BY THE U.S. GENERAL ACCOUNTING OFFICE

Report To The Chairman
Subcommittee On Oversight And Investigations
Committee On Energy And Commerce
House Of Representatives

EPA-Approved Revisions To State Implementation Plans Allowing Increased Sulfur Dioxide Emissions Were Legal

As directed by the Clean Air Act, states have developed implementation plans to limit emissions of various pollutants including sulfur dioxide--a pungent odored gas that can aggravate heart, lung, and respiratory disease. Under the act, these plans can be revised to increase emissions if national standards are not violated and the plans are approved by the state and EPA.

GAO found that the revisions allowed a net increase of 1.5 million tons of sulfur dioxide emissions during calendar years 1981-83. Based on a sample of the revised plans, GAO also found that EPA and the states had determined that the increases in emissions would not violate national standards and, thus, were consistent with key act requirements. GAO does note that EPA's approval decisions were based on some uncertainties, which EPA is currently assessing.

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RESOURCES, COMMUNITY,
AND ECONOMIC DEVELOPMENT
DIVISION

B-217221

The Honorable John D. Dingell
Chairman, Subcommittee on Oversight
and Investigations
Committee on Energy and Commerce
House of Representatives

Dear Mr. Chairman:

As requested in your January 30, 1984, letter and our subsequent discussions with your office, this report discusses state implementation plan revisions that increase allowable levels of sulfur dioxide emissions. This report provides information on actions by the states and the Environmental Protection Agency in reviewing and deciding on state plan revisions, the impact of such revisions on future economic growth, and the legal basis for these increases.

Unless you publicly release its contents earlier, we will make this report available to other interested parties 30 days after the issue date. At that time copies of the report will be sent to appropriate congressional committees; the Administrator, Environmental Protection Agency; and the Director, Office of Management and Budget.

Sincerely yours,

J. Dexter Peach
Director

The Clean Air Act requires each state to submit to the Environmental Protection Agency (EPA) for approval a state implementation plan specifying how the national standards for various emissions of pollutants such as sulfur dioxide would be achieved and maintained. Sulfur dioxide is a colorless gas with a pungent and irritating odor that can aggravate or increase symptoms of heart, lung, and respiratory disease. It also is a major ingredient and precursor of acid deposition (commonly referred to as acid rain).

Concerned about how revisions to the state plans have allowed increased sulfur dioxide emissions, the Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce asked GAO to:

--determine the increase in sulfur dioxide emissions allowed by the revisions and identify for selected revisions potential impacts on future economic growth;

--assess the legal basis for these proposed revisions, including whether EPA can disapprove them; and

--examine the actions taken by EPA and states in reviewing and approving these revisions.

BACKGROUND

The Clean Air Act requires that any revisions to a state implementation plan be approved by the state and EPA. This approval can be granted only after determining that the revision (1) does not result in violation of national standards and (2) does not cause significant deterioration of air quality in in-state or out-of-state areas. (See pp. 1 and 2.)

State plans and their revisions have been the primary vehicle for regulating sulfur dioxide emissions, but additional measures can be taken by EPA, the Congress, or individual states if necessary. For example, a number of bills introduced in the 99th Congress propose annual reductions in sulfur dioxide emissions of 8 million to 12 million tons, based on 1980 emission levels. (See pp. 1 to 4.)

RESULTS IN BRIEF

During calendar years 1981-83, EPA approved 114 revisions to state implementation plans involving sulfur dioxide, 58 of which permitted increased emissions. These revisions allowed a net increase of 1.5 million tons of sulfur dioxide emissions during that period. GAO's review of 18 state plan revisions indicated that emission increase approvals had both positive and negative economic implications.

The Clean Air Act permits EPA and the states to approve state implementation plan revisions that would increase sulfur dioxide emissions. EPA approval is mandatory if it determines that a state-approved revision meets the act's requirements.

In the 18 state plan revisions GAO reviewed, EPA determined that the revisions did not result in emission increases that violated national standards. However, EPA could improve the techniques used in making approval decisions. For example, mathematical models are needed that can better project the interstate impacts of sulfur dioxide emissions and the impact of those emissions in certain types of terrain. EPA has ongoing research in these areas.

GAO ANALYSIS

Impact of Revisions

Information from EPA and other parties associated with the state plan revisions identified several potential negative economic implications. The Clean Air Act, for example, sets limits on the amounts by which certain areas can increase sulfur dioxide emissions. The difference between such an area's current emission level and its limit is the maximum emission increase that is available to accomodate any new or expanding sources that emit sulfur dioxide. To illustrate this point, one revision approved for a Massachusetts area allowed a temporary emission increase that consumed 96 percent of the area's increment, leaving 4 percent for future development. (See pp. 4, 16, and 17.)

