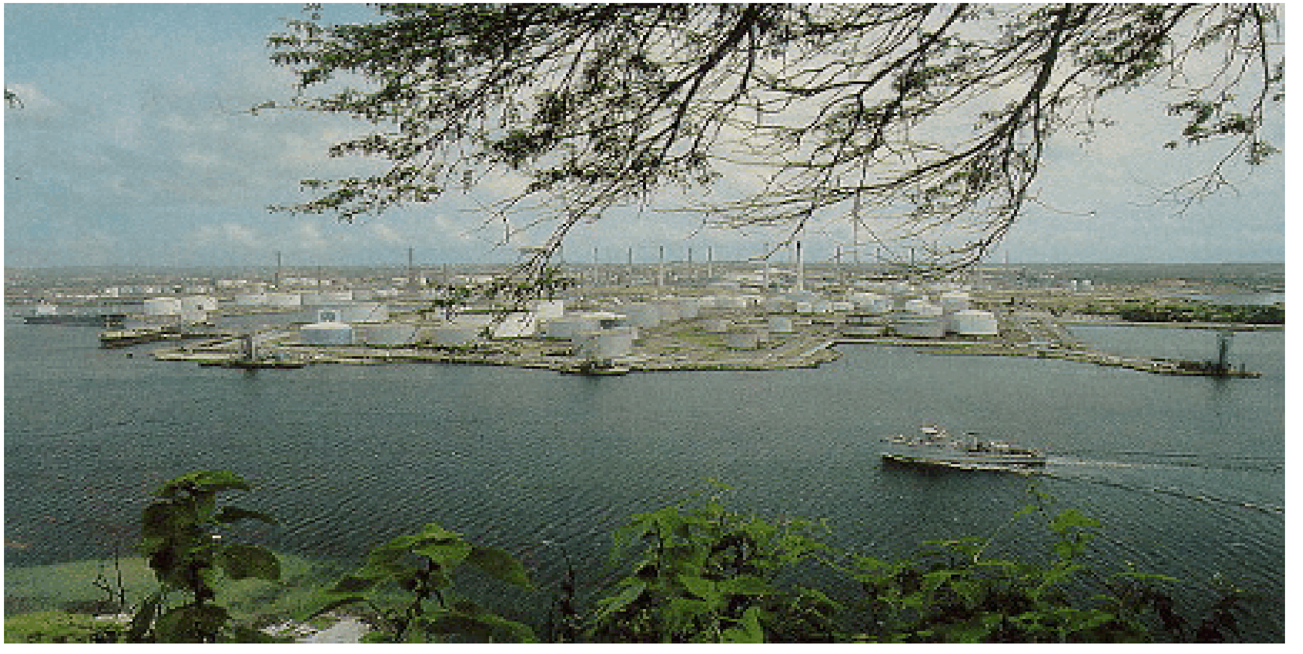


Emission Inventory Compilation

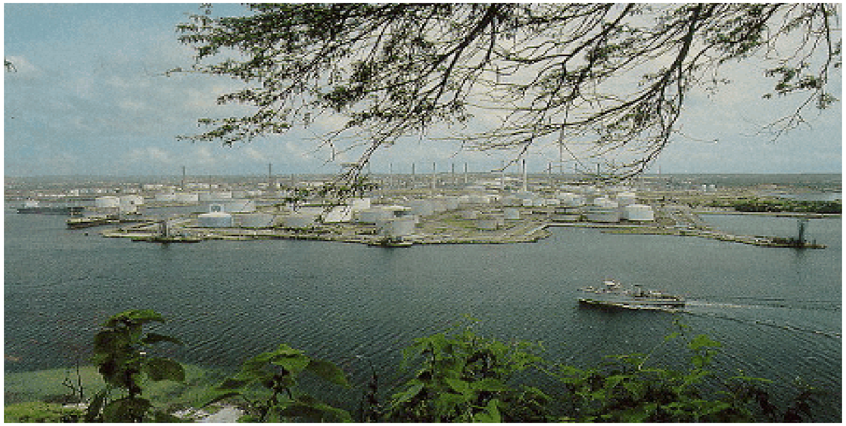
What Does An Inventory Contain?

An inventory includes:

- Database with fields needed to support uses of the inventory
  - Mandatory fields
  - Non-Mandatory fields
- Background information needed to reproduce inventory

Emission Inventory Compilation Steps

- Planning
- Gathering information
- Estimating Emissions
- Compiling the Database
- QA/QC
- Data Augmentation
- Documentation
- Providing Access to Data



