United States
Environmental Protection
Agency

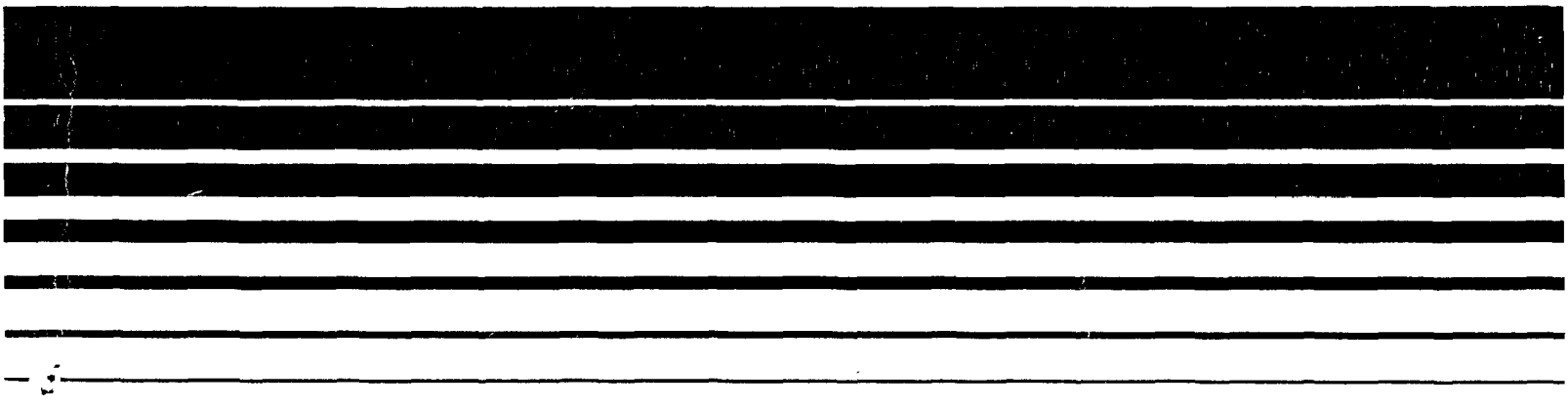
Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EPA-450/4-88-023
DECEMBER 1988

Air

EPA

GUIDANCE FOR THE PREPARATION OF QUALITY ASSURANCE PLANS FOR O3/CO SIP EMISSION INVENTORIES



EPA-450/4-88-023

GUIDANCE FOR THE PREPARATION OF QUALITY ASSURANCE PLANS FOR O3/CO SIP EMISSION INVENTORIES

BY

SHARON L. KERSTETER
REBECCA BATTYE
ALLIANCE TECHNOLOGIES
CHAPEL HILL, NC 27514

EPA CONTRACT NO. 68-02-4396

EPA PROJECT OFFICER: WILLIAM B. KUYKENDAL

OFFICE OF AIR QUALITY PLANNING AND STANDARDS
U. S. ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

DECEMBER 1988

This report has been reviewed by the Office Of Air Quality Planning And Standards, U. S. Environmental Protection Agency, and has been approved for publication as received from the contractor. Approval does not signify that the contents necessarily reflect the views and policies of the Agency, neither does mention of trade names or commercial products constitute endorsement or recommendation for use.

EPA-450/4-88-023

TABLE OF CONTENTS

FIGURES

TABLES

1.0 INTRODUCTION

1.1 PURPOSE AND OVERVIEW OF DOCUMENT

As part of the State Implementation Plan (SIP) process, each State involved in developing a SIP shall submit a quality assurance (QA) plan to the EPA Regional office for review and approval. The submittal and approval of a QA plan is new to the SIP inventory process and is designed to ensure emission inventories of higher quality than previous emission inventory submittals. The purpose of this document is to provide guidance to State and local agencies in the development of a QA plan for their inventories.

Section 1 of this document presents the purpose of the document and a brief introduction to quality assurance. Sections 2 through 5 examine the elements included in a QA plan. Section 2 describes the inventorying agency's QA policy statement, including the purpose and the scope of the program. Section 3 discusses the organization of the inventory as a whole. Included in this Section are general discussions of control techniques and audit procedures. In Section 4, the technical aspects of the inventory and the associated QA procedures are presented. The bulk of the discussion in this report is found in Section 4. Section 5 covers system audits, including audit responsibility and schedules and procedures.

Figure 1.1-1 gives an outline of an example QA plan. The structure of each section reflects the basic elements which should be considered and/or included in the State QA plan. While State agencies are not required to follow this format, the elements outlined in the following sections should be covered in the State QA plan.

1.2 DEFINITION OF QUALITY ASSURANCE

The purpose of quality assurance is to ensure the development of a complete, accurate and consistent data base. The quality assurance of an inventory is the system of procedures which operates to ensure that the inventory and accompanying data meet a specified level of quality. Planning and implementing such procedures ensure and document data quality. A quality

* 1.0 Quality Assurance Policy Statement
- 1.1 Purpose of the program
- 1.2 Scope

2.0 Summary
- * 2.1 Organization chart
- * 2.2 Emission inventory tasks and assignments or responsibility
- 2.3 Information flow
- 2.4 Summary of control techniques and relation to information flow
- 2.5 Audit procedures
- 2.6 Inventory objectives and constraints

3.0 Technical
- 3.1 Task planning
  - * 3.1.1 Resource allocation
  - 3.1.2 Prioritizing sources and data elements
  - * 3.1.3 Personnel training
  - * 3.1.4 Schedule and project planning
  - 3.1.5 Data sources
  - 3.1.6 Data checking procedures
- 3.2 Data collection and analysis
  - * 3.2.1 Identification of emissions sources
  - * 3.2.2 Collection procedures
  - * 3.2.3 Data quality
  - * 3.2.4 Emission estimation methods
  - * 3.2.5 Calculations
  - * 3.2.6 Validation procedures
- 3.3 Data handling
  - 3.3.1 Data coding and recording
    - 3.3.1.1 Recording and coding forms
    - 3.3.1.2 Rules for data coding
    - 3.3.1.3 Data editing procedures
  - * 3.3.2 Data tracking
  - * 3.3.3 Correcting data
  - * 3.3.4 Missing data
  - 3.3.5 Review of estimates
- 3.4 Data reporting
  - 3.4.1 Reporting formats

4.0 System Audits
- * 4.1 Audit responsibility and schedules
- 4.2 Procedures
  - 4.2.1 Elements
  - 4.2.2 Schedule
  - 4.2.3 Audit report

* Required to be submitted. Other elements are recommended but not required.

Figure 1.1-1. Outline of example quality assurance (QA) plan.

assured SIP inventory should produce a more accurate inventory and lead to better assessment of control strategies and the impact of emissions on air quality. In fact, a well-designed QA program promotes user/agency confidence in the data, provides a better assessment of emission inputs to air quality models and should lower program costs for subsequent data base maintenance.

An agency's QA plan should be designed to address such issues as:

- o are all source categories covered in the inventory?
- o have the best available data been used within the constraints of the inventory?
- o are calculated values reasonable?
- o have calculations been checked?
- o does the inventory meet the stated objectives and requirements?
- o how was the inventory produced?

These objectives and requirements can include the coverage, detail and format of the inventory as well as its end uses and its ability to be analyzed and updated.

1.3 QUALITY ASSURANCE COORDINATOR

Before a new emissions inventory effort is begun, the agency should appoint an individual to act as QA coordinator who will be responsible for all the QA activities and who will serve as the liaison for communication and contact. A State may wish to assign one person to cover the entire emissions inventory, or to assign one person for each major section (i.e., point sources, area sources and mobile sources). The coordinator does not necessarily have to work on QA full-time and should preferably not be an individual engaged in the actual inventory work.

The appointment of a QA coordinator will help ensure implementation of the quality assurance techniques. The QA coordinator can audit the emissions inventory process to ensure that errors in all phases of the inventory preparation are detected and corrected. The coordinator should also serve as the focal point for addressing significant QA problems and corrective actions

and should have a good understanding of the sources of the data used in the inventory.

2.0 QUALITY ASSURANCE POLICY STATEMENT

2.1 POLICY STATEMENT

The policy statement is the formal declaration of agency commitment for developing and maintaining a quality assurance program. The policy statement defines quality assurance as related to agency activities, explains the need for the program and provides the basis for committing resources to the program.

An example of a typical QA policy statement is given below. While the agency is not required to use this example statement, it should consider the items mentioned in this statement in preparing its own.

EXAMPLE. The objective of this emission inventory for 1988 is to compile an accurate and comprehensive inventory of emissions and facility data from point, area, and mobile sources for the base year. The inventory will be developed for volatile organic compounds (VOC), oxides of nitrogen (NO_x), and carbon monoxide (CO).

To ensure that the inventory is of the highest quality, this agency will implement certain quality assurance procedures at various points in the inventory process. Resources, including trained QA personnel, have been/will be allocated for this purpose. This agency will follow the procedures outlined in Guidance for the Preparation of Quality Assurance Plans for O_3/CO SIP Emission Inventories. The details of this QA program are discussed in the following sections.