Other negative economic impacts that were identified with increased sulfur dioxide emissions include reduced recreational value of land and waterways, increased maintenance costs

for building materials, and increased health care expenses. (See p. 18.)

State plan revisions can also produce benefits. GAO found that revision applications discussed how power plants and industrial facilities covered by the revisions would achieve savings in fuel costs and savings from avoiding or postponing the purchase of additional pollution control equipment. For example, the state plan revisions allowed Indiana, Ohio, and Pennsylvania to lower electricity costs by using higher sulfur-content coal mined in those states. (See pp. 17 and 18.)

Legal Basis for Revisions

EPA's policy requires that after state adoption and submission to EPA of a state plan revision, EPA approval is mandatory if the revision meets the criteria of the Clean Air Act. GAO found that the policy is consistent with the act's requirements. (See p. 20.)

While the act does not allow EPA's approval policy to be flexible, GAO noted that the act does not preclude states from attaching conditions to their state plan revisions. For example, in Massachusetts, certain sources were allowed to use higher sulfur fuel for up to 30 months, provided that the emissions did not exceed standards and that cost savings achieved were used for such measures as installing pollution control equipment or implementing energy conservation techniques. (See pp. 20 to 22.)

Process Consistent With Act

GAO found that for the 18 state plan revisions it reviewed, EPA and the states followed the key legal requirements for ensuring that revisions did not violate national standards or allow significant deterioration of air quality. (See p. 10.) However, some issues surfaced during GAO's review that injected some uncertainty into EPA's decision-making process. Specifically,

--modeling problems limited EPA's ability to assess impacts of the long-range transport of sulfur dioxide emissions, a concern also expressed in a December 1984 GAO report, An Analysis of Issues Concerning "Acid Rain" (see pp. 12 and 13),

--mathematical models were not sufficiently developed to project sulfur dioxide emissions in areas where some of the surrounding land is higher than the source's smokestack (see pp. 13 and 14), and

--some states calculated compliance with the emission standards by a method that has not been approved by EPA (see p. 15).

EPA has research underway to better assess the impacts of the long-range transport of sulfur dioxide emissions and to develop acceptable models that predict the impacts of a source's emissions in areas where the surrounding land has various altitudes. EPA is aware that some states have adopted an alternative method of measuring compliance with emission standards and has a sulfur dioxide study underway that addresses this issue. (See pp. 13 to 15.)

RECOMMENDATIONS

Because of EPA's ongoing research to improve its decision-making process, GAO is making no recommendations.

AGENCY COMMENTS

GAO discussed the state implementation plan revision process with EPA program officials and has included their comments where appropriate. However, GAO did not obtain the views of responsible officials on our conclusions, nor did it request official agency comments on a draft of this report.

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ABBREVIATIONS

EPA	Environmental Protection Agency
GAO	General Accounting Office
MMBtu	million British thermal units
NAAQS	National Ambient Air Quality Standards
PSD	prevention of significant deterioration
SIP	State Implementation Plan
SO_2	sulfur dioxide

CHAPTER 1

INTRODUCTION

The Congress enacted the Clean Air Act in 1963 to protect and enhance the quality of the nation's air in order to promote public health and welfare. The 1970 amendments to the act empowered the Environmental Protection Agency (EPA) to establish and enforce national ambient[1] air quality standards (NAAQS) for air pollutants. EPA established two sets of standards--primary standards were designed to protect human health, while secondary or welfare standards were to clean the air of visible pollutants and to prevent corrosion, crop damage, and other effects of polluted air. EPA has established primary and secondary standards for six air pollutants--carbon monoxide, lead, nitrogen oxides, ozone, sulfur dioxide, and total suspended particulates--and is authorized to establish standards for additional pollutants when necessary.

The act required each state to submit to EPA for approval a state implementation plan (SIP) specifying how the national standards for each pollutant would be achieved and maintained. The SIP was required to include emission limits for power plants and other major sources of air pollution, and schedules and timetables for adopting the measures necessary to assure attainment and maintenance of the national standards. Subsequent changes to a state's allowable air pollutant emissions require a SIP revision approved by the state and EPA. Some states, for example, found that their initial SIPs were more stringent than needed to meet the NAAQS and asked EPA to approve SIP revisions that increased allowable air pollutant emissions. Other states were required by EPA to submit SIP revisions that would decrease air pollutant emissions, since their initial SIPs were found to be inadequate to assure attainment and maintenance of the national standards. Therefore, the act established that the SIP revision process be an important mechanism for regulating air pollutant emissions in the United States.

The Clean Air Act amendments of 1977 contained two major provisions that affected the SIP revision process. First, the 1977 amendments provided for a program for the prevention of significant deterioration (PSD) of air quality in clean air areas.[2] Numerical air quality increments for sulfur dioxide and particulate matter were established designating the maximum increase in those emissions allowed in a PSD area. The amendments also provided for additional controls over interstate air pollution. EPA may approve a SIP revision only after

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[1]Ambient air is any unconfined portion of the atmosphere: open air.