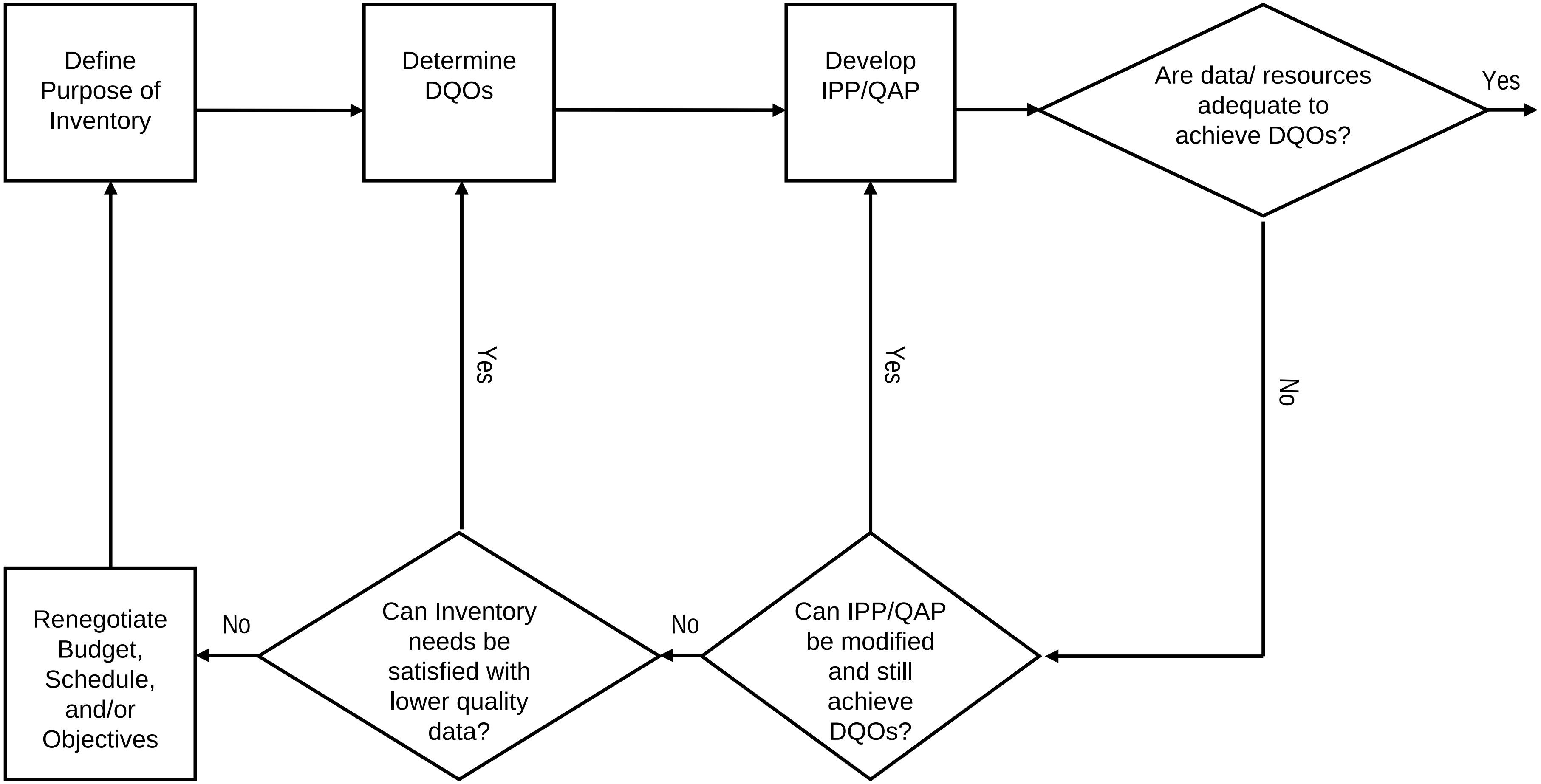
Emission Inventory Compilation: Why is Planning Important?

- Every inventory requires extensive advanced planning
- Emission inventories are the foundation of many decisions
- Planning is needed to ensure that the inventory objectives are met.
- Mistakes early in the process interject errors in downstream calculations
- Redoing work is costly and embarrassing

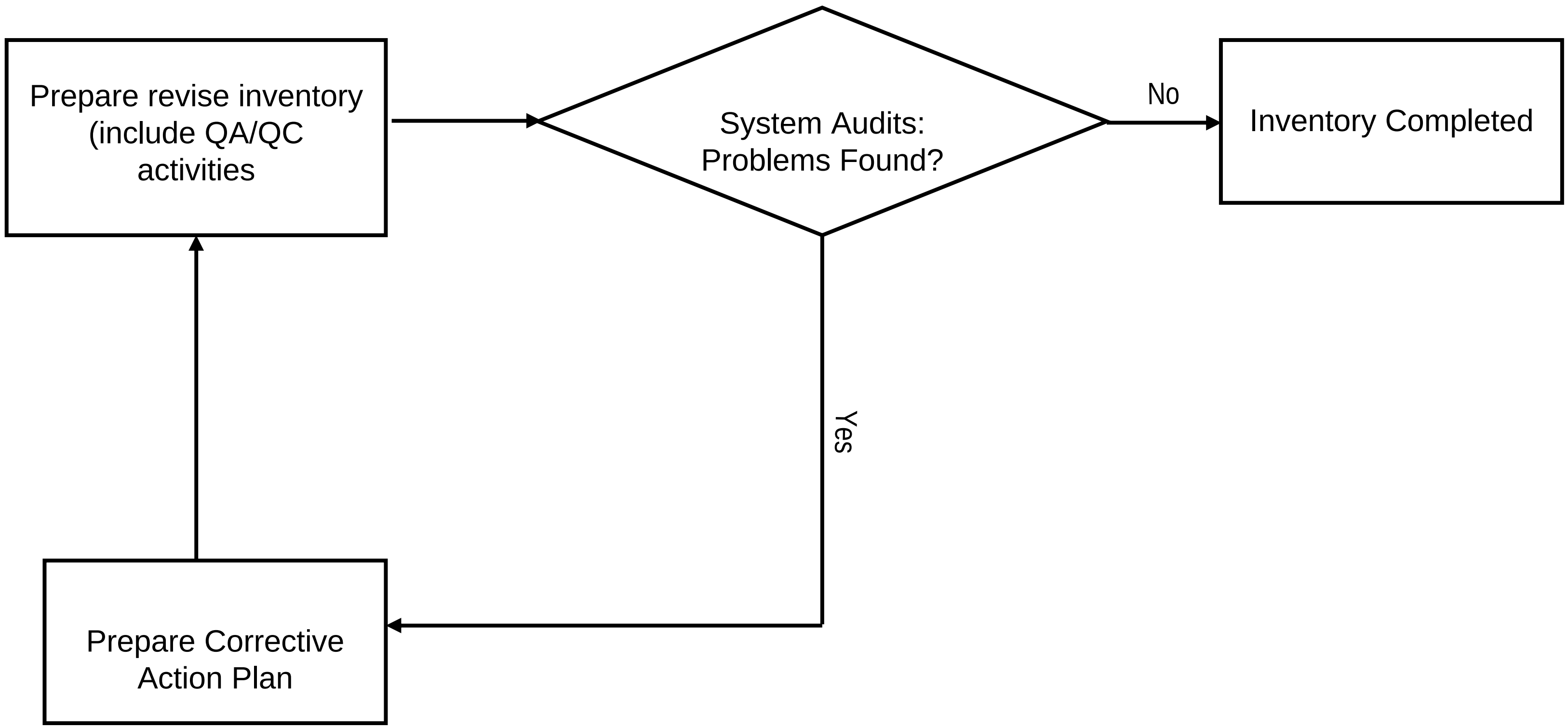
Emissions Inventory Planning

- Step #1 is to define the inventory uses and users
- The end uses of the inventory determine:
  - The required staffing and resource allocation
  - The structure of the inventory
  - The data quality objectives (DQOs)
  - The source types, categories, and pollutants to be included
  - Necessary level of spatial and temporal resolution

Emissions Inventory Development Process: Planning



Process (continued)



Inventory Preparation Plan (IPP)