_____

QA Coordinator

_____

Agency Administrator

3.0 SUMMARY

3.1 PROGRAM SUMMARY

The quality assurance program summary is an executive summary of the technical procedures. It provides an overview of the major components of the program without explaining the details of daily operating procedures. The summary explains the flow of emission inventory data through the agency, shows graphically the interaction among functional groups, and flags the points in the inventory procedures where quality assurance and quality control techniques are applied. It lists the control techniques and the frequency of their application.

The agency may also wish to include a discussion of the inventory objectives and constraints in its summary. While the major objectives for performing a SIP inventory have been outlined by EPA in Emission Inventory Requirements for Post-1987 Ozone State Implementation Plans[1] and Emission Inventory Requirements for Post-1987 Carbon Monoxide State Implementation Plans,[2] other inventory objectives may vary from agency to agency depending, for example, upon the choice of the photochemical model to be used. Inventory constraints may include personnel, time, resources, data processing capabilities, and others. Agency understanding of inventory objectives and constraints can aid in the decision of how resources will be allocated.

Figure 3.1-1 shows an example QA organization chart. The agency should specify the names and telephone numbers (if known) of the directors and coordinator on its organization chart.

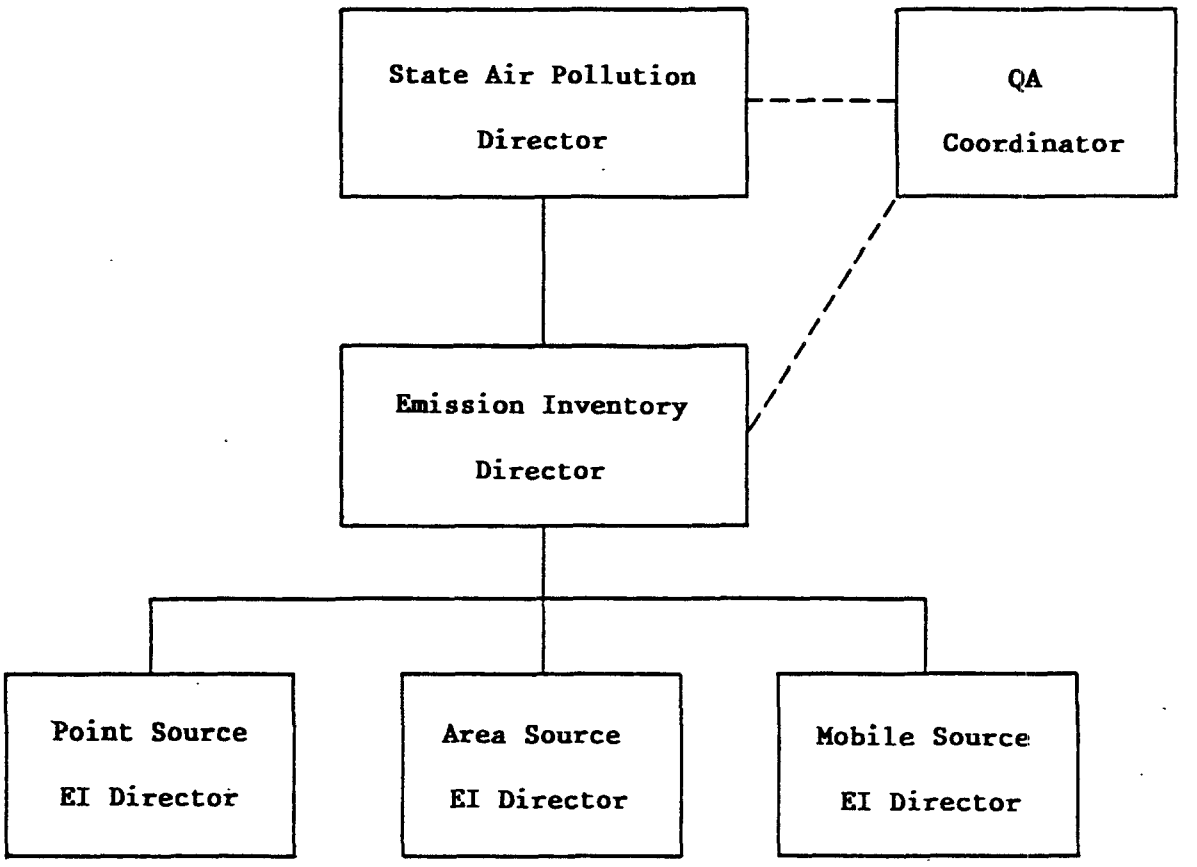


Figure 3-1. Example Emission Inventory (EI) Organization Chart.

4.0 TECHNICAL CONSIDERATIONS

4.1 INTRODUCTION

The QA plan includes the operating details of each of the four major emission inventory task categories (i.e., task planning, data collection, technical procedures and calculations, and data recording, processing, and reporting). The plan must include step-by-step procedures for and details of checking procedures. The following discussions focus on the QA principles shown in Figure 4.1-1.

4.2 PLANNING

The agency should identify the procedures and principles it will use in the planning section of the QA plan. The detailed descriptions of the procedures, or how the agency intends to implement the planned procedures, should be discussed under their appropriate headings; the planning section outlines the QA elements to be employed. The agency should explain that certain procedures such as appointing a QA coordinator, prioritizing sources for inclusion in the inventory, preparing checklists of sources to be evaluated, determining data collection activities, identifying the critical data elements, and implementing data checking programs, will be performed and should give a schedule of these activities. Some QA items to be included in the planning are shown in Figure 4.1-1. These items are discussed below.

4.2.1 Resource Allocation for Quality Assurance

The agency should acknowledge allocation of resources for the QA of the emission inventory and designation of or plans to designate a QA coordinator. The name and telephone number of the QA coordinator should be provided (if known) and the duties and responsibilities of the QA coordinator should be identified. Designation of a QA coordinator and his/her responsibilities early in the emission inventory process will aid in standard and consistent

Planning:

- Allocate resources for optimal QA.
- Prepare a checklist of sources of be evaluated.
- Account for significant VOC sources.
- Identify critical data elements and impacts on results and utility of the inventory.
- Review questionnaire design.
- Schedule routine checking of calculations and data entry.
- Prepare data checking programs incorporating standard range and missing data checks.
- Maintain a separate QA staff with experience in data collection and analysis.
- Plan audit procedures.

Data Collection and Analysis:

- Crosscheck identification of all major sources to ensure inclusion.
- Check questionnaire design based on response.
* - Check data collected.
- Check emission estimation methods and consistency of application.
* - Check calculated results.
- Initiate verification procedures.

Data Handling:

- Track data flow.
- Handle corrected data.
- Check data after conversion to inventory format.
* - Check individual data entries for missing emissions, SIC codes, implausible operating data, etc.
- Assign agency estimates for missing data on a consistent and documented basis.
* - Review tabulated data for quality and identification of outliers.

Data Reporting:

- Check aggregation of emissions.
- Check disaggregation of emissions.
- Compare results with other inventories.

* Logical checkpoints.

Figure 4.1-1. Principles of the QA program.

application of the QA procedures and establishment of effective lines of communication.

4.2.2 Prioritizing Sources and Data Elements

In order to focus the QA effort, the agency should prioritize the source categories and data elements for the inventory and should report the procedures used in these prioritization processes. Some brief examples are given below.

Source categories can be prioritized based on their importance in the inventory. For example, they can be prioritized so that the agency's resources are spent first on the source categories that the agency considers most important and/or the sources that are most important for meeting the inventory objectives. The sources can be prioritized by checking previous SIP inventories to identify the largest emitting area or point source categories, checking other types of inventories to identify the largest emitting area or point source categories, and/or determining the categories which are most important to the end users of the inventory. Within this process, the agency should also include consideration of how well the source category has been characterized. Once sources are prioritized, the agency must determine the most appropriate procedures or methods for data collection and emission estimation for each source category.

Data elements for source categories can also be prioritized since certain data are essential to the inventory. The data priorities for the point source inventory can be found in the guidance documents Emission Inventory Requirements for Post-1987 Ozone State Implementation Plans[1] and Emission Inventory Requirements for Post-1987 Carbon Monoxide State Implementation Plans[2]; those required are shown in Figure 4.2-1. These may be used as resources and checklists for prioritizing point sources and their data elements.