[2]The purpose of the PSD program is to ensure that air quality in clean areas--where air pollution levels are lower than the NAAQS--does not significantly deteriorate, while allowing for future industrial growth.

determining that the revision will not prevent that state or any other state from (1) attaining or maintaining the national primary and secondary ambient air quality standards and (2) meeting the act's PSD requirements.

SULFUR DIOXIDE TRENDS IN THE UNITED STATES

According to a December 1984 EPA report, National Air Pollutant Emission Estimates, 1940-1983, sulfur dioxide (SO_2) emissions have declined considerably since 1970. However, some studies published by environmental interest groups indicate that significant additional reductions in those emissions are needed for adequate protection of human health and the environment.

SO_2--one of the pollutants regulated by the Clean Air Act--is a colorless inflammmable gas that has a pungent and irritating odor. It aggravates symptoms of heart and lung disease and increases the incidence of acute respiratory disease including coughs and colds, asthma, bronchitis and emphysema. It is also toxic to plants; can destroy paint pigments, erode statues, corrode metals, and harm textiles; impairs visibility; and is a precursor to acid deposition.[3]

The December 1984 EPA report stated that between 1940 and 1970, nationwide SO_2 emissions increased by roughly 60 percent, from 19 million to 30 million tons per year. From 1970 to 1980, emissions totals declined by about 10 percent, from about 30 million to 26 million tons per year. Of the 1980 total, about 22 million tons--or 85 percent--were emitted in the 31 states east of or bordering the Mississippi River. Electric utilities emitted about 70 to 75 percent of the total eastern sulfur dioxide emissions. Non-utility combustion, primarily industrial boilers, accounted for about 10 to 15 percent of the total, with the remainder coming from industrial processes and other sources. EPA reported further reductions in total sulfur oxide--predominantly SO_2--emissions in 1981-1983.

Factors contributing to the decrease in SO_2 emissions since 1970 included:

--utilities and industrial facilities switching from coal to oil,

--increased use of low-sulfur coal,

--installation of controls at some coal-fired electric stations to remove sulfur dioxide from emissions before they are released, and

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[3]Commonly referred to as acid rain, acid deposition occurs when the oxides in sulfur emitted from power plants and industrial facilities are transported in the atmosphere and returned to earth as acid compounds. Biological damage caused by acid deposition in the United States has been observed in lakes, streams, and forests.

--controls imposed to reduce emissions from nonferrous[4] smelters.

The majority of the nation has attained the existing national ambient air quality standards for sulfur dioxide. Other studies, however, suggest that a more stringent SO_2 standard may be needed to fully protect human health. The Conservation Foundation--a national research and communication organization--reported in 1984 that existing sulfur oxide controls appear to be inadequate to protect lakes and forests against the problems of acid deposition. In addition, a June 1984[5] report by the Office of Technology Assessment estimated that--within the limits of current laws and regulations--SO_2 emissions in the United States as a whole would increase over 1980 levels by 10 to 25 percent by the year 2000.

The Clean Air Act requires that EPA review periodically the scientific adequacy of air quality standards. At the present time, three national ambient air quality standards exist for SO_2: an annual average, a 24-hour level, and a 3-hour level, each of which establishes a maximum allowable concentration of SO_2 emissions for the averaging period. The first two standards are primary standards, while the 3-hour level is a secondary or welfare-related standard. The annual standard is not to be exceeded, while the other standards are not to be exceeded more than once per year. As part of the standards review process, EPA issued a staff paper on sulfur oxides in November 1982 based on a series of controlled human studies. The staff paper recommended consideration of adopting a new peak (1-hour) SO_2 standard that would serve to reduce SO_2 emissions. The EPA Administrator is expected to decide by late 1985 on what changes, if any, to propose with respect to the sulfur dioxide standards.

Congressional measures in response to the acid deposition issue include a number of bills introduced in the 99th Congress calling for significant reductions in U.S. sulfur dioxide emissions. The proposed annual reductions in these bills ranged from 8 million to 12 million tons, based on SO_2 emissions levels in calendar year 1980. Some bills would accomplish these reductions by imposing controls on power plants and other major stationary sources of air pollution in the 31 easternmost states that emit the majority of the SO_2, while other bills would require reductions in SO_2 emissions in all of the 48 contiguous states. In the June 1984 report referred to previously, the Office of Technology Assessment estimated that the annual cost (in 1982 dollars) to reduce SO_2 emissions in the 31 eastern states by about 11 million tons per year would be about $4 billion to $5 billion. None of the bills introduced in the 99th Congress, however, had been enacted into law as of June 1985.