- An IPP is a concise, prescriptive document that declares how an inventory will be developed and reported
- Important sections of an IPP:
  - Introduction
  - Inventory Scope
  - Description of all Inventory Compilation Steps
  - Emission Estimation Methodology
  - Data Management and Reporting
  - Quality Assurance Plan
  - Documentation
  - Staffing and Resources

Inventory Preparation Plan (IPP)

- Introduction
  - Define uses of inventory and acceptable data quality for uses of inventory
  - Define Data Quality Objectives (DQOs)
- Inventory Scope:
  - Identify pollutants and source categories, geographic area, and time interval to be included in inventory
- Description of all steps in compiling emissions inventory

Inventory Preparation Plan (IPP)

- Emission Estimation Methodology - Define all procedures that will be used to estimate emissions
  - Data collection
  - Emission estimation methodology
    - Methods should be selected for each category
    - Selection of methods is based on several factors
      - Resources available to develop the inventory
      - Data availability
      - Time schedules
      - Priority of the category
      - DQOs and Intended uses of the inventory
    - Preferred" and "Alternative" methods

Inventory Preparation Plan (IPP)

- Data Management and Reporting
- Quality Assurance Plan
- Documentation
- Staffing and Resources
  - Establish resource requirements and schedule
  - Identify partners and develop communication plan
    - Industry
    - Trade Associations
    - Agencies
    - Community groups

Inventory Compilation: Gathering Information - What Data Should I Gather?

- Inventory guidance
- Existing emissions data
- Preliminary screening studies
- Emission Factors and Models
- Source characterization documents
- Activity data references

Gathering Information: How Do I Identify Source Categories?

- Usually dictated by the pollutant of interest
- Past inventory efforts and historical knowledge of the inventory area can help identify categories
- Inventories for other agencies

Gathering Information: How Should I Research Sources of Pollutants?

- Research all available resources to identify sources of pollutants
  - Documents and Tools
  - Existing inventories
  - Source tests
  - Compliance data
  - Permits
  - Risk assessments
- Eliminate any sources that are not found within the inventory area
- Prioritize the list of remaining categories
- Consider time and budget constraints
- Eliminate any categories for which no emission factors or acceptable methods have been developed
- Document your decisions for the benefit of future preparers

How do I Identify Specific Nonpoint Sources in the Geographic Area?

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

Where Do I Find Emission Factor and Models Information?

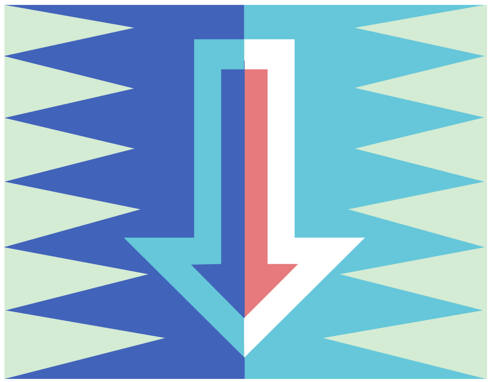
- Government agencies
- Industry
- Source test data for compliance purposes
- Professional societies - AWMA

Where Do I Find Source Characterization Information?

- Emission estimation guidance from EPA, UNEP, etc.

- Emission factor documents such as AP-42
- Existing inventory documentation

Emissions Inventory Development Approaches

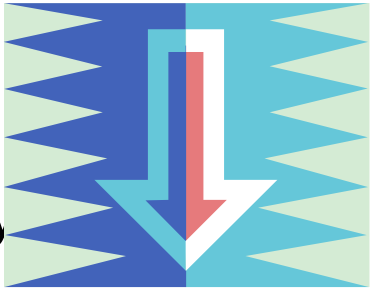


- Top-Down approach

- Bottom-Up approach

Top-Down Approach

- Methodology:
  - General emission factors combined with high level (national) activity data (e.g., emission factor x national coal consumption) to estimate emissions in country or region
  - National- or regional-level emissions estimates scaled to the inventory domain based on surrogate data (geographic, demographic, economic data)
- Typically 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
- Advantages: Requires minimum resources
- Disadvantages:
  - Emissions generally have high level of uncertainty
  - Loss of accuracy in emission estimates