Much of the agency's resources for the mobile source inventory will be spent developing the data inputs for the MOBILE model. Some specific parameters required as input to the MOBILE model include: region for which factors are to be calculated; calendar year; vehicle speed; ambient temperature; percentage of total VMT accumulated by noncatalyst vehicles

Data Elements	Data Elements (continued)
I. PLANT INFORMATION	**III. SEGMENT INFORMATION**
* NEDS State ID	* SCC
* NEDS County ID	* SCC Description
* NEDS Plant ID	* Process Rate Units
* NEDS Pollutant	
* Model Area (County, Township, or Grid Cell)	A. BASE YEAR INFORMATION
Number of Employees	Actual Annual Process Rate
* Base Year of Inventory	Seasonal Adjustment Factor
UTM Zone	* O3 Season Daily Process Rate
UTM Coordinates (km)	Maximum Hourly Design Rate
X:	Control Equipment
Y:	* primary
* Plant Name	* secondary
* Street Address	* Control Efficiency (%)
* City	* Emission Estimation Method
* State	* Emission Factor Units
* Zip Code	* Emission Factor (uncontrolled emissions)
Plant Contact	Annual Base Year Emissions (tons/yr)
* Plant SIC Code(s)	* Rule Effectiveness (%)
Principal Product	* O3 Season Daily Emissions (lbs/day)
Projected Attainment Year	Banked Emissions (tons/yr)
Total Plant Banked Emissions	Comment
Year Emissions Banked	
II. POINT INFORMATION	B. PROJECTED YEAR INFORMATION
* NEDS Point ID	Projected Baseline Information
* Point Description	Compliance Year
% Annual Throughput	Control Equipment
Dec-Feb	primary
Mar-May	secondary
June-Aug	Control Efficiency (%)
Sept-Nov	Growth Factor
Normal Operation Schedule	Baseline Daily Emissions (lbs/day)
* hrs/day	Projected Control Strategy Info
* days/wk	Regulation in Place? (Y/N)
* wks/yr	Emission Limitation
daily start/end times	Compliance Year
* Regulation in Place? (Y/N)	Control Equipment
* Emission Limitation	primary
* Compliance Year	secondary
* CTG Category (I,II,III)	Control Efficiency (%)
	Rule Effectiveness (%)
	SIP Strategy Daily Emissions (lbs/day)

* Required for base year ozone or CO SIP emission inventory.

Figure 4.2-1. Ozone SIP emission inventory point source information.

operating in the cold-start mode; percentage of the total VMT accumulated by catalyst-equipped vehicles operating in the hot-start mode; and percentage of total VMT accumulated by catalyst-equipped vehicles operating in the cold-start mode. The agency has the choice of specifying local data or using default values in the model for parameters such as: distribution of VMT by vehicle type; vehicle model year and accumulated mileage distributions; baseline emission rates; factors to correct emissions for air conditioner use, extra loading, trailer towing and humidity; and RVP of fuel, I/M parameters, and anti-tampering, if needed. These lists can be used to prioritize mobile source data elements.

4.2.3 Personnel Training

In this section, the agency should describe the training to be provided for personnel involved in producing the inventory. It may also want to identify the areas in which personnel are to be trained, who will lead the training, who will be trained, and how the agency has arrived at these decisions. Training of the inventory personnel will help to ensure consistency in the collection of data and estimation of emissions, reduce confusion in performing inventory functions, and allow the inventory to proceed at a quicker pace.

4.2.4 Schedule and Project Planning

The planning portion of the QA plan should also indicate the types of QA procedures that will be implemented and identify when these procedures will be implemented. Checkpoints for optimal problem detection should be located and provisions for timely correction of problems should be identified. (The actual correction processes will operate during the data collection and analysis and data handling procedures.) The agency's QA plan should identify or flag these checkpoints. To do this, the agency may provide a chart, such as that shown in Figure 4.1-1, showing the principles of the QA program, and denoting logical checkpoints with an asterisk.

4.2.5 Data Sources

An important element in planning is the identification of data sources. The agency should outline how it will determine the data sources it will use. To determine the reliability of the data and data sources, the agency should: (1) judge the professional capabilities and biases (if any) of the agencies or facilities supplying the data; (2) assess the collection techniques used to compile the data; (3) assess the purpose for which the data have been compiled; and (4) know and understand any limitations placed on the data by the originating agency. The agency's QA plan should also discuss how it will perform these assessments and how it will treat the results.

4.2.6 Data Checking Procedures

In the planning section, the agency should acknowledge that there is a need for preparing data checking procedures for elements such as standard range checks and missing data checks. It should identify where and how these checks will be implemented.

4.3 DATA COLLECTION AND ANALYSIS

In the agency's QA plan, it should identify not only the data collection procedures that it will use but also the quality control (QC) procedures that it will employ to verify the data collection. The following sections contain discussions of the items to be considered in data collection.

4.3.1 Identification of Emissions Sources

To ensure that all sources of emissions have been included in the inventory, the agency must identify and implement procedures to account for the sources. These procedures, also known as completeness checks, assure that all emission points within a source, and all major sources within the study region, are included in the inventory. Completeness checks may differ depending on the major source category, i.e., point source, area source and mobile source. The

agency should indicate how sources within these categories were identified and verified. The agency may use tables such as Table A-1 in Appendix A for point sources and Table A-2 in Appendix A for area sources to ensure that all sources are inventoried.

Sources of information on individual point sources to be surveyed for the inventory include: existing emission inventories; other air pollution control agency files or government agency files; EPA/CTG source listings; local information sources, such as local industrial directories, telephone directories, and manufacturers and suppliers; and national publications, such as trade and professional society publications and business references. The agency should describe the procedures it will use to crosscheck the identification of the major sources.

4.3.2 Collection Procedures

Data collection procedures can vary depending not only on the major source category involved (point, area, mobile), but also on the individual source categories within each of the above, the level of detail involved, and the estimation methods to be used. The choice of one particular collection method over another may be dependent on the agency's time and resource constraints. To ensure an emission inventory of the highest possible quality given the agency's constraints, the agency should identify the critical data elements of the collection procedures and assess their impacts on the results and utility of the inventory and how easily these data can be obtained.

The agency's QA plan should discuss: (1) the collection procedures that will be used; and (2) how the agency will provide quality control (QC) for these data collection procedures. Aspects of the first part of the discussion have been outlined briefly above and in greater detail in Procedures for the Preparation of Emission Inventories for Precursors of Ozone.[3] Examples of the second part of the discussion are given below.

To provide QC to the questionnaire approach to data collection, the agency may decide to use industry-specific questionnaires and specially trained personnel to handle those particular sources. If the agency uses plant inspections, it may provide special training, coding forms, and checklists to

its inspectors. It may also prepare the plant for its inspection by providing the plant manager with questionnaires for certain information prior to the inspection. These measures are examples of the type of QC procedures that the agency can use in their QA plan.

4.3.3 Data Quality

To ensure that the emission inventory is of the highest possible quality, the agency's QA plan should include procedures for evaluating the reliability and quality of the data and should explain how these procedures will be implemented. Some actions that might ensure data reliability and quality are: (1) check the date of the data to make sure that it corresponds with the year(s) being inventoried; (2) check the data sources against other published data; (3) assess the professional capabilities and biases (if any) of the agencies supplying the data; (4) assess the purpose for which the data have been compiled; and (5) assess the collection techniques used to compile the data. The agency may refer to Procedures for the Preparation of Emission Inventories for Precursors of Ozone[3] for further discussion of this topic.

As an example, the agency may have greater confidence in data that have been compiled for similar reasons as those for the current inventory, and therefore, may decide that these data should be given preference over other data. The agency may also have greater confidence in data that are based on actual activity levels rather than data based on assumptions. The agency may then decide to discard data based on assumptions in favor of those based on activity surveys.

4.3.4 Emission Estimation Methods

As with data collection procedures, emission estimation methods can vary depending on the source category. Within each major source category there are several estimation methods that can be used, as well as emission factors that can be employed. In its QA plan, the agency should identify the procedures it will employ to ensure that the method or methods used and the emission factors used are the best ones for the inventory considering the constraints and

objectives of the inventory. The agency should also include a discussion on how it plans to implement quality control procedures in the use of the emission estimation methods.

In estimating emissions from area sources (except highway mobile sources), the agency can use any of the following methods: (1) treating area sources as point sources; (2) using local surveys to determine activity data; (3) apportioning national or State totals to the area under consideration; (4) using per capita emission factors; or (5) using emissions-per-employee factors. (The available highway mobile source methods are described in Chapter 4, Volume 4 of Procedures for Emission Inventory Preparation.[4]) Determination of the method or methods to use for estimating emissions from an area source category will depend on the constraints of the inventory and the agency. The agency should identify the constraints to each method, including time and funds available to the inventory and availability of data and of experienced personnel. If the agency's resources are limited, it may choose to use per capita emission factors or emissions-per-employee factors, both of which can be found in Procedures for the Preparation of Emission Inventories for Precursors of Ozone.[3] If per capita factors are used, the agency may employ strict procedures and forms that provide spaces for each of the data elements (the emission factor, the population and the unit conversion factor, if necessary) required for the per capita estimation method.

If the agency has the resources to perform a detailed inventory, it may choose to treat area sources as point sources or perform local surveys to determine activity data. The QA of these estimation methods may include detailed investigation of the data sources, and again, strict procedures for using the data sources.

The agency may use emission factors from sources such as Compilation of Air Pollutant Emission Factors (AP-42)[5] or may decide to use local emission factors for point, area, and nonhighway mobile sources. The choice can depend on the availability of data and resources to compute local emission factors. (Agencies must use MOBILE4 for emission factors for highway mobile sources.) The agency must identify the procedures it will use to ensure that the emission factors it will employ are sound and that the deployment of those procedures are consistent (i.e., how will the agency QA and QC the emission factors it

will use). If, for example, the agency users local emission factors, the agency may compare the factors with published ones from AP-42[5] for reasonableness or may compare the results from using the emission factors with known emission published elsewhere. If its local factors fall outside of a certain percentage of the national factors from AP-42,[5] the local factors will be submitted to EPA with supporting documentation for approval.

