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Project Summary

The Development and Improvement of Temporal Allocation Factor Files

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Emissions inventories have traditionally been developed to produce estimates of annual or daily emissions. To be used as input to photochemical and other atmospheric simulation models, hourly emissions estimates are usually required. Ideally, hourly emissions would be measured or calculated directly at the emissions source; however, this approach is normally impractical due to technical and resource restraints. As an alternative, hourly emissions estimates can be obtained using surrogate temporal allocation factors from "temporal profiles" assigned to specific emissions source categories. Hourly emissions may then be estimated by applying the appropriate temporal allocation factors to available annual, seasonal, or daily emissions values. This approach has been followed in previous air pollution studies, including the National Acid Precipitation Assessment Program (NAPAP) and the Northeast Corridor Regional Modeling Project. Since the performance of atmospheric simulation models is dependent upon the availability of accurate, temporally resolved emissions values, suitable methodologies and databases must be available to personnel responsible for developing the daily emissions estimates needed for model inputs.

The purposes of this project were to evaluate the quality and completeness of data and methods being used for temporal allocation of emissions data, to identify and prioritize needed improvements to the current methods for developing temporal allocation factors, and to collect and use data to improve an existing temporal allocation factor (TAF) file. The TAF file will be used as a source of national default allocation factors by the emissions model processing systems that calculate temporally resolved emissions estimates for model input.

This Project Summary was developed by EPA's Air and Energy Engineering Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Methodology

Relevant literature references were identified, acquired, and reviewed to evaluate the quality and completeness of data and methodologies being used for temporal allocation of emissions data. The most comprehensive set of temporal factors developed to date was found to be those for the NAPAP effort. Major limitations of the NAPAP factors are that they were developed only for the NAPAP point and area source categories and were incompletely documented. To augment these data, the following data sources were identified:

- Business and labor statistics data
- Department of Energy data pertaining to production/consumption from various energy industries
- California Air Resources Board (CARB) AB-2588 "Hot Spots" pooled source test reports

- Texas Air Control Board (TACB) stationary source operating schedule data
- Southern Oxidant Study (SOS) data
- Lake Michigan Ozone Study (LMOS) data
- Continuous Emissions Monitoring (CEM) data
- Other data sources, including wastewater data from publicly owned treatment works; operating schedule/parameter data from resource recovery facilities; acidmodes field study data; and Urban Airshed Model Emissions Preprocessor System temporal profiles

Source Category Prioritization

Emissions source categories were prioritized to ensure attention for categories that are major national contributors to air pollution. The prioritization reflected only point source data available from the Aerometric Information Retrieval System (AIRS) Facility Subsystem. National area and mobile source emissions data were not available at the time of this study. To check for consistency with previous U.S. Environmental Protection Agency (EPA) efforts, high priority source categories listed in the September 24, 1992, *Federal Register* notice were reviewed. This notice listed industry groups and source categories targeted for Maximum Achievable Control Technology standard development. The comparison demonstrated consistency with the earlier prioritization effort.

Temporal Allocation Factor File Development

Data were collected for the high priority source categories. To process and combine these data, a number of intermediate data processing steps were required. The product of this effort was a single TAF file in a flat ASCII format. Figure 1 shows the final TAF file format. Key fields for this file are AIRS Source Classification Category (SCC) code, season (winter, spring, summer, fall), and a day code (weekday, Saturday, or Sunday). For each record in the file, day and seasonal scenario fractions are given, along with flags to identify the sources of these data. The TAF file also includes hourly allocation factors for hours 00 through 24, along with a flag to identify the source of these data. The final TAF file resides on EPA's mainframe computer at the National Computer Center in Research Triangle Park, NC.