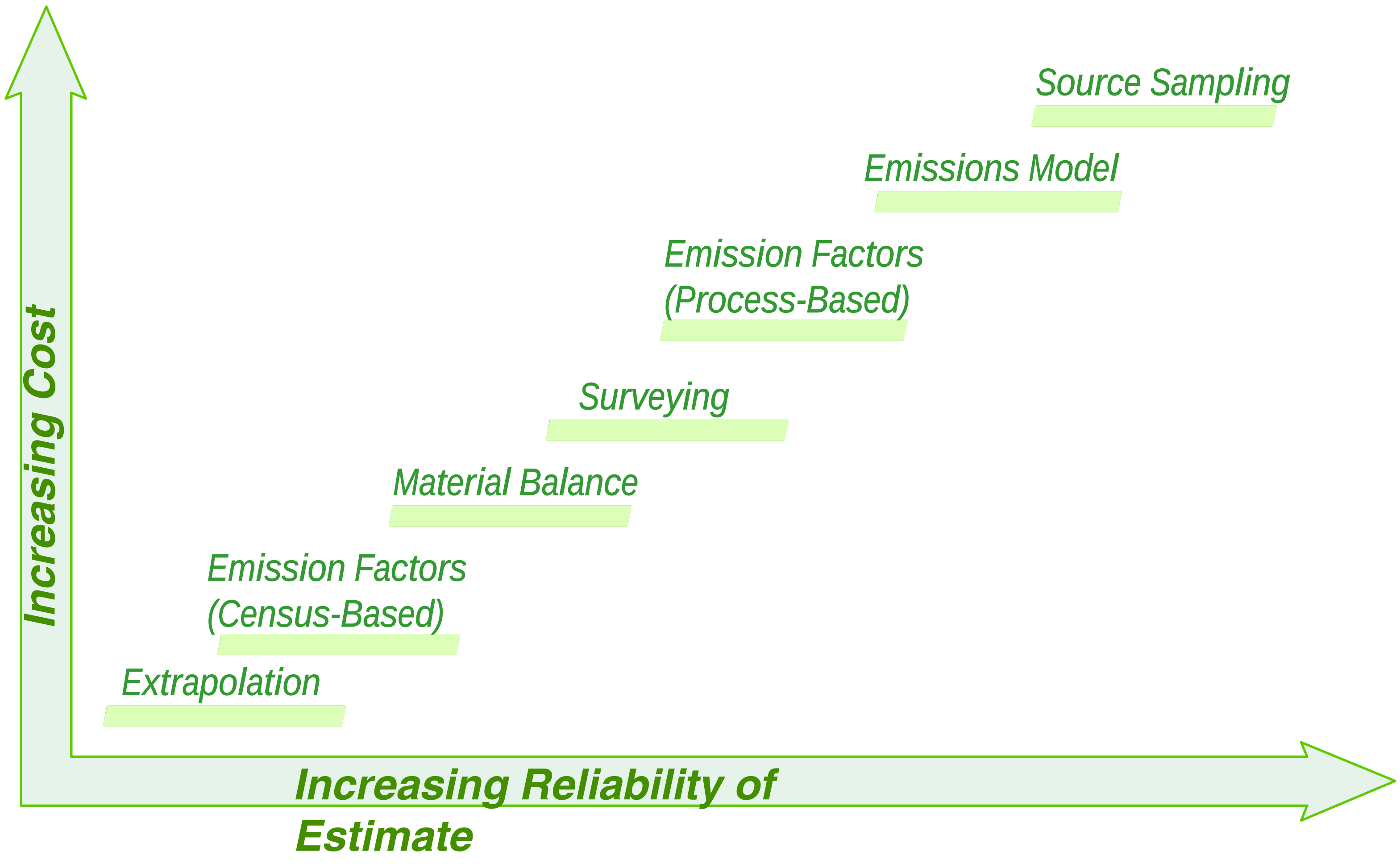


Bottom-Up Approach

- Methodology
  - Uses source-specific data (for point sources) and category-specific data at the most refined spatial level (for nonpoint and mobile sources)
  - Emission estimates for individual sources (and sc categories) are summed to obtain domain-level inventory

- Typically used when:
  - Source/category-specific activity or emissions data are available
  - End use of inventory justifies the cost of collecting site-specific data (e.g., for ozone control strategy demonstration)
- Advantages: Results in more accurate estimates than a top-down approach
- Disadvantages: Requires more resources to collect site-specific information than a top-down approach

Emission Estimation Techniques

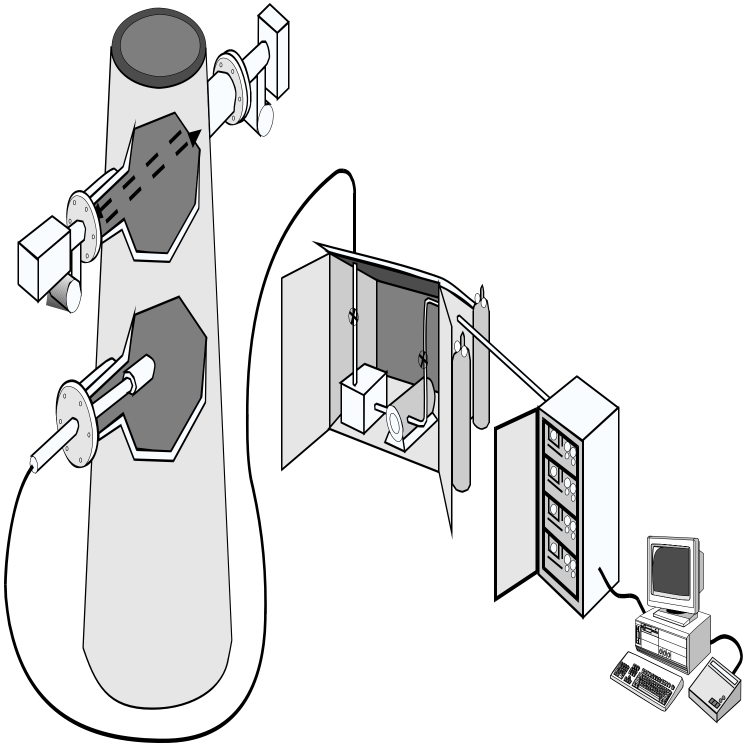


How Do I Choose Emission Estimation Methods?

- 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

Estimation Methods: Continuous Emission Monitoring (CEM) System

- Sampling is continuous
- CEMs measure and record actual emissions during the time period the monitor is operating and the data produced can be used to estimate emissions for different operating periods.
- CEMs can be required by permit conditions for some pollutants



Estimation Methods: A Continuous Emission Monitoring (CEM) System

Estimation Methods: Source Sampling

- Short term emission measurements typically taken from a stack or vent
- Includes:
  - Individual test at facility
  - Testing at similar facilities
  - Pooled source testing
- Sampling can be infrequent
  (1 stack test every 5 years)

Estimation Methods: Source Sampling

Estimation Methods: Source Sampling

- Emission rates generally reported as concentrations which must be converted to mass units for use in emission inventories
- Summarize emissions for each pollutant in terms of:
  - Mass loading rate
  - Emission factor
  - Flue gas concentration
- Results depend upon air pollution control device performance and design
- Screening measurements can be indicators of emissions, potential compliance issues

Estimation Methods: Fuel Analysis

- Used to predict emissions based on the application of conservation laws
- $E = Q_f$ x Pollutant in fuel x (MW_p/MW_f)
  where:
  Q_f = throughput of the fuel, mass rate (e.g. lb/hr)
  MW_p = molecular weight of pollutant emitted (lb/lb-mole)
  MW_f = molecular weight of pollutant in fuel (lb/lb-mole)

Estimation Methods: Emissions Models

- Used when
  - Calculations are very complex
  - Combination of parameters has been identified that affect emissions, but individually, do not provide a direct correlation
- Used to calculate emission factors or mass emissions for specific source categories
  - Examples: Mobile exhaust and evaporative emissions, storage tank evaporation and breathing losses, VOCs from wastewater treatment facilities
- Generally require that a significant amount of information be known about the sources) being estimated
  - Examples: meteorological conditions in the source area, tank capacity and color, amount and chemical make-up of wastes treated
- Mechanistic and multivariate 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

Estimation Methods: Emissions Models

U.S. EPA models include:

- TANKS - volatile liquid storage tanks (http://www.epa.gov/ttn/chief/software/tanks/index.html)
- WATER9 -wastewater treatment (http:/www.epa.gov/ttn/chief/software/ water/index.html)
- MOBILE6 – onroad motor vehicles (http://www.epa.gov/otaq/mobile.htm)
- LandGEM -landfills (http://www.epa.gov/ttn/catc/ products.html#software)