4.3.5 Calculations

As mentioned earlier, the agency's QA plan should discuss training for all personnel involved in developing the inventory. This includes providing information on the types of calculations to be used for each estimation method (per capita, production, throughput, etc.) and the format and equations to be used.

In the QA plan, the agency should identify how it will ensure the following: (1) that the equations used within each method or procedure are the same; (2) that all assumptions and engineering judgments used in the calculations are documented and reviewed; (3) that units and unit conversions are checked; (4) that calculations are reviewed for possible transposition of digits, entering of incorrect numbers in calculators or computers, or misinterpretation of either the emission factors or the instructions for their use; and (5) that forms for recording calculations are consistent (for example, for all vehicle classes in the mobile source inventory). The QA plan should identify who will perform this duty. The agency might decide that this individual should be independent of the inventory process.

One way to ensure quality for this part of the inventory is to spot check calculations. A certain percent, for example five percent, of all calculations should be recalculated and checked for errors. In actuality, the frequency of these checks will depend on staff experience, size of the staff, size of the inventory, etc. Another way to ensure the quality of the calculations is to record all assumptions and engineering judgments used in the calculations in a project notebook. The notebooks should contain all of the calculations used to develop the inventory and should contain the references for the data sources. If the data are calculated using computers, a hard copy of the source code for

all calculations and all input files should also be maintained in the project notebook (and described in the QA plan).

The use of a computerized system for calculations, such as EPA's SIP Air Emissions Inventory Management System (the SAM System) can be advantageous to the agency in its QA process. This and other PC programs can be generated to assist in inventory submittal tracking, edit checking, and data and calculation review.

4.3.6 Validation Procedures

Data validation includes quality checks such as those for completeness and internal data consistency. Quality checks should be designed into the inventory and should be documented in the inventory submittal. The data checks are divided into manual checks and computerized or mechanized checks. In the QA plan, the agency should discuss the specific validation steps that it will undertake.

Completeness includes checks to ensure that all emission sources have been represented in the inventory. Some of these checks can be performed manually while others can be performed by computers. Manual checks may include comparing the agency's list of area sources with the area source categories shown in Table A-2. Point sources can be checked against those categories shown in Table A-1 or can be compared with previous inventories (i.e., the 1985 NAPAP inventory) and independent listings by source category (local business directories) to ensure that all of the major sources in the MSA/CMSA are included.

Checks for data consistency should be implemented by the agency. To ensure consistency in the inventory, the agency must address issues such as: (1) is the same geographic area used for all major source categories as well as individual categories; (2) are only reactive VOC counted in the inventory; (3) has double-counting of some general source categories been taken into consideration; and (4) has the use of emission factors, units of measurement, populations of vehicles, year(s) of data and information, and apportioning and distribution techniques been consistent. The agency's plan for implementing these checks should be included in the QA plan.

The agency should use methods described in Procedures for the Preparation of Emission Inventories for Precursors of Ozone[3] to ensure that only reactive VOC are reported in the inventory. (For most categories, AP-42[5] includes emission factors for methane and nonmethane VOC.) Section 2.2.11 of Procedures for the Preparation of Emission Inventories for Precursors of Ozone[3] lists those compounds considered to be nonreactive hydrocarbons.

To ensure that double-counting does not occur in the inventory, the agency should identify those industries, for example, dry cleaning, included in its point source inventory that emit less than 100 tons per year VOC and subtract those emissions from the area source emission estimates where appropriate.

Data used in the inventory and estimates calculated in the inventory should be checked for reasonableness. Reasonableness checks can be employed on several levels. Individual data elements and emission estimates can be checked to make sure that the values fall within reasonable or acceptable ranges. Much of this effort can be done by computerized checks. In addition, the computer can check for internal consistency. Rudimentary edit checks will be built into the SAM System and will be provided to the agencies for their use. (These edit checks will initially consist mainly of range checks, etc.)

The EPA report Guidelines for Review of Highway Source Emission Inventories for 1982 SIPs[6] provides both information on reasonable data ranges and worksheets useful in reviewing the mobile source inventory for reliability. (The range checks in this document are only good for the travel data; any range checks in this document for temperature or emissions are out of date.) Source category emissions can be cross-referenced with other emission inventories. VMT data can be checked against data found in Highway Statistics[7] (for data at the State level only).

The inventory should also be checked to ensure that it meets its stated objectives and requirements. Appendix B of the EPA document entitled Emission Inventory Requirements for Post-1987 Ozone State Implementation Plans[1] includes a checklist of information to be reported by the State which will be used by EPA when reviewing the SIPs. The agency's QA plan should explain how it plans to verify the information that is to be reported by the State.

Once the data are in the inventory format, individual data elements can be checked for incomplete or missing data, implausible data, etc. Examples of

these procedures include checking for correspondence of units listed and SCC listed, checking control equipment codes against the process (SCC) to ensure that there is a proper fit and checking operating schedule ranges.

4.4 DATA HANDLING

Data handling includes all the aspects of following the data through the inventory. These aspects include: coding and recording the data; data tracking; correcting data and handling corrected data; checking data after they have been converted to the inventory format; dealing with missing data; and reviewing the estimates.

4.4.1 Data Coding and Recording

To ensure an inventory of high quality and to decrease confusion, data should be coded and recorded in a consistent manner. In its QA plan, the agency should discuss how the data are going to be coded and recorded consistently and how it plans to verify these procedures. To accomplish the consistent coding and recording, the agency can develop specific formats and coding forms for inventory personnel to use. Spot checking of coding forms for missing or incomplete data may be employed here. Once the data are in the specified format, the agency should have procedures to ensure that this recorded information is complete. Elements found in the discussion under data validation can be useful in this.

4.4.2 Data Tracking

During the development of the inventory, the sources of the data and equations should be tracked. The agency should discuss the procedures it will use to track the data throughout the inventory and how it will verify that the data are being tracked.

One method the agency may use to track data is to have all personnel working on the inventory keep notebooks, using a consistent format for recording emission estimates, calculations and associated individual data for

all emission sources. Calculations performed for the inventory, as well as other pertinent notes and references, can be recorded in the notebooks. Notebooks can be checked at specified intervals for QC of the tracking process.

If the agency uses spreadsheets, data tracking may involve maintaining diskettes. The data should be backed-up. Regardless of the method of data tracking, the agency should have procedures for identifying the location of the raw data, the calculations, and the references.

The data tracking effort should encompass the tracking of the original data as well as corrections and additions to the data. The QA of the raw data is expected to uncover errors in the data. As these data are corrected or found to be missing, the agency should have procedures in place to keep track of the source of the new data, the day the new data were put into the inventory and the person responsible for the change. One method for tracking data is the QA notebook; a separate notebook may be kept to follow the corrected data or audit trail. A discussion of the audit trail procedure should be included in the QA plan. It should include a discussion of the location and contents of the notebook and procedures for ensuring that corrected data are entered in the notebook. The audit trail could be a computer program that checks old values against new values and records the necessary data surrounding the change in a separate file.

4.4.3 Correcting Data

As has been mentioned earlier, the agency should have specific procedures for correcting data and for handling the corrected data. The QA plan should outline these procedures and how it will ensure that the procedures are being carried out. For example, information regarding the data items that have been corrected may be recorded in an audit trail notebook. Periodic checking of project notebooks against the audit trail notebook may help ensure that the procedure is being implemented.

4.4.4 Missing Data

As part of its QA plan, the agency should have procedures in place for dealing with missing data elements. The agency should identify how it will discover if data are missing and how it will assign estimates for missing data on a consistent and documented basis.

Missing data elements in the coded and recorded data can be identified through internal data checks using the computer. These checks can be implemented at periodic intervals, and the audit trail notebook can be used for recording both the identification of the problem and the documentation of the resolution. The audit trail notebook can be the resource material for assuring that estimates are assigned on a consistent and documented basis.

4.4.5 Review of Estimates

The emission estimates should be reviewed for quality and identification of outliers. The agency should discuss how it plans to estimate the quality of the inventory in the QA plan and how it will reexamine values that are outliers. It may assign values of confidence (for example, low, medium, high) to data sources, estimation methods, and emission factors, and may decide to assign confidence levels to portions of the inventory.

The agency may wish to choose certain data quality indicators for its inventory. The selection and use of data quality indicators may have great significance to modeling, strategy development, and other activities which will use the inventory data. For agencies with sufficient resources, the results of the validity and edit checks can be summarized for data users outside the inventory work group, and data quality indicators may go beyond this to include representativeness, bias, and error bounds or confidence intervals.

It should be noted that simply because the estimate is an outlier, i.e., it does not fall within the expected range, it is not necessarily in error. If the agency is confident in the data elements used to calculate the estimate, the estimate need not be changed. Outlier estimates may be recalculated and the elements and procedures involved in the calculations may be reviewed. If

the agency has confidence in the data or does not have the resources to use another estimation method, the outlier estimate may remain as it is.

