpoint Source File – 5 Record Types
 - Transmittal (TR)
 - Emission Process (EP)
 - Emission Period (PE)
 - Control Equipment (CE)
 - Emission (EM)

NEI Input Format, Version 3.0



Primary Key Fields – Nonpoint Sources

- TR: State, County, Tribe
- EP: State, County, Tribe, SCC
- CE: State, County, Tribe, SCC, pollutant
- PE: State, County, Tribe, SCC, Start and End Dates
- EM: State, County, Tribe, SCC, Pollutant, Emission Type, Start and End Dates

Nonpoint Source Examples

- Perchloroethylene Dry Cleaners & Adjustment for Colorado Inventory
- Residential Heating : Wood Combustion
Dade County Adjustment
- Houston Electroplating
- Texas Graphic Arts

Perchloroethylene Dry Cleaners



- National emissions estimated by using total PCE consumption in 1999 and subtracting % reduction for controls
 - MACT promulgated Sept. 1993; Compliance date Sept. 1996
- National emissions allocated to counties using business patterns
 - Estimates allocated based on employment of employees in SIC codes 7215, 7216, 7218

Perc Dry Cleaners: County Emissions Calculation

CE = County Emissions

PCE = Total Nationwide Consumption of PCE in 1999

R = % Reduction

CntyEmp = County SIC Employment

NatEmp = National SIC Employment

PCE = 31,500 Tons/year

R = 44%

CntyEmp = 1,433

NatEmp = 1,303,266

$CE = [PCE - (R \times PCE)] \times [CntyEmp/NatEmp]$

$CE = [(31,500 - (31,500 \times .44))] \times [1433/1,303,266]$

CE = 19.40 tons/year

Perc Dry Cleaners: County Emissions Calculation



- Colorado surveyed dry cleaners and created a state-wide inventory of point sources
- Determine completeness of point source inventory
- Make sure that emissions are not included in the nonpoint database to avoid double-counting between point and nonpoint

Perc Dry Cleaners: County Emissions Calculation



Revise Nonpoint Estimate:

Nonpoint Source County Estimate – Point Source
Estimate

- 1) > 0 , Adjust Nonpoint
- 2) ≤ 0 , Remove Nonpoint

Residential Heating: Wood



- 1997 National activity data used to extrapolate 1999 data (EIA, 2001)
 - | Woodstoves & fireplaces with inserts - based on total annual wood consumption
 - | Fireplaces - based on # of U.S. homes
- Counties grouped into 1 of 5 climatic zones and percentage of wood consumption assigned to zone
- Wood consumption allocated to county based on proportion of homes in county (compared with overall zone)

Residential Heating: Wood



- Counties designated as urban/rural
 - Combustion type differs by county type
 - 68% of fireplaces in urban
 - 69% of woodstoves in rural
 - 50-50 distribution of fireplaces with inserts
- Adjustments made if total wood consumption for zone didn't match this split
- Dade County had NO woodstoves, but would have emissions assigned based on this method

Metal Plating Emissions & Houston Study



- City of Houston surveyed 58 metal plating facilities by phone, mail, visits
- SIC group = 3471
- Information gathered enabled calculation of chromium, HCl emissions using emission factors
- Adjusted estimates based on response rate to survey, etc.

Texas Graphic Arts Example

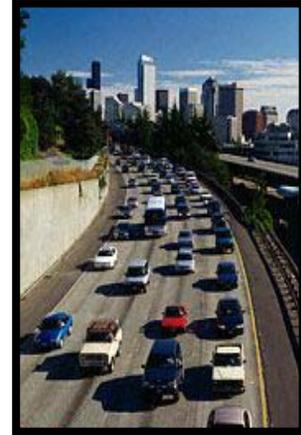


- Industry consists of many small facilities, with no emission controls
- Source category consists of many different printing technologies
- Hundreds of different inks, washes, and process solutions are used
- Surveyed facilities with support from industry trade associations
- Developed material consumption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



Nonpoint Source Questions, Discussion

Mobile Sources



Mobile Source Toxics Inventory Projections --1990 to 2020



- Emissions of major highway vehicle gaseous air toxics will be reduced by 75% or more
- Diesel PM to be reduced 94% with 2007 heavy duty standards
- Nonroad gaseous toxics to be reduced 30 - 50%

Developing a Mobile Source Inventory



- Planning
- Data Gathering
- Estimating Emissions
- QA/QC
- Compiling the Database

What Planning is Needed for a Mobile Source Inventory?

- Specify emission estimation methods, data needs, data availability
- Consider user needs, priorities, available resources
- Specify pollutants to include (diesel PM?)
- Temporal considerations
- Spatial considerations

How are Onroad Mobile Sources Categorized?