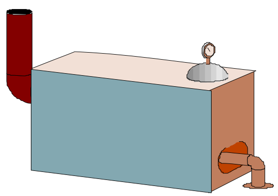
Estimation Methods: Emission Factors

- Definition: a ratio that relates the quantity of a pollutant released to a unit of activity
- Allow development of generalized estimates of typical emissions from source categories or individual sources within a category
- Estimates the rate at which a pollutant is released to the atmosphere as a result of some process

Types of Emission Factors

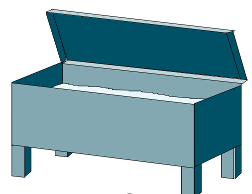
Process-Based Emission Factors

Natural Gas Boiler



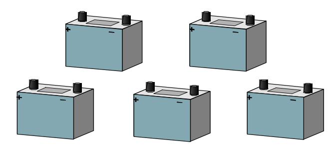
$kg/10^6 m^3$

Vapor Degreaser



$kg/hr/m^2$

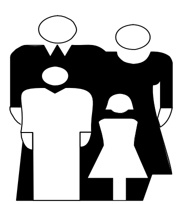
Battery Manufacturing



$kg/10^3$ batteries

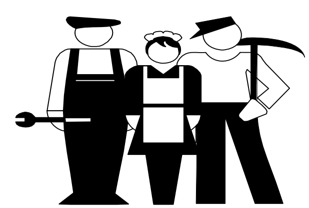
Census-Based Emission Factors

Per Capita



kg/person/yr

Per Employee



kg/employee/yr

Published Sources of Emission Factors

- U.S. AP-42 Compilation of Air Pollutant Emission Factors
  http://www.epa.gov/ttn/chief/ap42/index.html
- U. S. Emissions Inventory Improvement Program, EIIP
  http://www.epa.gov/ttn/chief/eiip/index.html
- U. S. Factor Information REtrieval (FIRE) Data System
  http://www.epa.gov/ttn/chief/software/fire/index.html
- European Environment Agency – CORINAIR
  (http://reports.eea.eu.int/EMEPCORINAIR4/en)
- Intergovernmental Panel on Climate Change (IPCC) database
  (http://www.ipcc-nggip.iges.or.jp/)

Calculating Emissions Using Emission Factors

- Emissions = EF × AD × (1 – CE/100)
  - EF = emission factor
  - AD = activity data (throughput)
  - CE = overall control efficiency (%) = (CAP × CON)/100
    - CAP = % of the emissions stream captured by the control
    - CON = % of pollutant removed from the emissions stream
- Activity data
  - Process weight rates = Mg/year, kg/hour, liter/hour
  - Fuel consumption rates = BTU/year, kJ/hour
  - Can be expressed in terms of production rates

Estimate VOC Emissions from Industrial Fuel Combustion

- Given:
  - Quantity of fuel used = 10,000,000 liters/year
  - VOC emission factor = 88 kg/10^6 m^3
  - CAP = 80% and CON = 90%
- Estimate overall control efficiency
  - CE = (80 x 90)/100 = 72%
- Convert fuel used in liters/year to m^3
  - 10,000,000/1,000 = 10,000 m^3
- Calculate annual emissions
  - Emissions = EF × AD × (1 – CE/100)
  - 88 kg/10^6 m^3 x (10,000 m^3/10^6) x (1 – 72/100) = 0.25 kg/year

Estimation Methods: Surveying

- Questionnaires are used to collect activity, controls, and emissions data from specific source types, categories
- 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
- Surveys can be conducted by various means
  - Workshops
  - Telephone
  - Internet
  - Visits to individual facilities by survey staff
- Keys to successful surveys
  - Well planned field effort
  - Well trained survey staff
  - Efficiently designed survey instrument
  - Quality assurance of data at various steps in the process

Estimation Methods: Material Balance

Used:

- When source test data, emission factors, or other developed methods are not available
- Where accurate measurements can be made of all process parameters
- For processes where material does **not** react to form secondary products or does not undergo significant chemical change
- For processes like solvent degreasing operations, and surface coating operations

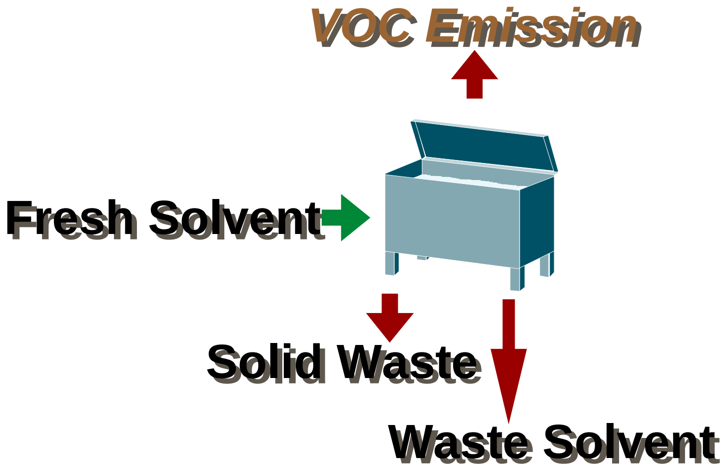
Estimation Methods: Material Balance

- Approach considers all inputs of a material and all possible fates for the material after passing through the process, including direct air emissions, fugitive air emissions, solid and liquid waste streams, and residual product content
  - Uses measurements of various components of a process to determine air emissions:

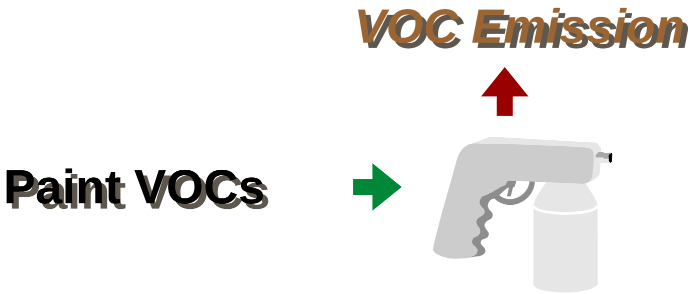
    Air emissions = Input – liquid emissions – solid wastes – products – by products – recycled material

- Commonly used to estimate emissions from solvent usage based on contents of various solvents
  - Solvent degreasing operations
  - Surface coating operations