4.5 DATA REPORTING

Data reporting formats have been proposed for the post-1987 ozone SIP emission inventories and are shown in Figures A-1 and A-2 in Appendix A. Consistency in adhering to these formats will facilitate QA of the data. The agency should include a discussion in its QA plan regarding the reporting format it will use and how it plans to use QA and QC procedures to ensure that the data will be in the required format.

5.0 SYSTEM AUDITS

5.1 INTRODUCTION

In general, this segment of a QA plan outlines the procedures for agency management and/or EPA to follow in reviewing the effectiveness of the program. System audits can be both internal (agency audits) and external (EPA audits).

5.2 INTERNAL AUDITS

An internal audit, while not required, is a process that the agency may choose to do. In an internal audit, a periodic and complete review of the QA system is performed to maintain the inventory. The auditor examines QA procedures and their effectiveness, assesses technical and personnel resources, and takes steps to tune the QA process accordingly. The documentation of the audit specifies the records and procedures that will be reviewed and the frequency of review. It provides guidelines for management report format that can be used to compare audit results over time. The system audit is important because it can flag procedures that are not cost-effective, or, on the other hand, it can indicate the need for more procedures to improve data quality. By employing self-auditing procedures, the agency can determine errors at an early stage and minimize costs to correct them.

5.2 EXTERNAL AUDITS

The agency's QA plan provides a basis for EPA's external audit of the SIP inventories. For the purposes of the SIP inventories, an audit of the agency's QA plan will be performed by EPA. The agency need only acknowledge that its QA plan may be audited by EPA (EPA may conduct an on-site audit) and that it may be called upon to update its program. Provisions for this external audit should be included in the agency's QA plan.

6.0 REFERENCES

1. Emission Inventory Requirements for Post-1987 Ozone State Implementation Plans, EPA-450/4-88-019, U.S. Environmental Protection Agency, Research Triangle Park, NC, December 1988.

2. Emission Inventory Requirements for Post-1987 Carbon Monoxide State Implementation Plans, EPA-450/4-88-020, U.S. Environmental Protection Agency, Research Triangle Park, NC, December 1988.

3. Procedures for the Preparation of Emission Inventories for Precursors of Ozone, EPA-450/4-88-021, U.S. Environmental Protection Agency, Research Triangle Park, NC, December 1988.

4. Procedures for Emission Inventory Preparation, Volume IV: Mobile Source, EPA-450/4-81-026d, U.S. Environmental Protection Agency, Research Triangle Park, NC, September 1981. (Revisions currently underway.)

5. Compilation of Air Pollutant Emission Factors, Fourth Edition and Supplements, AP-42, U.S. Environmental Protection Agency, Research Triangle Park, NC, September 1985.

6. Guidelines for Review of Highway Source Emission Inventories for 1982 SIPs, EPA-400/12-80-002, U.S. Environmental Protection Agency, Washington, DC, December 1980.

7. Highway Statistics, U.S. Department of Transportation, Federal Highway Administration, Washington, DC. Annual publication.

APPENDIX A

TABLE A-1. INDIVIDUAL SOURCE SUMMARY[a]

STORAGE, TRANSPORTATION AND MARKETING OF PETROLEUM PRODUCTS AND VOLATILE ORGANIC LIQUIDS

1. Oil and Gas Production
   - Detailed emissions from well head to load-out, including process sources, storage, fugitive and handling

2. Petroleum Product and Crude Oil Storage
   - Fixed Roof Tanks
   - External Floating Roof Tanks
     - Primary Seals
     - Secondary Seals
   - Internal Floating Roof Tanks
   - Leaks from Valves, Flanges Meters, Pumps

3. Bulk Terminals
   - Fixed Roof Tanks
   - External Floating Roof Tanks
     - Primary Seals
     - Secondary Seals
   - Internal Floating Roof Tanks
   - Leaks from Valves, Flanges Meters, Pumps
   - Vapor Collection Losses
   - Filling Losses from Uncontrolled Loading Racks
   - Tank Truck Vapor Leaks from Loading of Gasoline
   - Non-Tank Farm Storage

4. Bulk Plants
   - Fixed Roof Tanks
   - External Floating Roof Tanks
     - Primary Seals
     - Secondary Seals
   - Internal Floating Roof Tanks
   - Loading and Unloading Racks
   - Tank Truck Vapor Leaks
   - Leaks from Valves, Flanges Meters, Pumps

5. Volatile Organic Liquid Storage and Transfer
   - Fixed Roof Tanks
   - External Floating Roof Tanks
     - Primary Seals
     - Secondary Seals
   - Internal Floating Roof Tanks
   - Loading and Unloading Racks
   - Tank Truck Vapor Leaks
   - Leaks from Valves, Flanges Meters, Pumps

TABLE A-1. INDIVIDUAL SOURCE SUMMARY (Continued)

STORAGE, TRANSPORTATION AND MARKETING OF PETROLEUM PRODUCTS AND VOLATILE ORGANIC LIQUIDS (Continued)

6. Vessels
   - Petroleum Products and VOL Loading - Barge
   - Petroleum Products and VOL Loading - Tanker
   - Crude Oil Ballasting - Tanker

7. Barge, Tanker, Tank Truck and Rail Car Cleaning

8. Barges, Tankers, Tank Trucks and Rail Cars in Transit

9. Service Station Loading (Stage I)

10. Service Station Loading (Stage II)

11. Formulation and Packing VOL for Market

12. Local Storage (airports, industries that use fuels, solvents and reactants in their operation).

INDUSTRIAL PROCESSES

1. Petroleum Refineries
   - Process Drains ans Wastewater Separators
   - Vacuum Producing Systems
   - Process Unit Turnarounds
   - Fugitive Leaks from Seals, Valves, Flanges, Pressure Relief Devices and Drains
   - Petroleum Coking
   - Cooling Towers
   - Secondary Losses (Wastewater - Solid Waste)
   - Other Process Emissions such as Heaters, Boilers, Catalytic Cracker Regenerators (specify)

2. Natural Gas and Petroleum Product Processing

3. Lube Oil Manufacture

4. Organic Chemical Manufacture
   - Fugitive Leaks from Seals, Valves, Flanges, Pressure Relief Devices and Drains
   - Air Oxidation Units
   - Storage and Transfer
   - Wastewater Separators
   - Handling
   - Secondary Losses (Wastewater - Solid Waste)
   - Other Process Units (specify)

TABLE A-1. INDIVIDUAL SOURCE SUMMARY (Continued)

INDUSTRIAL PROCESSES (Continued)

5. Inorganic Chemical Manufacture
   - Fugitive Leaks from Seals, Valves, Flanges, Pressure Relief Devices and Drains
   - Storage and Transfer
   - Clean Up
   - Secondary Losses (Wastewater - Solid Waste)
   - Other Process Units (specify)

6. Iron & Steel Production
   - Sintering
   - Electric Arc Furnaces
   - Other Process Units (specify)
   - Secondary Losses (Wastewater - Solid Waste)

7. Coke Production
   - Coke Pushing
   - Coke Oven Doors
   - Coke Charging
   - Coke Preheater
   - Topside Leaks
   - Quenching
   - Battery Stacks
   - Secondary Losses (Wastewater - Solid Waste)

8. Coke By-Product Plants
   - Collection Leaks
   - Primary Cooler
   - Ammonia Stills
   - Light Oil Scrubbers
   - Tar Precipitators
   - BTX Stills
   - Tar Decanters
   - Secondary Losses (Wastewater - Solid Waste)
   - Other Unit Operations (specify)

9. Synthetic Fiber Manufacture
   - Dope Preparation
   - Filtration
   - Fiber Extrusion - Solvent Recovery
   - Takeup Stretching, Washing, Drying, Crimping, Finishing
   - Fiber Storage - Residual Solvent Evaporation
   - Equipment Leakage
   - Solvent Storage
   - Secondary Losses (Wastewater - Solid Waste)
   - Other Process Units (specify)

TABLE A-1. INDIVIDUAL SOURCE SUMMARY (Continued)

INDUSTRIAL PROCESSES (Continued)

10. Polymers and Resins Manufacture
    - Catalyst Preparation
    - Reactor Vents
    - Separation of Reactants, Solvents, Diluents from Product
    - Raw Material Storage
    - Solvent Storage
    - Handling
    - Equipment Leakage
    - Secondary Losses (Wastewater - Solid Waste)
    - Other Process Units (specify)

11. Plastic Products Manufacture
    - Mold Release
    - Solvent Consumption
    - Adhesive Consumption
    - Adhesives Preparation
    - Fiber Storage - Residual Solvent Evaporation
    - Secondary Losses (Wastewater - Solid Waste)
    - Other Process Units (specify)

12. Fermentation Processes
    - Fermentation Tank Venting
    - Aging (Wine or Whiskey)
    - Drying/Conditioning Used Grain
    - Bottling
    - Clean Up
    - Secondary Losses (Wastewater - Solid Waste)
    - Other Process Units (specify)

13. Vegitable Oil Processing
    - Oil Extraction and Desolventation
    - Meal Preparation
    - Oil Refining
    - Fugitive Leaks
    - Solvent Storage
    - Secondary Losses (Wastewater - Solid Waste)
    - Other Process Units (specify)