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[4]Use metals other than iron. U.S. smelters primarily use copper, zinc, or lead.

[5]Acid Rain and Transported Air Pollutants.

Regardless of what occurs at the federal level, states have the discretion to plan and implement their own programs to further reduce SO_2 emissions. However, as of March 1985, only New York had enacted such a program into law. The bill, signed by the governor in August 1984, requires New York State to reduce its SO_2 emissions by 245,000 tons per year by 1991. This would represent a reduction of 30 percent of total 1980 state SO_2 emissions. Several other states--including Massachussets, Maine, New Hampshire, Vermont, and California--are considering bills to control acid deposition.

SULFUR DIOXIDE SIP REVISIONS

During calendar years 1981-83, EPA approved a total of 114 SIP revisions involving sulfur dioxide. As the table indicates, the net increase in allowable SO_2 emissions from these revisions was about 1.5 million tons per year.

SO_2 SIP Revisions Approved by EPA

Year	Total number	SIP allowable SO_2 emissions change in tons per year and number of revisions: Increase	Decrease	No emissions change revisions
1981	55	1,104,475 (36)	33,550 (5)	(14)
1982	39	704,207 (15)	230,395 (6)	(18)
1983	20[a]	23,423 (7)	42,649 (2)	(7)
	114[a]	1,832,105 (58)	306,594 (13)	(39)

[a]Includes four SIP revisions for which change in emissions information was not quantified.

Various factors give rise to SO_2 SIP revisions. A source's allowable SO_2 limits may be revised to adopt higher limits if there will be no violation of ambient air quality standards, PSD increments, or any other requirement of the Clean Air Act. For example, a power plant may be given permission to burn fuel oil with a higher sulfur content, which is less costly than lower sulfur fuel, if these requirements are met. Revisions calling for decreases in allowable SO_2 emissions may reflect an attempt to bring an area into attainment of the SO_2 NAAQS. Revisions that result in no change in allowable SO_2 emissions include those that extend time frames for a source to comply with SIP requirements. Some SIP revisions are temporary, and others are permanent in nature.

The number of SIP revisions that increased allowable SO_2 emissions has declined in recent years. EPA officials stated

this decline stems, in part, from increased concern over acid deposition and also the belief that sources that wanted changes in their SO_2 limits had already applied for them.

OBJECTIVES, SCOPE, AND METHODOLOGY

This report responds to a January 30, 1984, request from the Chairman, Subcommittee on Oversight and Investigations, House Committee on Energy and Commerce, who expressed considerable interest and concern about the impact of SO_2 emissions on the environment and, also, about how further controls of SO_2 emissions may impact coal miners and industrial and residential users of electricity. The Chairman's letter requested that we review six issues regarding federal and state agency efforts to research the effects of and control SO_2 emissions. This report concerns one of those issues: SIP revisions that call for increases in allowable SO_2 emissions.

With respect to the SIP revisions issue, the Chairman's letter asked that we

- --examine the actions taken by the EPA and the states in reviewing and deciding on SO_2 SIP revisions;
- --determine the increase in sulfur dioxide emissions allowed by the revisions and any potential impacts on future economic growth and on other states; and
- --assess the legal basis for these increases, including whether EPA can disapprove them.

Our examination of EPA's and states' review and decision-making process relative to SO_2 SIP revisions was carried out at selected state agencies, at the EPA regional offices responsible for reviewing SIP revisions submitted by those states, and at EPA headquarters.

To address the Chairman's first two concerns, we reviewed pertinent sections of the Clean Air Act and EPA's implementing regulations. In addition, at selected state agencies, EPA regional offices, and EPA headquarters, we obtained and discussed the procedures employed to review and decide on SO_2 SIP revisions and determined how the process was documented at each level of review. To review the actions taken by the states and EPA, we followed selected SO_2 SIP revisions through the state and EPA review and decision-making processes to determine (1) whether there was compliance with established procedures, (2) what issues were raised during the review process and how they were resolved, and (3) the consistency in the review procedures used by EPA regions. As agreed with the Chairman's office, our work with respect to impacts on future growth and on other states was limited to reviewing economic information obtained during our review of selected SIP revisions. We did not verify the accuracy of this information.

Since the overwhelming majority of SO_2 emissions originate in the 31 eastern states, we selected 6 states in that area of the country: Indiana, Massachusetts, Michigan, New York, Ohio, and Pennsylvania. In making these selections, we chose states that (1) have varying SO_2 emissions policies, (2) use an extensive amount of coal to fire power plants, and/or (3) are allegedly being adversely impacted by SO_2 from other states. These states accounted for 59 of 114--or 52 percent--of all SO_2 SIP revisions approved by EPA during calendar years 1981-83 (1983 was the last complete calendar year for which statistics were available in the fall of 1984 when we made our review).