Examples of Material Balances



Assume waste solvent is sent to a reprocessor and solid waste is sent to a treatment facility



Assume all solvents in paint are evaporated

Estimation Methods: Engineering Judgment (Extrapolation)

- Last resort to be used only if none of the methods described can be used to generate accurate emission estimates
- Provides an “order of magnitude” estimate with significant uncertainty
- Scaling emissions estimates to create another inventory using scaling parameters
  - Production quantity
  - Material throughput
  - Land area
  - Number of employees
  - Population

Emission Estimation Methods: Temporal Allocation

- Emissions may be reported as seasonal, day of week, or hourly. Temporal allocation is needed to adjust emissions to time period of interest.
- Emissions estimates are adjusted to account for temporal differences by apportioning emissions to a particular time period using:
  - Activity level
  - Rate of emissions
- How do I make temporal adjustments?
  - Collect activity data for each specific time period represented by the inventory
  - Conduct a survey to collect source information (include seasonal emission rate variations)
  - Collect information from indirect sources such as business and labor statistics

Emission Estimation Methods: 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 of nonpoint sources are prepared.
- How do I spatially allocate emissions? Make Adjustments based on:
  - GIS
  - Local activity level data
  - National data
  - Population data
  - Employment data

Emission Estimation Methods: How Do I Maintain the Emission Inventory?

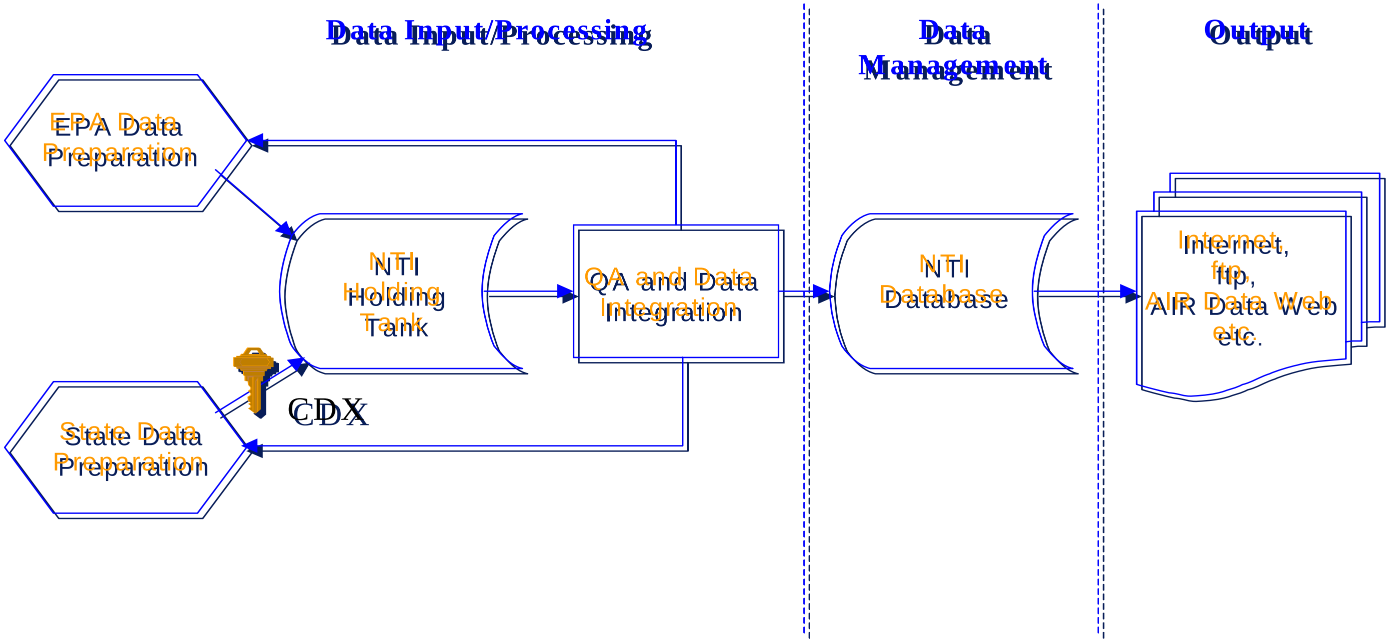
- Monitor and record changes in the total number of sources as well as changes in operation of existing sources
- Necessary to collect new data and information to calculate emissions to represent current conditions
- Existing inventories serve as the starting point for future inventories

Inventory Compilation: Compiling the Data into a Database

- The emission inventory database should contain all data elements necessary to transfer, share, and store emissions inventory data
  - The term data element refers to any piece of information used in the inventory compilation process
  - Selection of data elements in the emission inventory database will be dependent on the uses of the data

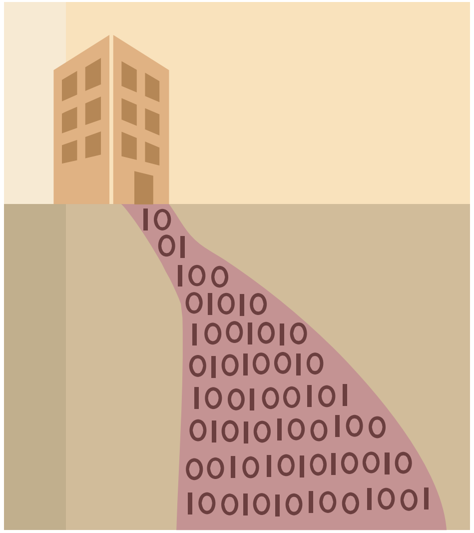
Emissions Data Systems should include: Input, Output and Management of Data

Example US Emission Inventory Data System: NTI



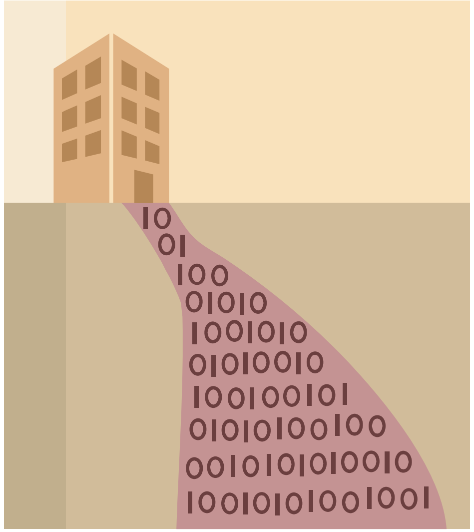
Compiling the Data into a Database

- Input of Data
  - Electronic submittals of data facilitate use of inventory by various entities
    - Facility-to-agency reporting
    - Agency-to-agency reporting
  - Considerations for electronic reporting of data:
    - Provide Single Point of Entry Move Data to from data providers to agency
    - Support Variety of Formats
      - User-Defined Flat Files
      - Extensible Markup Language (XML)
      - Web Forms
    - Automate and Secure Data Transfer With All Trading Partners