14. Pharmaceutical Manufacturing
    - Process Units such as Vacuum Dryers, Reactors, Distillation Units, Filters, Extractors, Centrifuges, Crystallizers
    - Major Production Equipment such as Exhaust Systems and Air Dryers
    - Storage and Transfer
    - Fugitive Leaks
    - Packaging
    - Secondary Losses (Wastewater - Solid Waste)
    - Other Process Units (specify)

TABLE A-1. INDIVIDUAL SOURCE SUMMARY (Continued)

INDUSTRIAL PROCESSES (Continued)

15. Rubber Tire Manufacture
    - Undertread and Sidewall Cementing
    - Bead Dipping
    - Bead Swabbing
    - Tire Building
    - Tread End Cementing
    - Green Tire Spraying
    - Tire Curing
    - Solvent Mixing
    - Solvent Storage
    - Retreaders
    - Secondary Losses (Wastewater - Solid Waste)
    - Other Process Units (specify)

16. SBR Rubber Manufacture
    - Blowdown Tanks
    - Steam Stripper
    - Prestorage Tanks
    - Secondary Losses (Wastewater - Solid Waste)
    - Other Process Units (specify)

17. Ammonia Production
    - Desulfurization Unit Generation
    - Primary Reformer, Heater Fuel Combustion
    - Carbon Dioxide Regenerator
    - Condensate Steam Stripper

18. Carbon Black Manufacture
    - Main Process Vent
    - Flare
    - CO Boiler
    - Solid Waste Generator

19. Phthalic Anhydride Production
    - Oxidation of o-Xylene
      - Main Process Stream
      - Pretreatment
      - Distillation
    - Oxidation of Naphthalene
      - Main Process Stream
      - Pretreatment
      - Distillation

TABLE A-1. INDIVIDUAL SOURCE SUMMARY (Continued)

INDUSTRIAL PROCESSES (Continued)

20. Terephthalic Acid Production
    - Reactor Vent
    - Crystallization, Separation, Drying
    - Distillation and Recovery
    - Product Transfer

21. Maleic Anhydride Production
    - Storage
    - Fugitive Leaks
    - Other Process Units (specify)

22. Pulp and Paper Mills

23. Primary and Secondary Metals Production

24. Plywood, Particle Board, Pulp Board, Chip or Flake Wood Board

25. Charcoal Production

26. Carbon Electrode and Graphite Production

27. Paint, Varnish and Other Coatings Production

28. Adhesives Production

29. Printing Ink Manufacture

30. Scrap Metals Clean Up

31. Adipic Acid Proction

32. Coffee Roasting

33. Grain Elevators (fumigation)

34. Meat Smokehouses

35. Asphalt Roofing Manufacture

36. Bakeries

37. Fabric, Thread and Fiber Dying and Finishing

38. Glass Fiber Manufacture

39. Glass Manufacture

TABLE A-1. INDIVIDUAL SOURCE SUMMARY (Continued)

INDUSTRIAL PROCESSES (Continued)

40. Soaps, Detergents and Cleaning Agents Manufacturing, Formulation and Packaging

41. Food and Animal Feedstuff Processing and Preparation

42. Bricks and Related Clays

INDUSTRIAL SURFACE COATING

1. Large Appliances
   - Cleaning and Pretreatment
   - Prime Spray, Flow or Dip Coating Operations
   - Topcoat Spray
   - Coating Mixing
   - Coating and Solvent Storage
   - Equipment Clean Up
   - Other Process Units (specify)

2. Magnet Wire
   - Cleaning and Pretreatment
   - Coating Applications and Curing
   - Coating Mixing
   - Coating and Solvent Storage
   - Equipment Clean Up
   - Other Process Units (specify)

3. Autos and Light Trucks
   - Cleaning and Pretreatment
   - Prime Application, Electrodeposition, Dip or Spray
   - Prime Surface Operations
   - Topcoat Operation
   - Repair Topcoat Application Area
   - Coating Mixing
   - Coating and Solvent Storage
   - Equipment Clean Up
   - Other Process Units (specify)

4. Cans
   - Cleaning and Pretreatment
   - Two Piece and Exterior Base Coating
   - Interior Spray Coating
   - Sheet Basecoating (Interior)
   - Sheet Basecoating (Exterior)
   - Side Seam Spray Coating
   - End Sealing Compound
   - Lithography
   - Overvarnish
   - Coating Mixing
   - Coating and Solvent Storage
   - Equipment Clean Up

TABLE A-1. INDIVIDUAL SOURCE SUMMARY (Continued)

INDUSTRIAL SURFACE COATING (Continued)

5. Metal Coils
   - Prime Coating
   - Finish Coating
   - Coating Mixing
   - Coating and Solvent Storage
   - Equipment Clean Up
   - Other Process Units (specify)

6. Paper/Fabric
   - Coating Operations
   - Coating Mixing
   - Coating and Solvent Storage
   - Equipment Clean Up
   - Other Process Units (specify)

7. Wood Furniture
   - Coating Operations
   - Coating Mixing
   - Coating and Solvent Storage
   - Equipment Clean Up
   - Other Process Units (specify)

8. Metal Furniture
   - Cleaning and Pretreatment
   - Coating Operations
   - Coating Mixing
   - Coating and Solvent Storage
   - Equipment Clean Up
   - Other Process Units (specify)

9. Miscellaneous Metal Parts and Products
   - Cleaning and Pretreatment
   - Coating Operations, Flow, Dip, Spray
   - Coating Mixing
   - Coating and Solvent Storage
   - Equipment Clean Up
   - Other Process Units (specify)

10. Flatwood Products
    - Filler
    - Sealer
    - Basecoat
    - Topcoat
    - Inks
    - Coating Mixing
    - Coating and Solvent Storage
    - Equipment Clean Up
    - Other Process Units (specify)

TABLE A-1. INDIVIDUAL SOURCE SUMMARY (Continued)

INDUSTRIAL SURFACE COATING (Continued)

11. Plastic Products
    - Cleaning and Pretreatment
    - Coating Operations, Flow, Dip, Spray
    - Coating Mixing
    - Coating and Solvent Storage
    - Equipment Clean Up
    - Other Process Units (specify)

12. Large Ships
    - Cleaning and Pretreatment
    - Prime Coat Operation
    - Top Coat Operation
    - Coating Mixing
    - Coating and Solvent Storage
    - Equipment Clean Up
    - Other Process Units (specify)

13. Large Aircraft
    - Cleaning and Pretreatment
    - Prime Coat Operation
    - Top Coat Operation
    - Coating Mixing
    - Coating and Solvent Storage
    - Equipment Clean Up
    - Other Process Units (specify)

NONINDUSTRIAL SURFACE COATING

1. Architectural Coatings

2. Auto Refinishing

OTHER SOLVENT USE

1. Degreasing
    - Cold cleaning
    - Vapor Degreasing
    - Conveyorized Degreasing

2. Dry Cleaning
    - Perchloroethylene
    - Petroleum Solvents

TABLE A-1. INDIVIDUAL SOURCE SUMMARY (Continued)

OTHER SOLVENT USE (Continued)

3. Graphic Arts
   - Letterpress
   - Rotogravure
   - Offset Lithography
   - Ink Mixing
   - Solvent Storage
   - Flexography
   - Equipment Clean Up

4. Adhesives
   - Adhesive Application
   - Solvent Mixing
   - Solvent Storage
   - Packaging
   - Equipment Clean Up
   - Other Process Units (specify)

5. Solvent Extraction Processes

6. Cutback Asphalt

7. Consumer/Commercial Solvent Use
   - Paints, Primers, Varnishes
   - Hair Sprays
   - All Purpose Cleaners
   - Insect Sprays
   - Car Polishes and Waxes
   - Room Deodorants and Disinfectants
   - Window and Glass Cleaners
   - Caulking and Sealing Compounds
   - Moth Control Products
   - Herbicides, Fungicides
   - Carburetor and Choke Cleaners
   - Auto Antifreeze
   - Personal Deodorants
   - Brake Cleaners
   - Adhesives (Consumer)
   - Engine Starting Fluids
   - Lubricants and Silicones
   - Engine Degreasers
   - Metal Cleaners and Polishes
   - Rug and Upholstery Cleaners

8. Asphalt Roofing Kettles

9. Pesticide Application

TABLE A-1. INDIVIDUAL SOURCE SUMMARY (Continued)

EXTERNAL COMBUSTION SOURCES

1. Industrial Fuel Combustion

2. Coal Cleaning
   - Fluidized Bed
   - Flash
   - Multilouvered

3. Electrical Generation

4. Commercial/Institutional Fuel Combustion

5. Residential Fuel Combustion

6. Resource Recovery Facilities

7. Solid Waste Disposal
   - On-Site Incineration
   - Open Burning
   - Prescribed Burning
   - Structural Fires
   - Wildfires

8. Recycle/Recovery (Primary Metals)
   - Auto Body Incineration
   - Drum Cleaning

9. Sewage Sludge Incinerators

STATIONARY INTERNAL COMBUSTION

1. Reciprocation Engines

2. Gas Turbines

WASTE DISPOSAL

1. Publicly Owned Treatment Works

2. Industrial Wastewater Treatment

3. Municipal Landfills

TABLE A-1. INDIVIDUAL SOURCE SUMMARY (Continued)

WASTE DISPOSAL (Continued)

4. Hazardous Waste Treatment, Storage and Disposal Facilities
   - Landills
   - Landfarms
   - Surface Impoundments
   - Storage
   - Incinerators
   - Leaking Undergroud Storage Tanks
   - Wastepiles

MOBILE SOURCES

1. Highway Vehicles
   - Light Duty Autos
   - Light Duty Trucks
   - Heavy Duty Autos
   - Heavy Duty Gasoline Trucks
   - Heavy Duty Diesel Trucks
   - Motorcycles

2. NonHighway Vehicles
   - Railroad Locomotives
   - Aircraft
     - Military
     - Civil
     - Commercial
   - Vessels
   - Motorboats
   - Off-Highway Motorcycles
   - Construction Equipment
   - Industrial Equipment
   - Farm Equipment
   - Lawn and Garden Equipment
   - Snowmobiles
   - Orchard Heaters

---

[a] Pollutants in each source category are shown in Table A-2.