We also performed work at the four EPA regional offices responsible for reviewing SIP revisions submitted by the six selected states: Region I (Boston), Region II (New York), Region III (Philadelphia), and Region V (Chicago). We also performed work at EPA headquarters offices in Washington, D.C., and Durham, North Carolina.

In each state, we selected three SIP revisions calling for increases in allowable SO_2 emissions that had been approved by EPA during calendar years 1981-83. We confined our review to SIP revisions that had received final EPA approval because those revisions had gone through the complete review and decision-making process. We selected at least one revision in each state involving an industrial source; the other sources selected were power plants. We also considered the recency of approval and the amount of increase in allowable SO_2 emissions. In addition, we reviewed SIP revisions calling for decreases in SO_2 emissions. For these, our review consisted of identifying the number of such revisions approved by EPA during calendar years 1981-83, calculating the total amount of SO_2 emissions covered by these revisions, and determining the reasons for these revisions.

The selection of the six states and 18 SIP revisions was judgmental, considering the factors discussed previously. Therefore, the results of our review are not projectable statewide or nationwide. Still, we believe the results of the review provide a reasonable indication of the degree of compliance with the SIP revision process and some of the problems/obstacles encountered in carrying it out.

To obtain additional perspective on the SO_2 SIP revision issue, we held discussions with representatives of the Edison Electric Institute, the New England Staff for Coordinated Air Use Management, the State and Territorial Air Pollution Program Administrators, and public service/utility commissions in Massachusetts, Michigan, and New York.

To determine the legal basis for EPA's actions concerning increased SO_2 emissions, we reviewed pertinent provisions of the Clean Air Act and court decisions interpreting those provisions. We also reviewed EPA correspondence and regulatory actions to obtain EPA's position on these issues.

Our review work was conducted between September 1984 and March 1985 in accordance with generally accepted auditing standards except for the following. We did not attempt to verify that the modeling performed in support of the selected SO_2 SIP revisions was done properly. Rather, we relied on the technical evaluations performed by EPA and state agencies. Air quality models, also discussed in the Chairman's January 1984 letter, are being addressed in a separate review.

We discussed the SIP revision process with EPA program officials and have included their comments where appropriate. However, in accordance with the requester's wishes, we did not obtain the views of responsible officials on our conclusions, nor did we request official agency comments on a draft of this report.

CHAPTER 2

SIP REVISIONS FOR SO_2 FOLLOWED KEY CLEAN AIR ACT REQUIREMENTS

The Clean Air Act contains certain requirements that have to be met before EPA can approve a SIP revision increasing SO_2 emissions. Our review of 18 SO_2 SIP revisions in six states, approved by EPA during calendar years 1981-83, disclosed that key requirements of the act were met in deciding on those revisions in that EPA made the required deteminations that the revisions would not violate the NAAQS or PSD standards. We did find, however, that the requirement for approving the revisions within the 3-month time frame was not met because EPA frequently requested additional information to support the revision proposed. In addition, EPA is addressing some issues that need to be resolved to improve the decision-making process. For example, EPA is still developing mathematical models needed to predict the impact of SO_2 emissions in areas beyond 50 kilometers (about 31 miles) from the source and in certain types of terrain. Our review also provided some insight into the economic implications of approving SIP revisions that increase allowable levels of SO_2 emissions.

HOW DOES THE SIP REVISION PROCESS WORK?

The Clean Air Act provides that before a SIP revision allowing an increase in SO_2 emissions is approved by EPA, it must meet certain requirements and have been adopted by the state after reasonable notice and public hearings. Key requirements of the act include determinations that the proposed increase (1) will not prevent the attainment and maintenance of the NAAQS, (2) will not violate the PSD requirements that limit increases in SO_2 emissions for areas with air quality that is better than that required by the NAAQS, and (3) will not prevent attainment and maintenance of the NAAQS or interfere with compliance with PSD requirements by another state.

In the process of developing their original SO_2 SIPs, states generally promulgated regulations that stipulated limits on the sulfur content of fuel that could be burned in specific areas of the state and by specific groups of air pollution sources, e.g., power plants. A request to revise the SO_2 SIP may originate at the appropriate state agency or may be initiated by an individual source that is subject to the SIP. The state, for example, may propose to change its sulfur-in-fuel regulations in one or more geographical areas. An individual source, on the other hand, may request a variance from the existing regulations or a delay in having to comply with them. In any case, the request for an SO_2 SIP revision that is ultimately submitted by the state to EPA must demonstrate that the requirements of the Clean Air Act (cited in the preceding paragraph) have been met. These demonstrations depend heavily on the mathematical modeling of air quality data. That modeling

may be performed by the source, the state, or a consultant engaged by either one, and must be consistent with procedures recommended in EPA's Guidelines on Air Quality Models and any additional EPA modeling guidance.

