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Project Summary

The NAPAP Utility Reference File for 1980

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Emission inventory activities within the National Acid Precipitation Assessment Program (NAPAP) estimate emissions of pollutants of concern to the acid deposition phenomenon. Electric utilities emit a large share of total acid deposition precursor emissions. The purpose of this study was to produce a 1980 utility data base that meets the needs of NAPAP task groups for utility data. Special emphasis was placed on meeting data needs of atmospheric modelers, emissions forecasters, and policy analysts. The product of this analysis, the NAPAP Utility Reference File (NURF) for 1980, now serves as the source of emissions data for the 1980 NAPAP Emission Inventory. It also serves as the source of operating and economic data for utility simulation models. Because both fossil and non-fossil units are included, the total number of units is more than 11,000. Utility NO_x and SO_2 emission estimates made using NURF data for 1980 are 6.5 million and 17.5 million tons, respectively.

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

Components of NAPAP have overlapping but not identical data needs; the purpose of this project was to develop a single data base that would meet the utility-related data needs of all NAPAP task groups. Existing data files were inadequate for this purpose. For example, Version 4.0 of the 1980 NAPAP Emissions Inventory, between its point source and area source components, includes only anthropogenic sources of major acid deposition precursor pollutants for that year. As another example, the Unit Inventory was developed to meet data requirements of the Advanced Utility Simulation Model (AUSM); the Unit Inventory contains unit-specific information for only a subset of generating units, however.

Technical Approach

Figure 1 provides an overview of the NURF data system. NURF comprises four component files: the master unit data file (containing information on all electric utility generating units), the fuel specific emissions file (containing emissions information by fuel and unit), the stack parameters file (containing stack information on a unit-specific basis), and the announced unit file (containing unit-specific information on units coming on-line or converting to coal-firing after 1980). In addition, as shown in Figure 1, three files were derived from NURF and made available for distribution: the NAPAP Emissions Inventory updates file (containing corrections and addendums to Version 4.0 of the 1980 NAPAP Emissions Inventory), information for AUSM, including a 1980 existing units data file (containing unit-specific information on larger generating units and aggregated information on smaller units), and the announced inventory (containing information on units coming on-line or planned for conversion to coal after 1980).

NURF was developed using information from Version 4.0 of the 1980 NAPAP Emissions Inventory, the Unit Inventory, and new data from a variety of sources.

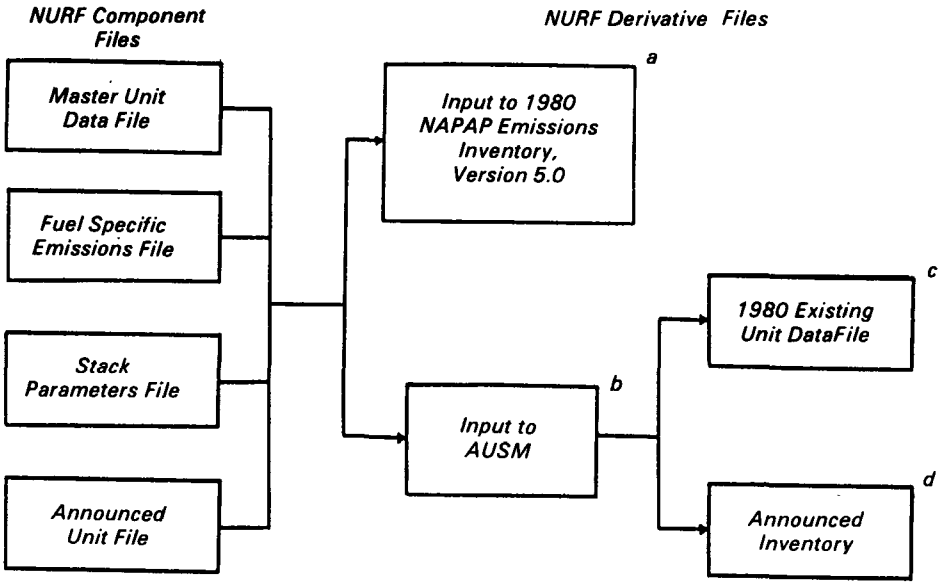
Table 1 lists major data inputs to NURF. In developing NURF, the greatest reliance was placed on data available from public sources, especially files available in machine-readable form. A variety of processing techniques were required to format the available information from these sources into a single consistent data system.