TABLE A-2. VOC, CO AND NO_x EMISSION SOURCES

SOURCES OF EMISSIONS	POLLUTANTS		
	VOC	CO	NO_x
Storage, Transportation, and Marketing of Petroleum Products and Volatile Organic Liquids			
Oil and Gas Production	X		
Petroleum Product and Crude Oil Storage	X		
Bulk Terminals	X		
Bulk Plants	X		
Volatile Organic Liquid Storage and Transfer	X		
Vessels	X		
Barge, Tanker, Tank Truck and Rail Car Cleaning	X		
Barges, Tankers, Tank Trucks and Rail Cars in Transit	X		
Service Station Loading (Stage I)	X		
Service Station Loading (Stage II)	X		
Formulation and Packing VOL for Market	X		
Local Storage (airports, industries that use fuels, solvents and reactants in their operation).	X		
Industrial Processes			
Petroleum Refineries	X	X	X
Natural Gas and Petroleum Product Processing	X	X	X
Lube Oil Manufacture	X	X	X
Organic Chemical Manufacture	X	X	X
Inorganic Chemical Manufacture	X	X	X
Iron & Steel Production	X	X	X
Coke Production	X	X	X
Coke By-Product Plants	X	X	X
Synthetic Fiber Manufacture	X		
Polymers and Resins Manufacture	X		
Plastic Products Manufacture	X		
Fermentation Processes	X		
Vegitable Oil Processing	X		
Pharmaceutical Manufacturing	X		
Rubber Tire Manufacture	X		
SBR Rubber Manufacture	X		
Ammonia Production	X		
Carbon Black Manufacture	X	X	X
Phthalic Anhydride Production	X		
Terephthalic Acid Production	X		
Maleic Anhydride Production	X		

TABLE A-2. VOC, CO AND NO_x EMISSION SOURCES (Continued)

SOURCES OF EMISSIONS	POLLUTANTS		
	VOC	CO	NO_x
Industrial Processes (Continued)			
Pulp and Paper Mills	X	X	X
Primary and Secondary Metals Production	X	X	X
Plywood, Particle Board, Pulp Board, Chip or Flake Wood Board	X		
Charcoal Production	X	X	X
Carbon Electrode and Graphite Production	X		
Paint, Varnish and Other Coatings Production	X		
Adhesives Production	X		
Printing Ink Manufacture	X		
Scrap Metals Clean Up	X		
Adipic Acid Proction	X		X
Coffee Roasting	X		X
Grain Elevators (fumigation)	X		
Meat Smokehouses	X	X	X
Asphalt Roofing Manufacture	X	X	X
Bakeries	X		
Fabric, Thread and Fiber Dying and Finishing	X		
Glass Fiber Manufacture	X		
Glass Manufacture	X	X	X
Soaps, Detergents and Cleaning Agents Manufacturing, Formulation and Packaging	X		
Food and Animal Feedstuff Processing and Preparation	X		
Bricks and Related Clays		X	X
Industrial Surface Coating			
	X		
Large Appliances	X		
Magnet Wire	X		
Autos and Light Trucks	X		
Cans	X		
Metal Coils	X		
Paper/Fabric	X		
Wood Furniture	X		
Metal Furniture	X		
Miscellaneous Metal Parts and Products	X		
Flatwood Products	X		
Plastic Products	X		
Large Ships	X		
Large Aircraft	X		

TABLE A-2. VOC, CO AND NO_x EMISSION SOURCES (Continued)

SOURCES OF EMISSIONS	POLLUTANTS		
	VOC	CO	NO_x
Nonindustrial Surface Coating			
Architectural Coatings	X		
Auto Refinishing	X		
Other Solvent Use			
Degreasing[a]	X		
Dry Cleaning	X		
Graphic Arts	X		
Adhesives	X		
Solvent Extraction Processes	X		
Cutback Asphalt	X		
Consumer/Commercial Solvent Use	X		
Asphalt Roofing Kettles	X	X	X
Pesticide Application	X		
External Combustion Sources[a]			
Industrial Fuel Combustion	X	X	X
Coal Cleaning	X		X
Electrical Generation	X	X	X
Commercial/Institutional Fuel Combustion	X	X	X
Residential Fuel Combustion	X	X	X
Resource Recovery Facilities	X	X	X
Solid Waste Disposal	X	X	X
Recycle/Recovery (Primary Metals)	X	X	X
Sewage Sludge Incinerators	X	X	X
Stationary Internal Combustion[a]			
Reciprocating Engines	X	X	X
Gas Turbines	X	X	X
Waste Disposal			
Publicly Owned Treatment Works	X		
Industrial Wastewater Treatment	X		
Municipal Landfills	X		
Hazardous Waste Treatment, Storage and Disposal Facilities	X		

TABLE A-2. VOC, CO AND NO_x EMISSION SOURCES (Continued)

SOURCES OF EMISSIONS	POLLUTANTS		
	VOC	CO	NO_x
Mobile Sources			
Highway Vehicles	X	X	X
Nonhighway Vehicles	X	X	X

[a] Emissions from these sources may occur from source categories identified elsewhere in Table 2.2-1. For example, carbon monoxide and oxides of nitrogen are emitted from industrial boilers at organic and inorganic manufacturing facilities. Likewise, carbon monoxide and oxides of nitrogen are emitted from reciprocating engines at oil and gas production facilities, and volatile organic compounds are emitted from many industries involved in degreasing operations. An effort should be made to avoid double counting from these sources.

Figure A-1.

Plant Information

Pollutant (VOC, NOx):	Plant Name:	Base Year (1987 or 1988):
NEDS ID (State, County, Plant):	Street Address, City, State:	Projected Attainment Year:
-- ---- ----		
Model Area (County, Township, or Grid Code):	SIC Code(s):[2]	Total Banked Emissions (tons/yr):

Base Year Point Information

NEDS Point ID	Process Description	Operating Schedule[3] (hr/dy)	(dy/wk)	(wk/yr)	Applicable Regulation	Emission Limitation	Compliance Year	CTG Category (I,II,III)

Base Year Segment Information

NEDS Point ID	SCC[4]	Process Rate Units[5]	Process Rate[6] (/day)	Control Equipment[7]	Control Efficiency (%)	Emission Estimation Method[8]	Emission Factor (lb/process rate unit)	Rule Effectiveness (%)	03 Season Emissions (lbs/day)	Banked Emissions (tons/yr)
	- - - -									
	- - - -									
	- - - -									
	- - - -									
	- - - -									
	- - - -									
	- - - -									
	- - - -									
	- - - -									
	- - - -									

Emissions Information for Individual Processes Within A Point Source Facility

Figure A-1. (cont.)

Projection Year Information

Projection Year ____

Point ID	SCC[4]	Control Equipment[7]	Control Efficiency (%)	Growth Factor[7]	Projected Baseline Emissions (lbs/day)	Applicable Regulation	Emission Limitation	Compliance Year	Rule Effectiveness (%)	Projected SIP Strategy Emissions[11] (lbs/day)

Projection Year ____

Point ID	SCC[4]	Control Equipment[7]	Control Efficiency (%)	Growth Factor[7]	Projected Baseline Emissions (lbs/day)	Applicable Regulation	Emission Limitation	Compliance Year	Rule Effectiveness (%)	Projected SIP Strategy Emissions[11] (lbs/day)

Projection Year ____

Point ID	SCC[4]	Control Equipment[7]	Control Efficiency (%)	Growth Factor[7]	Projected Baseline Emissions (lbs/day)	Applicable Regulation	Emission Limitation	Compliance Year	Rule Effectiveness (%)	Projected SIP Strategy Emissions[11] (lbs/day)

Emissions Information for Individual Processes Within A Point Source Facility (cont)

Figure A-2.