To comply with EPA processing procedures, the air quality analysis prepared for a SIP revision increasing actual and/or allowable SO_2 emissions generally includes the following:

--Justification for the model used and how it was applied.

--Background levels of SO_2 in the area covered by the proposed revision, stated in terms of the 3-hour, 24-hour, and annual SO_2 standards.

--Meteorological data base used in the modeling process, including number of years of data and location of meteorological stations.

--Receptor grid network (location of monitors in relation to source) used to plot impacts of emissions.

--Location and level of maximum ground level concentrations of the pollutant stated in terms of the 3-hour, 24-hour, and annual SO_2 standards.

--Analysis of interaction among the emissions of major SO_2 sources in the area covered by the revision.

--Justification that a facility's stack (smokestack) height conforms to good engineering practice.

--Analysis of a facility's SO_2 emissions at peak and lesser fuel load levels.

Before a SIP revision is submitted to EPA, the state issues a public notice covering the proposed action, including the notification of neighboring states. A public hearing is held, and comments are received on the proposal. If the state approves the revision, the state regulation is amended to reflect the changed SO_2 emissions limits. The state then submits the SIP revision to the appropriate EPA regional office for its review and decision making. Under the act, the SIP revision does not become effective until final EPA approval.

Within EPA, the regional offices have primary review and decision-making responsibility for SO_2 SIP revisions. The regional office reviews the revision for completeness and consistency with EPA policy and the requirements of the Clean Air Act. The EPA regional office also coordinates with the state to make any changes or obtain any additional information it believes is necessary to support the proposed revision.

The regional office then prepares a draft Federal Register notice on the proposed revision, with appropriate recommendations and actions, and forwards the entire package to EPA headquarters for review and concurrence. EPA headquarters reviews all SO_2 SIP packages for legal, national policy, and technical implications, as well as for consistency of reviews among EPA regions. If headquarters concurs, notice of the proposed revision is published in the Federal Register. After the comment period has ended and the comments have been evaluated by the regional office, the final notice of the revision is prepared and sent to headquarters for approval and publication.

CLEAN AIR ACT REQUIREMENTS FOLLOWED, BUT INCOMPLETE DATA AND UNRESOLVED ISSUES AFFECTED THE REVIEW PROCESS

The 18 SO_2 SIP revisions we reviewed accounted for a net annual increase in allowable SO_2 emissions of 810,767 tons, or about 53 percent of total net increases in allowable SO_2 emissions approved by EPA during calendar years 1981-83. Of the 18 revisions, 8 were for power plants, 6 were for industrial facilities, and 4 covered both types of activities. In 9 of the 18 cases, the revisions were approved on a temporary basis for up to 5 years (Massachusetts, Michigan, and New York). The other revisions represented permanent changes to the SO_2 SIP (Indiana, Ohio, and Pennsylvania). We found that the states had issued the required public notice on the SIP revisions, held a public hearing or comment period where required, and made a determination that there would be no violations of the NAAQS or PSD provisions of the Clean Air Act and no significant interstate impacts resulting from the SIP revision. We also found that EPA took the necessary actions regarding publication in the federal register, and made its own determinations that the 18 revisions did not violate these requirements. In addition, we did not identify any inconsistencies in procedures employed and factors considered by the four EPA regional offices in reviewing the revisions. However, in making determinations, EPA and the states frequently required additional information. This contributed to EPA's review and approval process taking longer than the 3 months the act allows. Also, the determinations were affected by some unresolved issues such as modeling limitations.

Incomplete data lengthened the review process

Incomplete data submitted to the state and EPA in support of many of the revisions lengthened the processing time for final approval. The following statistics summarize the time it took for the states and EPA to review and decide on the 18 SO_2 SIP revisions.

Time Frames for Deciding on Selected SIP Revisions

	3 months or less	4-6 months	7-12 months	More than 12 months
	(number of revisions)			
State review[a]	2	2	6	5
EPA review[b]	0	2	2	14

[a]Three revisions in Ohio were reviewed only by EPA, since EPA was administering the Clean Air Act program in that state when these revisions were initiated and processed.

[b]Time frames calculated from date of initial state submission to EPA to its final approval.

The table points out that for 14 of the 18 revisions, EPA took more than 12 months to decide on approval. For many of these revisions, EPA determined that additional data were required including the following:

--The analysis from another mathematical model.

--The meteorological data base used in the modeling analysis.

--Application in the modeling analysis of background concentrations of SO_2 for 3-hour, 24-hour, and annual averaging periods.

--The receptor network coverage.

--Inclusion of additional major SO_2 sources within the area impacted in the analysis.

--Justification for smokestack height increases.

--Consideration in air quality analysis of impacts during average and minimum fuel load periods.

