



Project Summary

THE 1985 NAPAP Emissions Inventory: Development of Temporal Allocation Factors

David B. Fratt, Daniel F. Mudgett, and Robert A. Walters

This report documents the development and processing of temporal allocation factors for the 1985 National Acid Precipitation Assessment Program (NAPAP) emissions inventory (Version 2). The NAPAP emissions inventory represents the most comprehensive emissions data base available for the year 1985. Emissions data have been collected for each of the 48 contiguous United States and 10 Canadian provinces. The inventory reflects data from a total of 9,175 point sources as well as area sources in 3,073 counties in the United States and 10 provinces in Canada. A primary use of this inventory is as the input file for certain regional atmospheric transport models; e.g., the Regional Acid Deposition Model (RADM). These models can be used to simulate the deposition of acid rain products. Requirements of RADM dictate that the annual emissions data be resolved to produce an inventory of hourly, spatially gridded emissions for all 59 chemical species represented. This report describes the development of the temporal allocation factors used to apportion emissions to each hour throughout the year. It also documents the software used to computerize the factors so that they can be applied to annual emissions using the existing Flexible Regional Emissions Data System (FREDS) software.

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).

Introduction

The 1985 NAPAP emissions inventory was developed by the NAPAP Task Group on Emissions and Controls to provide a comprehensive inventory of anthropogenic and natural emissions sources in the United States and Canada. Requirements of RADM dictate that annual emissions be allocated temporally, spatially, and by chemical species. As a result, annual emissions values for 10 pollutants are converted to hourly emissions for 59 chemical species apportioned into grid cells approximately 20 x 20 km square covering the United States and Canada.

Temporal allocation factors are based on statistical representations of the temporal distributions of emissions from different source types. Four seasonal factors are applied to annual emissions to produce seasonal subtotals. Three daily multipliers further divide these subtotals among three day types; i.e., a typical weekday, Saturday, and Sunday in each season. Twenty-four hourly factors are then applied to account for diurnal variation in emissions.

Overview of Temporal Allocation Factors

Temporal allocation factors were originally developed for point and area source categories represented in the



1980 NAPAP emissions inventory. The methodology and processing techniques used to develop factors for the 1985 NAPAP emissions inventory are based on those used for the 1980 effort. While many of the factors used with the 1985 inventory were based on those from 1980, extensive updates were made in certain areas.

Temporal allocation factors were developed for all 102 U.S. area source categories in the 1985 NAPAP emissions inventory. Depending on the magnitude of emissions and the availability of data, source-specific factors were frequently resolved to the regional and state level. Point source factors for sources in the United States were developed for a subset of all emissions categories in the inventory. Particular attention was given

to major acid rain precursor emissions categories such as electric utilities. Point sources for which specific factors were not developed were allocated on the basis of operating schedule available with the emissions data.

Data sources for emissions sources in the United States include: the Northeast Corridor Regional Modeling Project (NECRMP), U.S. Department of Energy, U.S. Department of Transportation, U.S. Department of Commerce, U.S. EPA, and the Electric Power Research Institute. Temporal profiles for emissions sources in Canada were provided by Environment Canada. All factors were compiled and processed using SAS-based software on the U.S. EPA National Computer Center's IBM 3090 mainframe.

Conclusions

The purpose of this project was to develop and document the temporal allocation factors used with Version 2 of the 1985 NAPAP emissions inventory. The report details the methodology used to develop the factors and presents the computer source code used to generate computerized temporal allocation factor files. Complete listings of point and area source temporal allocation factors for emissions sources in the United States are provided. This report will facilitate the understanding of the temporal allocation factors, especially as related to their use with the 1985 NAPAP emissions inventory.

David B. Fratt, Daniel F. Mudgett, and Robert A. Walters are with Alliance Technologies Corporation, Bedford, Massachusetts 01730.

Carl T. Ripberger is the EPA Project Officer (see below).