Compiling the Data into a Database

- **Management of Data**
  - Facilitate data backup and revision
  - Allow tracking of changes to the inventory
  - Transfer, share, and store emissions inventory
  - QA QC of data



- **Output of Data**
  - Determine audience and their needs
    - Internal vs. External audience
    - Level of data needed
      - Full data base with all data elements
      - Summary data sets
  - Determine how to provide access to data
    - FTP site or web or CD-ROM/DVD
    - Raw data or Interactive query systems

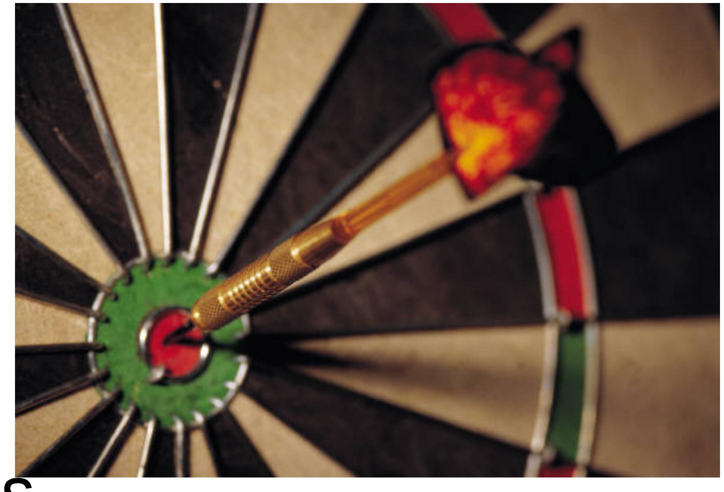
Inventory Compilation: Quality Assurance/Quality Control (QA/QC)

- QA/QC is not optional in emission inventory development
  - Integral part of emission inventory compilation

- Why do we need to conduct QC and QA?
  - Instills confidence in emission estimates and their uses
  - Improves accuracy of emission estimates
  - Improves assessment of emissions on air quality
  - Provides a better assessment of emission inputs to air quality models
  - Improves transparency of estimates and provides documentation
  - Lowers program costs for subsequent data base maintenance

Quality Assurance/ Quality Control (QA/QC)

- QA versus QC
- QA Plan
- QA/QC Activities
- QA/QC Tools
- Uncertainty Analysis
- Documentation



QA vs. QC

- External review and audit process
- Independent review by a third party to assess
  - Effectiveness of QC program
  - Overall quality, completeness, accuracy, representativeness of the inventory
- Conducted by person not involved in inventory development

- Routine internal technical activities to measure and control the quality of the inventory *as it is being compiled*
- Uses standardized procedures
- Includes use of good documentation
- Carried out by members of the inventory team
- Example QC activities
  - Comparing emissions to previous inventories
  - Using checklists to ensure that all inventory development requirements are met
  - Determining outliers by using computer-aided, graphical, or other reviews
  - Conducting accuracy checks

Data Quality Objectives (DQOs)

- Qualitative and quantitative statements to identify the level of uncertainty that a decision-maker is willing to accept
- DQOs ensure that the final inventory meets intended uses
- DQOs are Identified as part of the inventory planning process
- DQOs must be realistic and achievable to be useful

DQOs : Example EPA NEI

- NEI will meet US Government's Office of Management and Budget Information Quality Guidelines to ensure transparency and reproducibility of NEI data. Because the NEI is considered an influential product , EPA will ensure maximum objectivity, utility and integrity of data.

- DQO will require NEI to:
  - Undergo scientific peer review
    - Must be capable of being reproduced by a qualified third party
  - Have a Quality Assurance Plan
  - Be transparent
    - Log and archive all original submittals
    - Archive holding tables which contain compiled revisions
    - Archive and index intermediate work products
    - Incorporate data elements in output files which allow user to determine source of record and nature of revision as well as origin of defaulted data
    - Prepare Emissions History Table to track changes over time in NEI
    - Assign data ratings for estimates
    - Prepare documentation including end users of inventory, purpose, data sources, submittal contacts and methodology

Data Quality Indicators (DQIs)

- Data quality indicators - qualitative and quantitative descriptors used to interpret degree of acceptability or utility of the data
- Principal DQIs
  - Accuracy
  - Comparability
  - Completeness
  - Representativeness

Example DQIs Table

DQI	Inventory Target Values
Accuracy/Uncertainty	• Quantify variability of all emissions based on source test data or surveys • Use expert judgment method to estimate uncertainty for all sources >5% of emissions of any pollutant
Completeness	• Include 100% of all point sources equal to or greater than 100 metric tons/yr of VOC • Include 90% of all other point sources • Include top 20 emitting nonpoint source categories from the 1999 inventory
Representativeness	• Provinces A, B, C, and D • 2004 daily ozone season
Comparability	• Results to be compared with the 1999 base year inventory

Quality Assurance Plan (QAP)

- A description of specific QA and QC procedures and responsibilities
- Every Inventory Preparation Plan should contain a QAP
- Initial QA/QC planning
  - Identify a Quality Assurance Coordinator
  - Restate the DQOs and DQIs
  - Determine resources needed to implement the QA plan
  - Determine authority and responsibility for QA/QC plan implementation
- Accurate and complete QAPs for inventories are necessary to:
  - Ensure that the final compilation of the data accurately reflects the inventory effort
  - Support QA/QC assessments of inventory
  - Determine quality of emission estimates and data references
  - Allow reproducibility of estimates
  - Ensure inventory will be starting point for future inventories

Components of a Comprehensive QAP

- Policy Statement
  - Declares organization's commitment
- Introduction
- QA Program Summary
  - Data flow
  - Points where QC procedures will be applied
- Technical Work Plan
  - Resources, documentation, schedule
- QA/QC Procedures
  - Techniques, checkpoints
- Inventory Preparation and QA/QC Activities
  - Roles and responsibilities of agencies, personnel
  - Reality checks, peer review, sensitivity checks, audits, etc.
- Corrective Action Mechanisms
- References