--Demonstration that all SO_2 standards would be attained.

--Inclusion of public notice and public hearing certifications.

Issues needing resolution to improve the review process

Reaching a final decision on an SO_2 SIP revision is a complex task. In deciding on the SIP revisions we reviewed, disagreements over a number of issues arose between EPA and the states or sources requesting SIP revisions and between EPA and

the states or organizations that questioned either EPA's decision to approve certain of the revisions or how the agency went about reaching its decision. This section discusses the three issues we found needing resolution to improve the review and approval process. EPA has efforts underway to address each of these issues.

--Limitations on assessing interstate impacts of SO_2 emissions.

--EPA-approved models to project the impact of SO_2 emissions in complex terrain areas (terrain exceeding the height of the source's smokestack being modeled) not available.

--Reasonableness of using 30-day averaging of SO_2 emissions to test compliance with the 3-hour and 24-hour NAAQS.

Limitations exist on assessing interstate impacts of SO_2 emissions

Section 110(a)(2)(E) of the Clean Air Act requires that EPA approve a SIP revision only if it determines that the revision will not prevent any other state from (1) attaining or maintaining the ambient air quality standards, or (2) complying with the PSD provisions of the act. EPA received comments on several of the 18 SO_2 SIP revisions we reviewed expressing concern over increased interstate air pollution if the revisions were approved or claiming that EPA failed to comply with section 110(a)(2)(E) of the act. EPA's response to those comments disclosed that certain limitations presently exist on assessing the interstate impacts of SO_2 emissions.

The original premise of the Clean Air Act was that air pollution sources should be required to protect air quality in their own immediate area. This requirement, over time, prompted many sources to build tall smokestacks through which pollutants, including SO_2, are emitted high in the atmosphere and dispersed, thereby allowing the source to show attainment of the NAAQS. This practice heightened concern over interstate air pollution. Section 110(a)(2)(E), enacted in 1977, addresses these concerns.

According to EPA's Chief, Source Receptor Analysis Branch, because EPA's air reference models are only valid out to 31 miles, EPA generally only calculates out to that distance when performing its interstate impact asessments. In responding to comments on several of the SO_2 SIP revisions we reviewed, EPA pointed out limitations that presently exist in its ability to address interstate impacts of SO_2 emissions. These included the following:

--No reference techniques have yet been established for accurately evaluating impacts beyond 31 miles. No EPA-approved regulatory tools are currently available to assess long-range impacts.

--EPA's currently adopted models are not capable of estimating the impact of SO_2 emissions from one state on the particulate matter levels in other states.

--In the absence of a national air quality standard for sulfates, EPA is not required to consider the impact of an SO_2 SIP revision on airborne sulfate levels or acid deposition.

In a December 1984 GAO report, An Analysis of Issues Concerning "Acid Rain" (GAO/RCED-85-13), we also point out these concerns. The report states that EPA-approved models can only estimate pollutant concentrations with moderate accuracy. It states that these models are even less accurate when predicting the impacts of the long-range transport of air pollutants, such as between the Midwest and Northeast.

EPA has recognized the importance of estimating impacts at distances greater than 31 miles. However, the agency has pointed out that models submitted to EPA have not as yet undergone sufficient field evaluation to be recommended for general use. In addition, EPA has also stated that the inability to quantify to a greater distance the extent and the specifics of the long-range transport and transformation problem has prompted the agency to continue its research program in these areas.

EPA-approved models to project impact of SO_2 emissions in complex terrain areas not available

As stated previously, the SO_2 SIP revision process depends heavily on mathematical models in making the determinations required by the Clean Air Act before a SIP revision can be approved. Our review disclosed several cases where questions arose over the acceptability of models used to project impacts in complex terrain areas, i.e., terrain higher than smokestacks being modeled. EPA acknowledges that suitable models for complex terrain and other situations do not exist and that various initiatives are underway to correct those and related problems, including the need for consistency in modeling decisions.

In several cases involving SO_2 SIP revisions in New York and Ohio, questions arose concerning the acceptability of the models used to project air pollution impacts in complex terrain areas. In one case, EPA proposed approval of a SIP revision allowing increased SO_2 emissions for two New York power plants, relying on an analysis based on an EPA-approved model. The state of Connecticut provided comments to EPA, however, alleging that the increased emissions caused violations of the SO_2 standard and exacerbated existing violations of the particulates standard. The analysis conducted by Connecticut was based on use of another EPA-approved model. The basic issue involved was whether the model used by Connecticut was the most appropriate technique for estimating the impact of the power plants upon

rolling terrain over 22 miles away in Connecticut. The EPA regional office submitted the issue to the Model Clearinghouse--an EPA headquarters unit formed to resolve issues associated with the selection and use of air quality models--for a decision. The Clearinghouse ultimately advocated the use of the model that supported approval of the revision.