The complete report consists of paper copy and magnetic tape entitled "The 1985 NAPAP Emissions Inventory: Development of Temporal Allocation Factors:"

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National Technical Information Service

5285 Port Royal Road

Springfield, VA 22161

Telephone: 703-487-4650

The EPA Project Officer can be contacted at:

Air and Energy Engineering Research Laboratory

U.S. Environmental Protection Agency

Research Triangle Park, NC 27711

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Center for Environmental Research
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Project Summary

The 1985 NAPAP Emissions Inventory: Development of Spatial Allocation Factors

Lysa G. Modica and Daniel R. Dulleba

This report documents the development and application of the spatial allocation factors for the 1985 National Acid Precipitation Assessment Program (NAPAP) Emissions Inventory (Version 2). The 1985 annual inventory and related modelers' inventory represent the most comprehensive and highest quality emissions data available. The inventory spans the 48 contiguous United States and 10 Canadian provinces. Emissions data are included for 9,175 plants and area source categories from 3,073 counties in the U.S. and the 10 Canadian provinces. One application of the NAPAP inventory is to provide an emissions data input file for regional atmospheric models used to simulate the transport and transformation of acid deposition precursors and the patterns and magnitudes of deposition products. Annual emissions data were resolved into a consistent spatial grid pattern, into hourly values for 12 representative day types and into 59 pollutant species for modeling applications. This report discusses the development of the spatial allocation factors that were used to distribute county and province level area source emissions estimates to a grid pattern defined by 1/6-degree latitude and 1/4-degree longitude covering the contiguous U.S. and Canada to 60 degrees north latitude. The report also documents the computer software used to formulate the spatial allocation factors. These factors were implemented in a modular computer program known as the Flexible Regional Emissions Data System (FREDS).

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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).

Introduction

The 1985 NAPAP Emissions Inventory (Version 2) has been developed by the NAPAP Task Group on Emissions and Controls. One purpose of the inventory is to support NAPAP and other research efforts by providing a high quality modelers' emissions inventory that can be used as input for regional modeling applications. The emissions inventory was developed principally for application to the Regional Acid Deposition Model (RADM); however, it was developed with resolution suitable for use in other models, such as the Acid Deposition and Oxidant Model (ADOM) and the Regional Oxidant Model (ROM).

The 1985 NAPAP Emissions Inventory (Version 2) was resolved spatially, temporally, and by pollutant species to support these models. Spatial, temporal, and species allocation factors were developed and applied to create the modelers' inventory. Spatial allocation factors are based on statistical representations of the distribution of surrogate indicators which can be used to estimate the spatial distribution of emissions from area source categories.

The spatial allocation factors applied to the 1985 NAPAP Emissions Inventory were based largely on factors and methodologies developed for the 1980 NAPAP Emissions Inventory. The additional effort completed for the 1985 Inventory devel-



opment resulted from quality assurance (QA) and quality control (QC) procedures that identified problems and errors in the 1980 spatial factors. Details of the QC procedures and the enhancements to spatial factors that resulted from the QC program are also described in the report.

Spatial Factor Overview

The spatial allocation factors were compiled in a data file which describes the fraction of the county or province level totals of each of the surrogate indicators that are included in each inventory grid cell. The spatial allocation surrogate indicators applied to the 1985 NAPAP Inventory are summarized in Table 1. Data reported at various levels of geographic coverage were used to derive the spatial allocation factors. In each case, the level

of resolution of the spatial indicators was modified to be relative to the county or province level, to be consistent with the level of resolution of the emissions estimates.

The development and application of the spatial allocation factors for the U.S. and Canada are discussed separately, due to differences in the methodologies used to prepare and process the spatial allocation data. The development of U.S. spatial allocation factors was based on two main sources of data: U.S. Department of Commerce, Bureau of the Census, Census of Population and Housing, 1980; and land use/classification data derived from 1972-1973 Landsat satellite imagery and land use/cover maps. Canadian spatial factors were based on data supplied to Environment Canada by Statistics Canada which represent the base year 1981. Environment Canada supplied data for the

