United States
Environmental Protection
Agency

Air and Energy Engineering
Research Laboratory
Research Triangle Park, NC 27711

Research and Development

EPA/600/S8-88/090 Nov. 1988

EPA

Project Summary

A Projection Methodology for Future State Level Volatile Organic Compound Emissions from Stationary Sources (Version 1.8)

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This report presents the model framework used to estimate state level and national future volatile organic compound (VOC) emissions and control costs for stationary industrial and utility sources. The framework involves a projection approach using the 1980 NAPAP inventory for VOC emissions aggregated by 101 defined source categories apportioned by ozone attainment and nonattainment areas for each state. The projection approach involves applying expected industry activity factors (growth/-decline/replacement rates) and emission constraint factors (environmental control reductions) to the base year emission levels. Future year uncontrolled and controlled VOC emissions and annualized control costs are estimated using annualized control cost values (1980 dollars per ton) for each source category.

The model was developed for use on an IBM personal computer with data input capabilities from mainframe computers containing the NAPAP inventory and industry growth/decline rate data bases. The model has five data files which interact to provide uncontrolled/controlled VOC emission projections and cost of controls for: any year from 1980 to 2030; 49 geographic regions (48 contiguous states and the District of Columbia); and 90 industrial/utility point source categories and 11 industrial area sources.

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

This report documents the approach taken for estimating national and state level future volatile organic compound (VOC) emissions and the cost of controlling the emissions from industrial and utility sources. This study was sponsored by the U.S. Environmental Protection Agency in support of the National Acid Precipitation Assessment Program (NAPAP).

Emissions of VOC may indirectly contribute to acid deposition through participation in atmospheric reactions with nitrogen oxides (NO_X), sulfur oxides (SO_X), and other pollutants. The reaction products may result in wet (precipitation) or dry acid deposition. For example, it is generally accepted that the presence of ozone (a photochemical reaction product of VOC and NO_X) affects transformation rates of SO_X to sulfates. However, there are indications that the hydrocarbons emitted from natural sources have less impact on air quality than those from anthropogenic sources. The evidence for these atmospheric reactions is far from conclusive, and the possible chemical reaction mechanisms are not fully understood. If a definite relationship between VOC emissions and acid deposition were established, a VOC control strategy could be considered. Development of a VOC policy would obviously involve analysis of future year VOC emissions and the cost of controls associated with alternative regulatory control strategies.

Under this study, a computer model (VOC Model) was developed that takes data from the 1980 NAPAP emission inventory for utility and industrial point and area source emissions and projects future year emission levels by applying expected future activity (growth/decline and retirement/replacement rates) and emission constraints due to existing/future environmental regulations. Base year and future year levels of emission reductions, due to environmental controls, are then multiplied by various control cost effectiveness values to develop the annual costs of emission controls. The VOC Model analytical framework is compatible with the other EPA pollutant models on stationary and mobile sources for integration into the overall acid precipitation emission strategy modelling.

Objectives

The program objectives were to project future VOC emissions and emission control costs by industry category for each of the 48 U.S. contiguous states and the District of Columbia (49 regions). The specific model objectives were to develop a projection approach that would:

- have a simple and flexible framework;
- operate on an IBM personal computer with mainframe computer data input capabilities;
- permit easy updating of data files;
- use a menu-driven structure;
- be consistent with other acid precipitation models; and
- be compatible with NAPAP emission inventory.

The model contains five primary data files which interact as shown in Figure 1.

The base year emissions file contains the NAPAP emissions inventory data aggregated into 90 point source categories and 11 area source categories for the 49 regions. VOC emissions are expressed on uncontrolled and controlled bases. The model estimates future year uncontrolled emissions by applying the appropriate activity rates found in the replacement rate file and the growth/decline rate file. Replacement rates account for the replacement of existing industry capacity with new capacity due to the retirement of existing equipment. The growth/decline rates account for changes in industrial product/service capacity due to market demand.

Future year controlled emissions are calculated by imposing emission constraints on the projected uncontrolled emissions. These constraints are most often due to environmental regulations, and this file contains emission reduction factors for the following types of environmental regulations:

- New Source Performance Standards (NSPS) - Best Available Control Technology (BACT);
- State Implementation Plans (SIP) based on Control Technology Guidelines (CTG) - Reasonably Available Control Technology (RACT);
- New source emissions in ozone nonattainment areas - Lowest Achievable Emission Reduction (LAER) control technology;
- Prevention of Significant Deterioration (PSD) - Best Available Control Technology (BACT) economically achievable for new major sources;
- National Emission Standards for Hazardous Air Pollutants (NESHAP); and
- General state regulations mandating 80 to 90% control of reactive VOC emissions.