- Vehicles that operate on paved roadways, including:
 - Passenger vehicles, trucks and vans
 - Heavy duty trucks with trailers
 - Buses and motor homes
 - Taxis
 - Two and three-wheeled vehicles designed for on-road use
- May operate on any fuel, including gasoline, diesel, propane, methanol, and electricity

Types of Mobile Source Emissions



- Evaporative Emissions:

- VOC emissions from the gasoline tank and hoses

- Crankcase Emissions:

- VOC emissions from the engine

- Tailpipe Emissions:

- From the engine exhaust

Data Gathering—Onroad



- MOBILE6.2 will calculate HAP emission factors
- Can be modified for locality-specific speciation profiles
- Dioxin must be calculated outside of the model
- Model can provide gasoline distribution stage II estimates, can be adjusted for border crossings

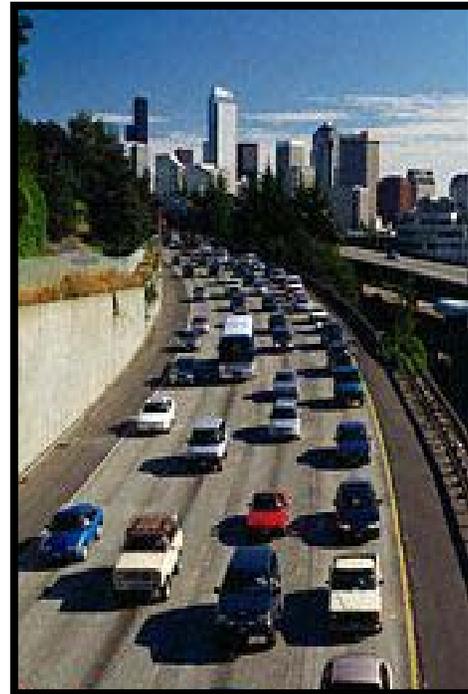
At What Level of Detail Are Mobile Source Inventories Compiled?



- State
- County
- Tribal jurisdiction
- Other jurisdictions for which activity surrogates are available, e.g. community scale assessments

What Data are Needed?

- VMT by road and vehicle type
- Fuel type and usage by period



What Data Elements Are Required in the Inventory?



- Source Identification
 - Source Category
- Source Location
 - State/County/Tribe
- Source Category Description
 - Source Classification Code (SCC)
- Activity
 - Throughput
 - Temporal Data
- Emissions By Pollutant Species (CAS #)
 - Amount
 - Include emission factor if this method is used
 - Emission Type – Entire period, average, weekday, etc.
 - Emissions reliability indicator

NEI Input Format, Version 3.0



- Onroad Source File – 3 Record Types
 - Transmittal (TR)
 - Emission Period (PE)
 - Emission (EM)

NEI Input Format, Version 3.0



Primary Key Fields – Onroad Sources

- TR: State, County, Tribe
- PE: State, County, Tribe, SCC, Start and End Dates
- EM: State, County, Tribe, SCC, Pollutant, Emission Type, Start and End Dates

How are Nonroad Mobile Sources Categorized?



- Mobile sources not found on roads and highways
 - 2/4 stroke engines in lawn mowers, construction vehicles, farm machinery, etc
 - Aircraft
 - Locomotives
 - Commercial marine vessels

Data Gathering--Nonroad Equipment



- NONROAD model
 - Calculates VOC and PM
 - Speciation profiles for organic HAPs
 - Emission factors for metal HAPs based on fuel and hours of operation
- Local survey for activity data

Data Gathering--Aircraft



- Commercial Air Carriers
 - | FAA's Emissions and Dispersion Modeling System (EDMS)
- Air Taxis, General Aviation
 - | Activity data available for FAA-towered airports
 - | Need local airport activity data
- Military Aircraft
 - | Limited information on fleet composition
 - | Need local activity data
- Helicopters
 - | Need local activity data

Data Gathering--Locomotives



- Long haul and passenger trains
 - GIS activity data available
- Yard and Commuter Class II/III trains
 - Need local data
- Work trains
 - Addressed in NONROAD model

Spatial Allocation



- Use DOT railroad traffic in ton-miles
- Regional, state, or county level

Data Gathering--Commercial Marine Vessels



- Diesel-powered vessels
 - Category 1: recreational cruisers, ancillary engines
 - Category 2: tug boats, barges
 - Category 3: tankers, large passenger liners
- Steamships
- Turbine-powered vessels
- Activity data can be obtained from Harbor Master, DOT
 - Fuel usage
 - Horsepower hours
 - Ton-miles

Spatial Allocation



- Port emissions can be allocated based on amount of cargo handled
- Underway emissions can be allocated to shipping lanes with survey data or DOT shipping data

How Can We Help Improve Nonroad Mobile Source Toxics Inventories?