Summary Table Of VOC Emissions For _____
(County or Equivalent)

(tons per day)[1]

	Applicable Regulation[2]	Base Year (specify year)		Base Line Projection (specify year)		Revised SIP Strategy Projection (specify year)	
		Point	Area	Point	Area	Point	Area
Storage, Transportation And Marketing Of VOC							
Oil and Gas Production							
Natural Gas and Gasoline Processing							
Other Petroleum Processing							
Gasoline and Crude Oil Storage[3]							
All (except floating roof)							
Floating Roof							
Volatile Organic Liquid Storage							
VOL - Transfer							
Ship and Barge							
Other							
Barge and Tanker Cleaning							
Bulk Gasoline Terminals[4]							
Gasoline Bulk Plants[5]							
Service Station Loading (Stage I)							
Service Station Unloading (Stage II)							
Gasoline Tank Trucks							
Others (specify)							
Industrial Processes							
Petroleum Refineries							
Vacuum Systems							
Fugitive							
Other							
Lube Oil Manufacture							

1 Typical ozone season weekday
2 List appreviations at end of table with brief explanation, (i.e., I = Group I CTGs - State Reg XX.X; II = Group II CTGs - State Reg. YY.Y, etc.)
3 Includes all storage facilities except those at service stations and bulk plants
4 Emissions from loading tank trucks and rail cars
5 Emissions from storage and transfer operations

Figure A-2. (cont)

Summary Table Of VOC Emissions For _____
(County or Equivalent)

(tons per day)[1]

	Applicable Regulation[2]	Base Year (specify year)		Base Line Projection (specify year)		Revised SIP Strategy Projection (specify year)	
		Point	Area	Point	Area	Point	Area
Organic Chemical Manufacture							
Polyethylene							
Propylene							
Styrene							
Others (specify)							
SOCMI							
Fugitive							
Air Oxidation							
Others (specify)							
Inorganic Chemical Manufacture							
Fermentation Processes							
Vegetable Oil Processing							
Pharmaceutical Manufacture							
Plastic Products Manufacture							
Rubber Tire Manufacture							
SBR Rubber Manufacture							
Textile Polymers and Resin Manufacture							
Synthetic Fiber Manufacture							
Iron and Steel Manufacture							
Coke Ovens							
Others (specify)							
Industrial Surface Coating							
Large Appliances							
Magnet Wire							
Autos and Light Trucks							
Cans							
Metal Coils							
Paper							
Fabric							
Metal and Wood Furniture							
Miscellaneous Metal Products							
Flatwood Products							
Plastic Products							

(continued on next page)

1 Typical ozone season weekday
2 List appreviations at end of table with brief explanation,
(i.e., I = Group I CTGs - State Reg XX.X;
II = Group II CTGs - State Reg. YY.Y, etc.).

Figure A-2. (cont)

Summary Table Of VOC Emissions For _____
(County or Equivalent)

(tons per day)[1]

	Applicable Regulation[2]	Base Year (specify year)		Base Line Projection (specify year)		Revised SIP Strategy Projection (specify year)	
		Point	Area	Point	Area	Point	Area
Large Ships							
Large Aircraft							
Others (specify)							
Non-industrial Surface Coating							
Architectural Coatings							
Auto Refinishing							
Others (specify)							
Other Solvent Use							
Degreasing							
Dry Cleaning							
Perchloroethylene							
Petroleum							
Other							
Graphic Arts							
Adhesives							
Cutback Asphalt							
Solvent Extraction Processes							
Consumer/Commercial Solvent Use							
Others (specify)							
Waste Disposal							
Municipal Waste							
Combustion							
Landfills							
TSDFs							
POTWs							
ITWs							
Industrial Boiler Co-firing							
Others (specify)							

1 Typical ozone season weekday
2 List appreviations at end of table with brief explanation,
(i.e., I = Group I CTGs - State Reg XX.X;
II = Group II CTGs - State Reg. YY.Y, etc.).

Figure A-2. (cont)

Summary Table Of VOC Emissions For _____
(County or Equivalent)

(tons per day)[1]

	Applicable Regulation[2]	Base Year (specify year)		Base Line Projection (specify year)		Revised SIP Strategy Projection (specify year)	
		Point	Area	Point	Area	Point	Area
Other Miscellaneous Sources							
Fuel Combustion							
Forest, Agricultural, and Other Open Burning							
Pesticide Applications							
Stationary Internal Combustion Engines							
Mobile Sources							
Highway Vehicles							
Light Duty Autos							
Light Duty Trucks							
Heavy Duty Gasoline Trucks							
Heavy Duty Diesel Trucks							
Other Highway Vehicles							
Non-highway Vehicles							
Rail							
Aircraft							
Vessels							
Other							
Mobile Sources Total:							
Stationary Sources Total:							
Grand Total For All Sources:							

1 Typical ozone season weekday
2 List appreviations at end of table with brief explanation,
(i.e., I = Group I CTGs - State Reg XX.X;
II = Group II CTGs - State Reg. YY.Y, etc.).

Figure A-2. (cont)

Summary Table For Oxides Of Nitrogen Emissions For _____ (County or Equivalent)

(tons per day)[1]

	Base Year		Base Line Projection		Revised SIP Strategy Projection	
	Point	Area	Point	Area	Point	Area
External Fuel Combustion						
Utility Boilers						
Industrial Boilers						
Commercial, Institutional, Residential						
Other External Fuel Combustion						
Stationary Internal Combustion						
Reciprocating Engines						
Gas Turbines						
Other Combustion						
Waste Disposal						
Open Burning						
Other						
Industrial Processes						
Chemical Manufacturing						
Adipic Acid						
Nitric Acid						
Other						
Iron and Steel						
Mineral Products						
Cement						
Glass						
Other						
Petroleum Refining						
Other						
Mobile Sources						
Highway Vehicles						
Light Duty Autos						
Light Duty Trucks						
Heavy Duty Gasoline Trucks						
Heavy Duty Diesel Trucks						
Other Highway Vehicles						

* Typical ozone season weekday

Figure A-2. (cont)

Summary Table For Oxides Of Nitrogen Emissions For _____ (County or Equivalent)

(tons per day)[1]

	Base Year		Base Line Projection		Revised SIP Strategy Projection	
	Point	Area	Point	Area	Point	Area
Non-highway Vehicles						
Rail						
Aircraft						
Vessels						
Other						
Mobile Sources Total:						
Stationary Sources:						
>250m Effective Stack Height: Subtotal						
Other Stationary Sources: Subtotal						
Grand Total For All Sources:						

* Typical ozone season weekday

Figure A-2. (cont)

Summary Table For Carbon Monoxide Emissions For _____
(County or Equivalent)

(tons per day)[1]

	Base Year		Base Line Projection		Revised SIP Strategy Projection	
	Point	Area	Point	Area	Point	Area
External Fuel Combustion						
Utility Boilers						
Industrial Boilers						
Commercial, Institutional, Residential						
Other External Fuel Combustion						
Stationary Internal Combustion						
Reciprocating Engines						
Gas Turbines						
Other Combustion						
Waste Disposal						
Other						
Industrial Processes						
Chemical Manufacturing						
Iron and Steel						
Mineral Products						
Petroleum Refining						
Other						
Mobile Sources						
Highway Vehicles						
Light Duty Autos						
Light Duty Trucks						
Heavy Duty Gasoline Trucks						
Heavy Duty Diesel Trucks						
Other Highway Vehicles						
Non-highway Vehicles						
Rail						
Aircraft						
Vessels						
Other						

* Typical ozone season weekday

Figure A-2. (cont)

Summary Table For Carbon Monoxide Emissions For _____
(County or Equivalent

(tons per day)[1]

	Base Year		Base Line Projection		Revised SIP Strategy Projection	
	Point	Area	Point	Area	Point	Area
Mobile Sources Total:						
Stationary Sources:						
>250m Effective Stack Height: Subtotal						
Other Stationary Sources: Subtotal						
Grand Total For All Sources:						

[1]Typical ozone season weekday

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO
EPA-450/4-88-023		

4. TITLE AND SUBTITLE	5. REPORT DATE
Guidance For The Preparation Of Quality Assurance Plans For O_3/CO SIP Emission Inventories	December 1988
	6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO.
Sharon Kersteter Rebecca Battye	

9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT NO.
Alliance Technologies Corporation 500 Eastowne Drive Chapel Hill, NC 27514	11. CONTRACT/GRANT NO. 68-02-4396 Work Assignment 3

12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED
U.S. Environmental Protection Agency Office of Air and Radiation Office of Air Quality Planning and Standards Research Triangle Park, NC 27711	Final
	14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

EPA Project Officer: William B. Kuykendal

16. ABSTRACT

This document presents guidance for the preparation of quality assurance (QA) plans by State and local air pollution control agencies required under the post 1987 ozone and carbon monoxide State Implementation Plans. The guidance discusses both required and recommended components for these QA plans. Major topics that are covered are as follows: QA policy statement, QA and the project organization, planning, data collection and analysis, data handling, data reporting, and QA auditing.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Quality Assurance Ozone Carbon Monoxide Emission Inventories State Implementation Plans		

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
Release Unlimited	Not classified	62
	20. SECURITY CLASS *(This page)*	22. PRICE
	Not classified	

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE