Review of the Arkansas Emission Inventory Improvement Effort

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ABSTRACT

MACTEC worked with the Arkansas Department of Environmental Quality (ADEQ) to conduct a complete assessment of their emission inventory program. The assessment included a complete review of the emissions data and structure of the *i*-STEPS database (*i*-STEPS is the program developed by MACTEC for use in building and tracking emissions inventories). Based on the assessment, changes were recommended to the input procedures and database structure. Necessary changes were made and a customized user's manual was prepared to assist ADEQ staff with future inputs.

The on-site assessment of the emission inventory program in Arkansas was initiated by conducting interviews with emission inventory and permitting staff to determine how the emission inventory data are collected and maintained. The forms sent out by the Department to collect emission inventory data, and the methodologies used by the Department to assemble and submit the emission inventory to EPA and develop internal reports were reviewed. The emission inventory forms sent to ADEQ by industry were quality assured and the data in the *i*-STEPS database were audited. Using the knowledge gained in this assessment, procedures were recommended to modify the data collection and input procedures and improve the *i*-STEPS data structure. The recommendations were specifically designed to accommodate the needs of ADEQ and other departments that depend on the quality and availability of the emissions inventory data, while ultimately improving the quality of the Arkansas inventory data for submittal to EPA.

As a final step towards incorporating upgrades to the emission inventory program, a customized user's manual was developed for use by ADEQ staff to assist with adoption of updated data entry procedures.

INTRODUCTION

The Arkansas Department of Environmental Quality (ADEQ) has used MACTEC's *i*-STEPS program to develop annual emissions inventory submittals and track air emissions related data for the State since 2000. Since ADEQ began using the program MACTEC has provided them with support in the following areas:

- Training ADEQ personnel on i-STEPS data entry and functionality,
- Assistance with installing program updates,
- Solving questions or problems related to program operation, and
- Assisting on an as-needed basis with such tasks as compiling the annual emissions inventory for final submittal to EPA.

During this same period, the Planning and Air Quality Analysis Branch (Planning Branch) of ADEQ's Air Division has implemented and maintained a staff of data entry personnel and administrators to develop and maintain emissions inventory, permit, and compliance data for Arkansas air emissions sources. This staff is primarily responsible for:

- Developing and submitting emissions inventory request forms to industry,
- Receiving the emissions inventory responses from industry,
- Inputting emissions inventory data into i-STEPS, and
- Submitting the annual emissions inventory to EPA.

In addition to these tasks, the Planning Branch receives all air permits issued by the Permits Branch. The elements of the air permits including emissions limits are entered into *i*-STEPS for tracking purposes. Facility compliance information is also added to the *i*-STEPS database by Planning Branch personnel. The Planning Branch uses standard *i*-STEPS reports and custom designed reports to supply summary data to other ADEQ divisions as needed.

EMISSIONS INVENTORY PROGRAM REVIEW AND IMPROVEMENTS

In 2004, new management within the Planning Branch were tasked by ADEQ with performing additional quality assurance and control steps to ensure the accuracy of the Arkansas emissions inventory. The additional focus on the quality of the emissions inventory coincided with ADEQ's air quality concerns related to the Crittenden County 8-hour ozone non-attainment area. The Planning Branch contracted with MACTEC to provide on-site support to assist with input and quality assurance of emissions inventory data and to review data gathering and input procedures.

On-site efforts at ADEQ were initiated by meeting with personnel from the Planning Branch to learn how the department organized the flow of point source data from emissions inventory requests, subsequent receipt of data from industry, data input to *i*-STEPS, and emission inventory submission to EPA. Since ADEQ also maintains air permit information and compliance information in *i*-STEPS, MACTEC also interviewed the Permits Branch and Enforcement Branch of ADEQ's Air Division to learn the flow of information to and from *i*-STEPS.

Personnel interviews, examination of *i*-STEPS data, and the hardcopy files maintained by the Planning Branch highlighted some areas that could be improved. Specifically, MACTEC identified the following focus areas specifically related to improving the quality of the emissions inventory:

- Format of emissions inventory data request forms,
- Quality assurance and follow-up of emissions inventory submittals, and
- Emissions inventory data formatting and entry procedures.