Some data elements (e.g., heat rate and capacity factor) were not available from standard sources and had to be calculated from available data. When the calculated values were unreasonable, judgments were made as to which of the input values were the most accurate; other data were adjusted on a unit-specific basis so that all resultant values were reasonable.

Because of the wide range of types of data processing required to create NURF, a combination of programming languages and methodologies was used in its development. Initial data reduction of the larger data files was performed by a series of programs written in Programming Language/I (PL/I). These larger files were reduced to one record per unit (or plant if a plant-level file). The reduced files were converted to a consistent format using the Statistical Analysis System (SAS). These SAS files were then combined and manipulated using a series of SAS programs. Examples of the processing required include calculation of default state average fuel quality data and assignment of plant technology codes. The result of these manipulations was a final NURF in SAS format. The final processing steps converted the NURF data in their component file form into the set of derivative files which were discussed earlier.

Development of NURF was a multi-step process. The first step was to identify the universe of units to be included. Because the coverage of the major contributing data files differs, it was necessary to compare several data files on a plant-specific basis in order to develop the best possible universe of facilities. Conflicts between these files occurred in many cases. These had to be resolved on a case-by-case basis. In cases where a conflict occurred, if two or more files contained consistent information, those data were chosen. Otherwise, preference was given to the U.S. Department of Energy's (DOE) 1980 Form 67 data and the Generating Unit Reference File (GURF), both of which contain more recent information.

Operating characteristics (e.g., total generation and total fuels consumed for



[a]existing plants emitting SO_2, NO_x, or TSP
[b]Advanced Utility Simulation Model
[c]aggregated information on smaller units
[d]planned plants (or conversions)

Figure 1. Overview of NAPAP Utility Reference File (NURF) elements.

Table 1. Major Data Inputs to NURF

Data Input	Type[a]	Level of Detail	Data Provided
EIA Form 759 (formerly FPC Form 4)	A	Plant	Fuel consumption and generation
FPC Form 423	A	Plant	Cost and quality of fuels
FPC Form 67	A	Boiler/fuel feeder	Fuels consumed, control equipment, firing type, and bottom type
FGDIS	A	Boiler	SO_2 scrubber data
NAPAP Emission Inventory	A	Boiler	Stack parameters
Generating Unit Reference File	A	Unit	Year online, year retired, capacity
EPA State Implementation Plan file	A	Unit	TSP, SO_2 and NO_x emission limits
NERC planned plants	M	Unit	New plants
NERC coal conversions	M	Unit	Plants converted or planning conversion to coal
DOE coal conversions	M	Unit	Plants converted or planning conversion to coal
Pechan nuclear plant status	M	Unit	Status of planned nuclear units
NO_x control update	M	Unit	NO_x control measures
ANL firing data	A	Unit	Supplemental data on firing types and bottom type

[a]A = Automated, M = Manual.

generation) were obtained from the Federal Power Commission's (FPC) Form 4; in 1980, FPC Form 4 was renumbered to EIA Form 759. Form 4 is a monthly data base; for use in NURF, however, the monthly data for 1980 were aggregated into annual totals. Form 4 data are reported by plant and prime mover; e.g., a plant having both steam and combustion turbine units would have fuel use and generation data provided for each of these two prime movers.

Unit-specific operational data for 1980 were estimated by applying 1980 unit shares computed from 1980 Form 67 data on fuel use and generation to the corresponding data elements from the 1980 plant and prime mover totals from Form 4. This method was adopted to correct errors associated with the use of incorrectly reported units on Form 67 submissions. Because the Form 67 data were used only to compute shares of validated totals, unit errors in Form 67 data were not carried through to NURF.

Fuel quality data were obtained from FPC Form 423. For units with no reported Form 423 information, state average data obtained from Form 423 were used.