Primary QA/QC Methods

- Reality checks
  - Is this number reasonable? Does it make sense?
  - You should never use the reality check as the sole criterion of quality

- Peer review
  - An independent review of calculations, assumptions, and/or documentation by person with a moderate to high level of technical experience

- Sample calculations – Replication of Calculations
  - Most reliable way to detect computational errors
  - General rule, a minimum of 10% of calculations is checked depending on:
    - Complexity of calculations
    - Inventory DQOs
    - Rate of errors encountered

Primary QA/QC Methods

- Computerized checks
  - Automated data checks can be built-in functions of databases, models, or spreadsheets or can be designed as stand-along programs
  - Automate to
    - Check for data format errors
    - Conduct range checks to ensure data falls within specified min/max
    - Provide look-up tables to define permissible entries
- Sensitivity analysis
- Emission estimation validation

Primary QA/QC Methods

- Statistical checks
  - Descriptive statistics
  - Statistical procedure to identify outliers
  - Statistical tests

- Independent Audit
  - Identify staffing issues
  - Evaluate the effectiveness of the technical and quality procedures
  - Provide confidence in the accuracy and completeness of the emission data
  - Determine if DQOs are being met
  - Identify the need for additional QC measures

What QC Procedures Should I Follow?

- Best implemented through standardized checklists
- Use checklist to monitor
  - Data collection
  - Data calculations
  - Evaluation of data reasonableness
  - Evaluation of data completeness
  - Data coding and recording
  - Data tracking

QA/QC Documentation

- QA/QC documentation should include records of QA/QC activities, especially changes made as a result of these activities
- Report should include
  - Procedures used
  - Technical approach used to implement QA plan
  - Any calculation sheets and QA/QC checklists
  - Dates of each audit, and the names of the reviewers
  - Responses to QA/QC audits
  - Results of QA activities, including problems found, correction actions and recommendations
  - Discussion of the inventory quality

Uncertainty in Emissions Inventories

- Two types of errors cause uncertainty in emissions inventories:
  - Bias = Systematic difference between a measurement and its true value
  - Imprecision = Random fluctuations between a measurement and its true value
- Factors introducing uncertainty in emissions data
  - Variability

    (spatial and temporal uncertainty)
  - Parameter uncertainty
  - Model uncertainty

When Should Uncertainty in Emissions Inventories be Estimated?

- Overall objective of an uncertainty analysis is to develop confidence limits (e.g., 90-95%), about the mean of emission estimates from each source type analyzed.
- A needs analysis can help determine:
  - Degree of acceptable uncertainty
  - Appropriate statistical approach
  - Resources needed to implement the approach

Methods and Relative Time to Estimate Emissions Uncertainty

- <100 Hours
  - Qualitative discussion
  - Subjective Data Quality Ratings
- <500 Hours
  - Data Rating System
  - Expert Estimation
  - Propagation of Errors
- <1,000 Hours
  - Direct Simulation
- >1,000 Hours
  - Direct or indirect measurement
  - Receptor modeling (source apportionment)
  - Inverse air quality modeling

What Is Role of Emission Uncertainty in Ambient Model Concentrations?

- Total Mass
  - Completeness of emission sources - facilities and source categories
  - Speciation of compound classes for grouping
- Geographic Distribution of Mass
  - Facility location data
  - Spatial allocation of nonpoint sources
- Vertical Distribution of Mass
  - Stack parameters
- Chemical/Physical Characteristics
  - Assignment of PM coarse/fine splits
  - Assignment of reactivity classes
- Temporal Resolution
  - Allocation of emissions from annual to 3 hr

Inventory Compilation: Data Augmentation

- Data fields in the inventory
- Examples:
  - Latitude/longitude coordinates
  - Stack parameters
  - Emissions Data Gaps

Emission Inventory Compilation: Documentation

Why Is Documentation Important?

- Ensures that the final written compilation of the data accurately reflects the inventory effort.
- Supports QA/QC assessments of the inventory
- Ensures reproducibility of the inventory estimates
- Enables an inventory user or reviewer to assess the quality of the emission estimates and identify the data references
- Is a foundation for future inventories

What Records Should Be Kept?

- Documentation of all data collection and emission estimation activities
  - methods
  - assumptions
  - raw data
  - calculations (manual and electronic)

Emissions Inventory Report Outline

- Executive Summary
  - Overview of scope, uses
  - Inventory summaries
- Introduction
  - Background, objectives, uses, DQOs
  - Inventory limitations
  - Scope, inventory characteristics
  - Data management approach
- Point Source Inventory
  - Categories
  - Methods, data, assumptions
  - QA/QC steps, corrective actions
  - Results by source category
- Nonpoint Source Inventory
- Motor Vehicle Inventory
- Nonroad Inventory
- Natural Source Inventory
- Results by Pollutant
- References
- Appendices
  - Sample calculations
  - Additional tables, graphs

Emission Inventory Compilation: Access to Data

Distribution of product:

- Final emission inventory product includes both documentation and data files
- Data and documentation must meet the format and content requirements specified in the Inventory Preparation Plan
- You may want to consider developing a communication plan for emission inventory distribution.

Summary: Inventory Compilation

- Inventory Compilation includes:
  - Planning
  - Gathering information
  - Estimating Emissions
  - Compiling the Database
  - QA/QC
  - Data Augmentation
  - Documentation
  - Providing Access to Data
- Inventory Preparation Plan describes <u>how</u> and <u>why</u> the inventory is being developed
- Estimation methods are determined by the DQOs, resources, and data available - Compromise between method accuracy and cost to implement
  - Least resource/data intensive methods yield most uncertain results (extrapolation)
  - Most resource/data intensive methods yield least uncertain results (source sampling)
- Data management strategies address the elements needed to input, output and manage the inventory data and results

Summary: Inventory Compilation

- A QA Plan implements QA/QC procedures and establishes DQOs for:
  - Accuracy
  - Comparability
  - Completeness
  - Representativeness
- Uncertainty analysis can help establish level of quality of an inventory, can be resource intensive
- After QA/QC is completed, data augmentation is necessary to address problems found in QA/QC of data in order to compile inventory that can meet DQOs
- Proper inventory documentation allows reproduction of the emissions estimates
- Thought should be given about final inventory products and their distribution

Questions or Comments?

IPP Exercise