Format of Emissions Inventory Data Request Forms

All point source emissions submitted to EPA are assigned to Source Classification Codes (SCCs). The emissions inventory request forms submitted by the Planning Branch to industry did not require emissions to be reported by SCC; therefore, Planning Branch personnel historically used the description of the emissions source from the inventory request form to determine the appropriate SCC for association with emissions from each source. The level of detail concerning source descriptions reported in the emissions inventory was not sufficient to determine the SCC that best described the source. This lack of SCC association by industry also caused problems with throughput reporting. Throughput reporting by industry was found to be intermittent and/or incomplete, often not related to the emissions being reported, and not always associated with any set of units. Efforts by Planning Branch data entry personnel to maintain complete data records for each facility complicated quality assurance of the data since many assumptions had been used to fill in the mandatory data fields for submittal to EPA. MACTEC worked with Planning Branch personnel to improve the emissions inventory request forms to require SCCs and units for each process. Additionally, MACTEC assisted with the development of improved instructions for the new forms. MACTEC also worked with data entry personnel to develop procedures for processing emissions inventories with incomplete data.

Quality Assurance and Follow-up of Emissions Inventory Submittals

Due to the many demands placed on the Planning Branch, emissions inventories completed and returned by industry were not immediately reviewed by Planning Branch engineering personnel upon receipt. Once the time came to process the emissions inventory submittals, data entry personnel were the initial reviewers. Data entry personnel were trained to enter data as reported, but there were few procedures in place to conduct quality assurance of the emissions inventories. As a result, incomplete or incorrect responses from industry were entered into *i*-STEPS. The primary change in processing incomplete responses from industry was to promote follow-up with industry to obtain all the correct information. Changes to the emissions inventory reporting schedule now allow time for review of the emissions inventories upon receipt by Planning Branch engineering staff. As a result, revisions to the data can be requested from industry before problems are encountered during data entry.

Emissions Inventory Data Formatting and Entry Procedures

The Planning Branch is very diligent in maintaining complete air-related emissions, permit, and compliance data in *i*-STEPS. This diligence in maintaining complete records often makes the job of the data entry personnel more difficult when incomplete emissions

inventory records are returned. *i*-STEPS stores facility information in a stratified system where facility information is stored at the top level. Group information (e.g. Boiler #1) is stored under the facility record while process level information (e.g. natural gas combustion) is stored under the group record. Generally, the group level information is defined in the facility permit and consists of one emissions unit for each group. Likewise, process information is defined in the permit as the types of activities performed by each group. When a new facility obtains an air permit in Arkansas, the Planning Branch obtains the air permit and enters the permit into *i*-STEPS to mimic the permit.

This method of entering the air permit into *i*-STEPS is the most efficient way to maintain facility records; however, problems arise if the facility does not report their emissions inventory in the same format. One of the major problems with emissions inventory reporting in Arkansas was that many facilities grouped their emissions units in a way that was inconsistent with the format of their emissions permit. Planning Branch data entry personnel attempted to resolve the grouping by dividing emissions, throughput, and other related information among the appropriate *i*-STEPS groups when entering emissions inventories. Some mathematical errors resulted from this practice, but the primary problem with this method was that the practice is very subjective. Data entry personnel maintained notes to create an audit trail that could be followed, but generally this method of dividing the emissions made quality assurance of the emissions inventory cumbersome.

To correct this problem, MACTEC worked with Planning Branch personnel to modify emissions inventory instructions to industry and require that emissions be reported according to the format of the permit. Additionally, a new *i*-STEPS data entry manual was written and specifically oriented to ADEQ's Planning Branch data maintenance and reporting procedures.

IMPROVEMENT OF THE 2002 EMISSIONS INVENTORY

The improvements that were made to the emissions inventory requests and instructions together with implementation of improvements in the receipt and quality assurance resulted in efficient procedures for processing future emissions inventories. As a second part of the improvement effort, MACTEC assisted the Planning Branch with quality assurance of the existing 2002 emissions inventory.