Results

The major user files derived from NURF are inputs to Version 5.0 of the 1980 NAPAP Emissions Inventory and the 1980 existing units data file, an input to AUSM. Due to data coverage and desired data base size considerations, both of these derivative files have been segmented into components comprising large and small generating units. The size cutoff utilized in the existing units data file is more restrictive than that used to update Version 4.0 of the 1980 NAPAP Emissions Inventory because the existing units data file is used as the basis for projection of emissions and fuel use in AUSM; the activity of smaller units cannot be projected reasonably. For example, the 1980 existing units data file includes unit-specific data on only 30% of all fossil-fired units, while Version 5.0 of the 1980 NAPAP Emissions Inventory contains detailed data on 62% of all fossil-fired units; because the units represented in detail in these data files are the larger units, these files have more extensive coverage of generating capacity, generation, and emissions. For fossil-fired generating capacity, 92% of the total is represented in unit-specific data in the 1980 existing units data file and 96% of the total is included in Version 5.0 of the 1980 NAPAP Emissions Inventory file. Generation and emissions coverage is almost complete for Version 5.0 of the 1980 NAPAP Emissions Inventory file and is extremely high (more than 98%) for the 1980 existing units data file. Note that the existing units data file also includes non-fossil units, which are not included in the NAPAP Emission Inventory.

Table 2 provides some summary statistics on NURF's coverage of generation capacity, generation, and emissions, by fuel and plant type. Fossil-fired units account for more than 75% of capacity and generation, and 100% of emissions. Table 2 also shows that the proportion of coal-fired generation is larger than the proportion of coal-fired capacity; the opposite is true for oil-fired units. As expected, coal-fired units account for most emissions.

Discussion

NURF was compiled from every major publicly available data file on utilities. By matching and combining this information, the development of NURF gathered all relevant information into one data file. Discrepancies that existed in the past between data bases are resolved in NURF; the result is a cohesive and comprehensive electric utility operations and emissions data file.

Because NURF is a composite of the best data available from a number of sources, it does not exactly match any other individual file. Aggregate measures of key variables are in excellent agreement with published statistics, however. NURF is important as an input to NAPAP's emission efforts, as well as an important utility operations data base in its own right.

Conclusions

NURF is a central repository of data for utility operations and emissions, facilitating analysis of the electric utility sector. The largest sources of NO_x and SO_2 emissions have been thoroughly covered. In addition, data on all large units (including fossil-fired, non-fossil fired, existing, and planned) are provided in a comprehensive manner.

Table 2. *Summary Statistics by Plant Type*

Plant Type	Capacity (MW)	% of Total	Generation (TWh)	% of Total	SO_2 (1000 tons)	% of Total	NO_x (1000 tons)	% of Total	TSP (1000 tons)	% of Total
Coal steam	242,700	42	1,171,000	51	16,070	91	5,200	79	570	88
Oil steam	67,600	11	217,000	10	1,320	8	400	6	60	9
Gas steam	93,500	16	338,000	15	120	1	750	12	20	3
Oil non-steam	29,300	5	7,000	0	10	0	40	1	3	0
Gas non-steam	24,400	4	21,000	1	0	0	100	2	2	0
TOTAL FOSSIL	457,500	78	1,754,000	77	17,520	100	6,490	100	655	100
Nuclear	48,900	8	233,000	10	0	0	0	0	0	0
Hydroelectric	81,500	14	287,000	13	0	0	0	0	0	0
Other	900	0	5,000	0	0	0	0	0	0	0
TOTAL	588,800	100	2,279,000	100	17,520	100	6,490	100	655	100

Note: Percentages calculated from detailed data.

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The complete report consists of two parts, entitled "The NAPAP UTILITY Reference File for 1980:" (paper copy, Order No. PB 87-182 887; Cost: $18.95) "1980 U.S. Electric Utility Data Base," (computer tape, Order No. PB 87-182 879; Cost: $175.00; cost of tape includes paper copy as well)
The above reports will be available only from: (costs subject to change)
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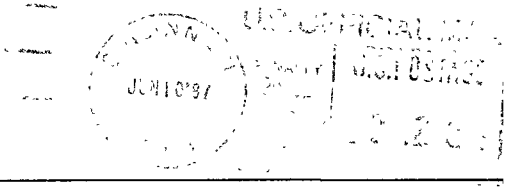

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