A three-tiered approach was used to produce the final TAF file data. Tier 1 provided a baseline TAF file, covering all source categories, but including only monthly data. Tier 1 data are useful for constructing seasonal allocation profiles. These profiles were constructed predominantly using monthly labor statistics and energy consumption data. Tier 1 data were used only for sources not included in Tier 2 or 3. Tier 2 data provide increased temporal resolution for a large number of categories. Tier 2 data were created based on information from TACB, SOS, and LMOS for specific sources. These files provided hourly profiles. Tier 2 data were used for emissions sources not included in Tier 3. Tier 3 data were developed from CARB reports, CEM data, and other data sources. The data in the Tier 3 files represent efforts focused on improving the default operating profiles for a few important emissions sources. Tier 3 data are the most detailed and desirable data available in the final TAF file.

Analysis and Conclusions

This project created comprehensive, well-documented, representative national default allocation profiles that may be used to generate hourly emissions estimates from annual estimates. The methodology used to create the TAF file is well-documented, allowing future updates and improvements. TAF profiles are based on activity, rather than emissions, making them valid for allocating the emissions of any pollutant. Still, there are many source categories for which further improvements would be desirable. Detailed, Tier 3 level data could be collected and analyzed for high priority categories.

A plan for analyzing the TAF file data was developed for this project. A limited implementation of the plan for the highest priority SCC categories revealed inconsistent and unexpected data for some SCC categories. Resources available for this project did not permit review of all SCC categories. Inconsistencies in TAF profiles for electric utility boiler categories were traced to CEM data. It was determined that the CEM data obtained for this project were inappropriate for the calculation of TAF profiles. The CEM data, consisting of only concentration measurements, were found not to be accurate indicators of source activity levels. The CEM data were removed from the final TAF profiles for electric utilities.

This project focused primarily on improving temporal profiles for stationary point sources. TAF profiles for many point source categories were improved as the result of this effort. A number of other data sources are available that could be

Variable Name	*Field Format*	*Field Width*	*Description/Validation*
SCC	*Numeric*	*10*	*Source Classification Code (Point area or mobile)*
DAY_CODE	*Numeric*	*1*	*Day scenario identifier (1=Weekday, 2=Saturday, 3=Sunday)*
SEA_CODE	*Numeric*	*1*	*Season scenario identifier 1=Spring, 2=Summer, 3=Fall, 4=Winter)*
DAY_FRAC	*Real*	*7.5 [a]*	*Day scenario fraction (65 x weekday fraction) + (13 x Saturday fraction) + (13 x Sunday fraction) = 1.0*
SEA_FRAC	*Real*	*7.5 [a]*	*Seasonal scenario fraction (Spring fraction + Summer fraction + Fall fraction +Winter fraction = 1.0)*
SEA_FLAG	*Character*	*4*	*Seasonal profile data source or combination method identifier*
DAY_FLAG	*Character*	*4*	*Daily profile data source or combination method identifier*
HOUR_FLAG	*Character*	*4*	*Hourly profile data source or combination method identifier*
HOUR1-HOUR24	*Real*	*7.5*	*Diurnal profile*

[a] *Field width for field type real is defined as X.Y, where X represents the field width and Y represents the allowable number of digits to the right of the decimal.*

Figure 1. *Final TAF file format.*

used to improve point source data for additional categories and to expand the geographic base for point source temporal data. The report lists recommendations for additional data sets that could be examined. On the other hand, only one existing source of area source temporal data could be obtained for this study. To improve temporal profiles for area source categories, it may be necessary to collect new information through surveys of the most important source categories. This approach was beyond the scope of this project and would require additional calendar time and resources to design the surveys, obtain Office of Management and Budget clearance, and perform the surveys. One product of this study was statistical methods for the analysis of temporal data. The application of these methods to quality assure the TAF file data would be appropriate. In addition, the development of computer software to access and analyze the TAF file data was recommended. The availability of an improved TAF file does not eliminate the need to collect actual data for temporally resolved emissions when these data are needed for an emissions inventory. Whenever inventory development resources permit, actual data should still be collected and quality assured for inventory projects where seasonal, daily, or hourly emissions estimates are needed. The TAF file provides an improved database of default values that should be used when actual data cannot be collected.

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***Charles O. Mann** is the EPA Project Officer (see below).*
The complete report, entitled "The Development and Improvement of Temporal Allocation Factor Files," (Order No. PB95-166153; Cost: $52.00; subject to change) will be available only from
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