- Develop and submit local emission inventories
 - Specific nonroad studies (e.g., construction equipment)
 - Local airports
 - Military aircraft
 - Yard locomotives
 - Port-specific studies

NEI Input Format, Version 3.0



- Nonroad Mobile Source File – 5 Record Types
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 - Emission Process (EP)
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 - Control Equipment (CE)
 - Emission (EM)

NEI Input Format, Version 3.0



Primary Key Fields – Nonroad Mobile Sources

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- CE: State, County, Tribe, SCC, pollutant
- PE: State, County, Tribe, SCC, Start and End Dates
- EM: State, County, Tribe, SCC, Pollutant, Emission Type, Start and End Dates

Electronic Data Transfer to EPA



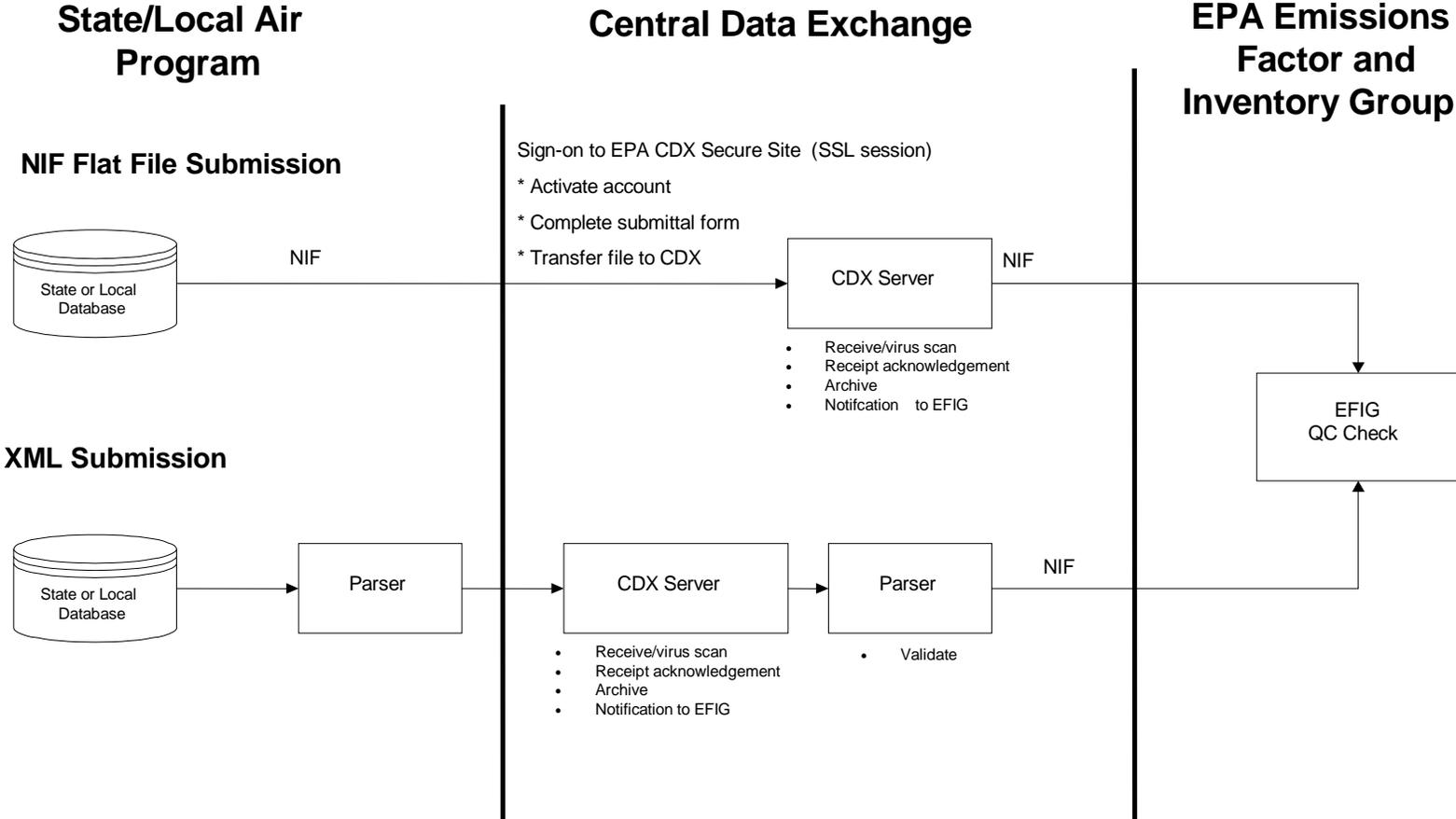
■ CDX Role in NEI Development

- Provide Single Point of Entry to EPA
 - Move Data to EPA Programs
- Support Variety of Formats
 - User-Defined Flat Files
 - Extensible Markup Language (XML)
 - Web Forms
- Automate and Secure Data Transfer With All Trading Partners