An initial review of the 2002 emissions inventory highlighted the following areas to be addressed for emissions inventory improvement:

- Duplication of Group-Level Information in *i*-STEPS,
- Outdated Permit and Emissions Inventory Data,
- Use of Chemical Species Synonyms, and
- Association of Emissions Unit Controls in *i*-STEPS.

These issues were addressed and corrected by MACTEC as part of a complete 2002 emissions inventory quality assurance effort.

Duplication of Group-Level Information in *i*-STEPS

Data analysis of the facility emissions units (groups) in *i*-STEPS revealed that data entry personnel had made use of a cataloging system that was acceptable, but not the most efficient system. Multiple records for each emissions unit existed in *i*-STEPS for the purpose of maintaining an individual group number for each pollutant. This created efficiency problems when the data were entered from an emissions inventory. In order to condense the data and make use of the relational database organization employed by *i*-STEPS, MACTEC wrote scripts to rebuild the database with only one group record for each emissions unit. This step made the quality assurance effort much more efficient. Future data entry will also be much more efficient. MACTEC trained data entry personnel on the input of group data using the more efficient relational method.

Outdated Permit and Emissions Inventory Data

As part of the quality assurance process, it was noted that some data records in the *i*-STEPS database had not been updated to reflect the most recent year of emission inventory data. The problem was that emission inventory records were not zeroed from one year to the next when new data was entered. If a facility reported emissions for 10 emissions units one year, but only 5 units in a subsequent year, sometimes the previous year's emissions remained in the database for current year reporting. As part of the quality assurance process, MACTEC removed the stale data records and suggested that in the future, all emissions be zeroed prior to entering a new year of emissions inventory data in *i*-STEPS.

Use of Chemical Species Synonyms

Differences in chemical nomenclature used by industry in reporting emissions resulted in a number of chemical synonyms in existence in the *i*-STEPS database (e.g. PM10 vs. PM10 Total, more than one CAS used for the same pollutant, etc.). This caused problems with reporting since the NEI requires one consistent nomenclature for each pollutant. The Planning Branch data entry personnel added pollutants as needed to accommodate the emissions inventory reports submitted by industry. *i*-STEPS contains a built-in script to properly associate criteria pollutant synonyms for submittal to NEI, but the existing script is not designed to catch some of the synonyms that had been added by data entry personnel. MACTEC reviewed all pollutant entries existing in *i*-STEPS, and designed a new script to resolve the duplicates. Additionally, incorrect duplicate pollutants caused by incorrect CAS numbers were removed.

Association of Emissions Unit Controls in *i*-STEPS

i-STEPS allows information on control devices to be maintained by the user. This information comes from the air permit, and is useful for permit and compliance records. When the control records are associated with the groups in *i*-STEPS, and controlled emissions from a facility emissions inventory are added to *i*-STEPS, the calculated

emissions are modified according to control parameters. This feature is useful to *i*-STEPS industrial clients since it assists them in calculating controlled emissions from uncontrolled emissions. It is a problem, however, for recording emissions inventories by State agencies since industry is instructed to report emissions after all controls have already been applied. MACTEC removed all associations of emissions units with control devices and recalculated the emissions for all facilities. Additionally, data entry staff were trained on maintaining control information in *i*-STEPS without associating the controls.

QUALITY ASSURANCE RESULTS

Upon completion of 2002 emissions inventory quality assurance, MACTEC compiled the results of the changes and presented a summary of the revised emission inventory data to ADEQ. The quality assurance effort resulted in an average 37% reduction in criteria pollutant emissions reported to EPA. The revised 2002 emissions inventory was resubmitted by the Planning Branch to EPA. Use of the data entry manual developed specifically for the Planning Branch will prevent common data entry related problems that were encountered in the past. Additionally, the increased level of quality assurance of emissions inventories will improve the data quality of industry submittals in the future.