The model outputs the base year and projection year (up to year 2030) uncontrolled/controlled VOC emissions by industry category and region.

Control costs are calculated by applying the amount of controlled VOC emissions (uncontrolled minus controlled emissions) for each industry category times a control cost value (dollars per ton of controlled VOC). The control cost file can contain up to 12 control cost values for each industry category (control cost versus control effectiveness). The model outputs the VOC emission level of control and annualized 1980 dollar cost of controls for each industry category anc region.

The model can also model emissio offsets (additional emission reduction required for new facilities i nonattainment areas) and emissio rollbacks (arbitrary restrictions on futur emissions specified as a percentage o current emissions). Input data for thes options are contained in an emissio offset/rollback file. However, no inpu data for these options had bee developed at the time of the writing o this report, and this input data file is no discussed further. However, the gener model framework and implementation c offsets and rollbacks are discussed.

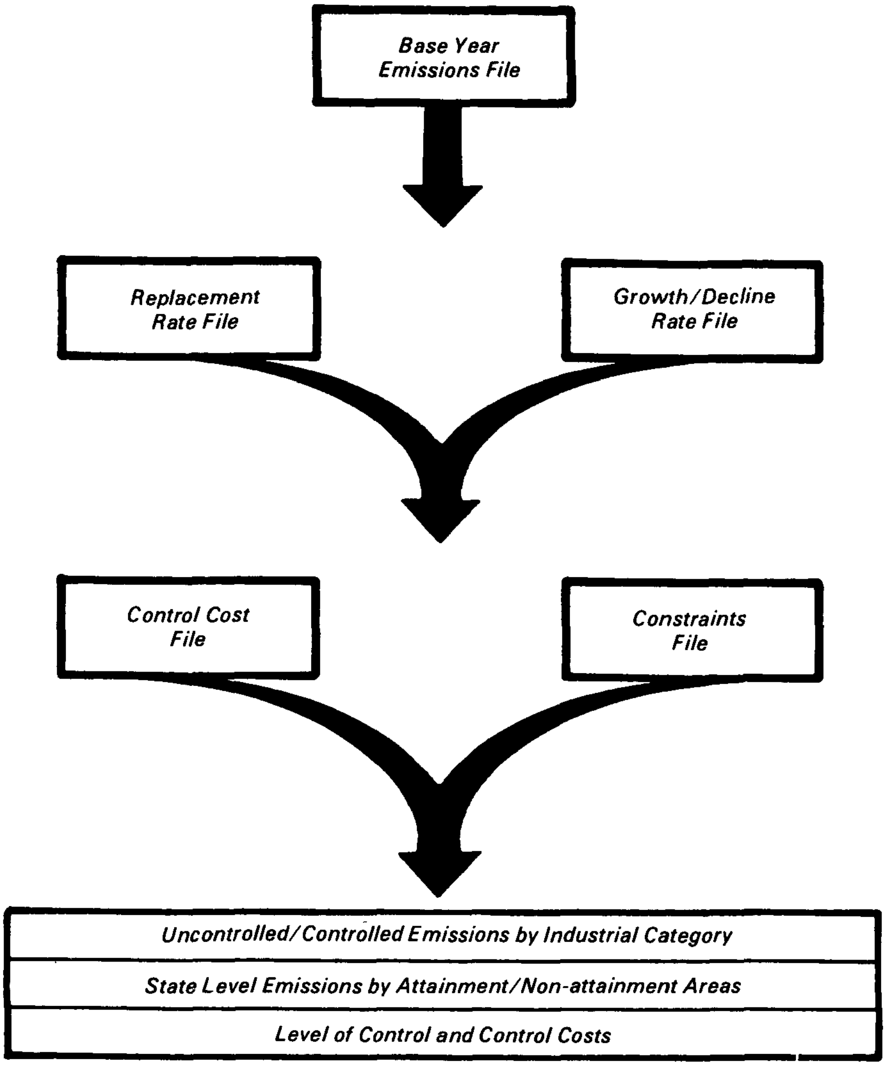

Figure 1. *VOC Model Framework.*

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The complete report, entitled "A Projection Methodology for Future State Level Volatile Organic Compound Emissions from Stationary Sources (Version 1.8)," (Order No. PB 88-238 373/AS; Cost: $19.95, subject to change) will be available only from:
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EPA/600/S8-88/090