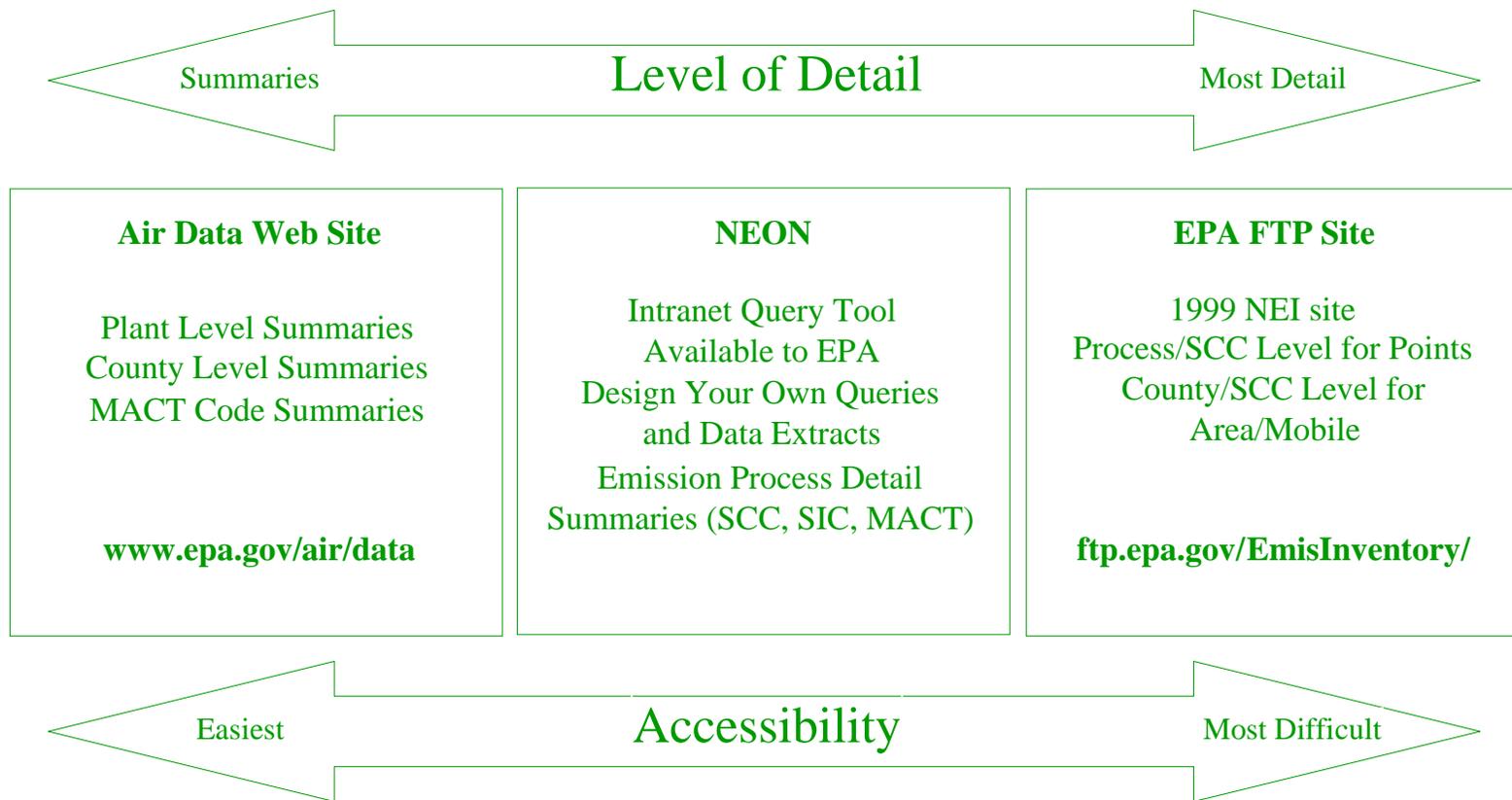
■ Submission Procedures

- State /Local/Tribal Air Program or Industry Prepares Emissions Data in NEI Input Format (NIF), Version 3.0 or XML
- Submitters Access EPA CDX Secure Web Site
 - Complete (on-line) NEI Submittal Form
 - Upload NIF Version 3.0 File
- Data Files Accessed by OAQPS

CDX Process



NEI Data Access



Relevant Web Sites



- **Resources List of Relevant Web Sites**