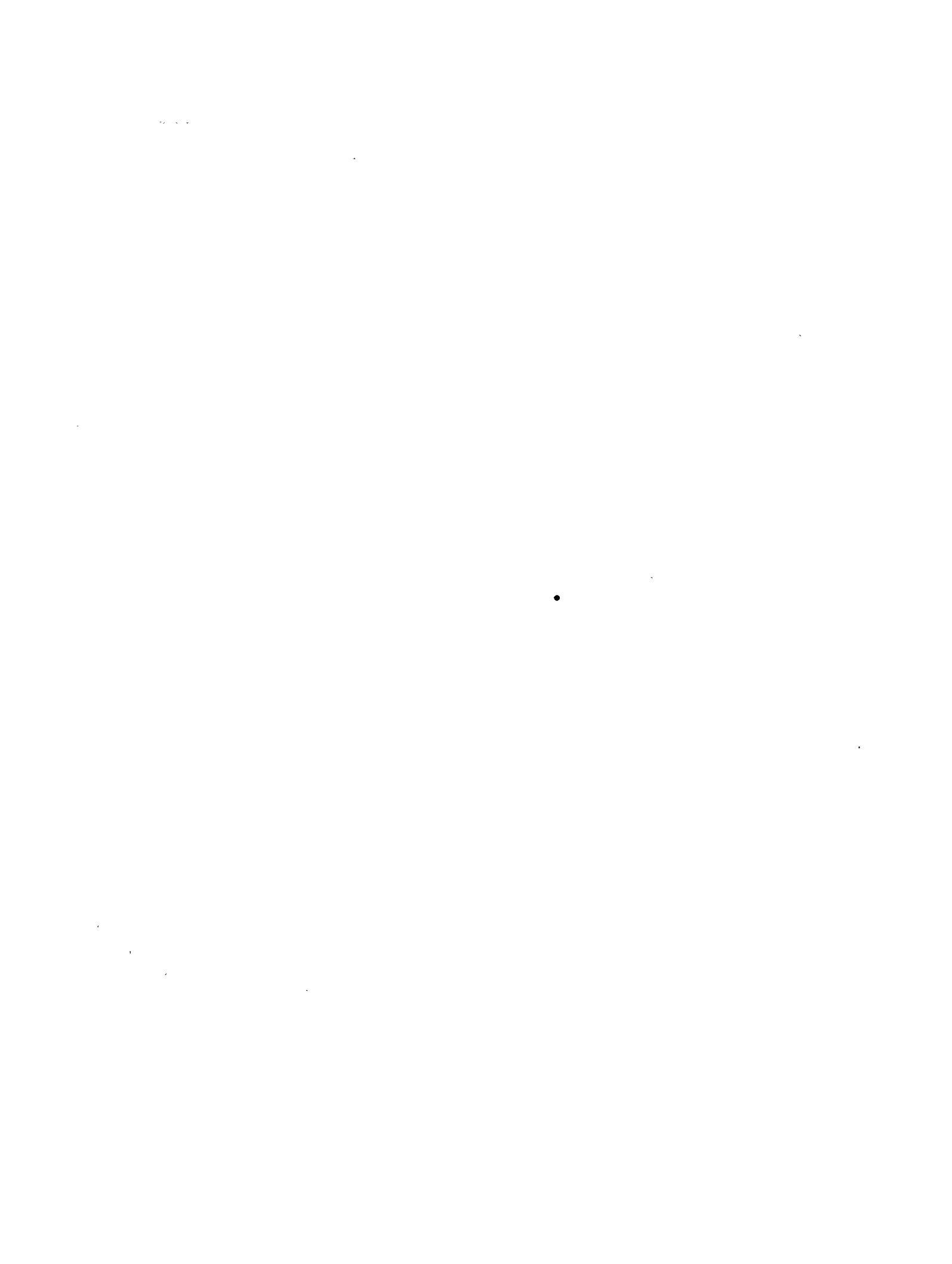
grid cell resolution by province. All data processing was completed using the EPA National Computer Center's Sperry UNIVAC 1100 and the IBM 3090.

Conclusions

The objectives of this project were to develop and document the software used to generate the spatial allocation factors used in the development of the 1985 NAPAP Modelers' Emissions Inventory (Version 2). The series of computer programs described in the document support the spatial resolution requirements of regional acid deposition and photochemical oxidant models. The information provided in the report will facilitate the use and interpretation of the spatial allocation factors by all inventory users.

Table 1. Spatial Allocation Surrogates Used in the 1985 NAPAP Emissions Inventory

<i>Surrogate No.</i>	<i>Surrogate Indicator</i>	<i>Source</i>
U.S. SPATIAL FACTORS		
1	Population	1980 Census
2	Housing	1980 Census
3	Urban Land	Landsat
4	Agricultural Land	Landsat
5	Composite Forest	Landsat
6	Land Area	EPA/Alliance
CANADIAN SPATIAL FACTORS		
1	Population	Statistics Canada
2	Oil Homes	Statistics Canada
3	Gas Homes	Statistics Canada
4	Total Homes	Statistics Canada
5	Industrial Labor Force	Statistics Canada
6	Commercial Labor Force	Statistics Canada
7	Agricultural Labor Force	Statistics Canada
8	Mining Labor Force	Statistics Canada



Lysa G. Modica and Daniel R. Dulleba are with are with Alliance Technologies Corporation, Bedford, Massachusetts 01730.

R. Lagemann and C. T. Ripberger are the EPA Project Officers (see below). The complete report consists of paper copy and magnetic tape entitled "The 1985 NAPAP Emissions Inventory: Development of Spatial Allocation Factors:"

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