In another case, which involved a SIP revision for a General Electric plant in New York, the EPA regional office concluded that the model used in the air quality analysis to demonstrate maintenance of the 3-hour SO_2 standard did not consider terrain impacts and, therefore, was inappropriate. EPA pointed out that the model used tended to underpredict maximum SO_2 concentrations and recommended that the analysis be redone using another model. The recommended analysis was carried out and disclosed that the model originally used predicted higher SO_2 concentrations. Therefore, EPA approved the use of the former model.

A SO_2 SIP revision currently before EPA for decision making also provides a good example of the uncertainty surrounding the modeling of impacts in complex terrain areas. In a public notice on the proposed revision--involving the conversion of two generating stations from oil to coal--EPA addressed the terrain issue. The agency pointed out that it had reviewed that state's submittal, that had included using an air quality dispersion model to determine the effect of a power plant converting to coal. EPA stated that the power plant is located in complex terrain and because no widely accepted dispersion models have been identified for complex terrain situations, the state utilized a model not validated by EPA to demonstrate that air quality standards would not be violated. Due to modeling uncertainties, EPA subsequently performed its own dispersion modeling analysis and then solicited public comments on whether or not the revision met the requirements of the act.

EPA has stated that, although the need for refined complex terrain dispersion models has been acknowledged for several years, adequate refined models have not been developed. The agency pointed out that the lack of detailed descriptive data bases and basic knowledge concerning the behavior of atmospheric variables in the vicinity of complex terrain presents a considerable obstacle to the solution of the problem and the development of refined models. EPA officials informed us that ongoing research is addressing these areas.

EPA also acknowledged that while its regional administrators have the authority to select appropriate models, consistency should prevail. It pointed out the need for assistance and guidance in the selection process so that fairness and consistency in modeling decisions are fostered among the various regional offices and the states. To satisfy that need, EPA established the Model Clearinghouse mentioned previously and also holds periodic workshops with headquarters and regional office modeling representatives.

Appropriateness of Indiana's method for determining compliance with SO_2 standards needs to be resolved

On June 26, 1979, Indiana revised its SIP to include an amended SO_2 regulation that used 30-day averaging of SO_2 emissions to test compliance with the NAAQS. In 1980, EPA proposed disapproval of the use of a 30-day averaging period because the agency believed no demonstration could prove that this method will protect the 24-hour or 3-hour NAAQS for SO_2. Nevertheless, in 1982 EPA approved the three Indiana SIP revisions we reviewed--covering LaPorte, Marion, and Vigo counties but explicitly said that is was not ruling on the acceptability of 30-day averaging for testing compliance with the NAAQS.

EPA has established 3-hour, 24-hour, and annual standards for SO_2 emissions. According to EPA regulations, if more than one emission measurement exceeds the 3-hour or 24-hour standard in a 1-year period, the source violates the standard. With 30-day averaging, some 3-hour or 24-hour emissions may exceed the NAAQS as long as the average for 30 days is at or below the 3-hour or 24-hour standard.

In not ruling in 1982 on the 30-day averaging provision of Indiana's SO_2 regulations, EPA officials pointed out that it had initiated a review of its policies and procedures for regulating coal-fired power plants in 1980. As part of the review, EPA officials said the agency investigated compliance test methods that use longer averaging times and at the same time ensure protection of the NAAQS. Two Indiana utilities subsequently requested the 7th Circuit Court of Appeals to review EPA's approval of Indiana's 1982 SIP revisions because of EPA's failure to determine the validity of the 30-day averaging provision. On May 11, 1984, the court voided EPA's approval of the 1982 revisions on the basis that EPA had effectively disallowed the 30-day averaging provision of the SIP without evaluating this provision to determine whether it violated the requirements of the Clean Air Act. In May 1985, an EPA official informed us that a comprehensive sulfur study is underway to resolve the 30-day averaging issue and related SO_2 issues.

INFORMATION ON ECONOMIC IMPACTS OF SO_2 SIP REVISIONS REVIEWED

SIP revisions that increase the allowable levels of SO_2 emissions are granted or denied primarily on the basis of environmental considerations. The Clean Air Act does not require that such revisions be accompanied by analyses of economic impacts. However, the information we reviewed on selected SO_2

SIP revisions provided some insight into the economic implications of approving those revisions, including impact on future growth and economic benefits claimed by electric utilities and industrial firms covered by the revisions. These benefits included the continued use in Indiana, Ohio, and Pennsylvania of more coal mined in those states.

Future economic growth

As stated earlier, the PSD program established under the Clean Air Act seeks to ensure that air quality in clean air areas--areas that meet the NAAQS--does not significantly deteriorate. To meet that objective, the program established limits on an area's future increase in SO_2 emissions. The difference between an area's current emissions and this limit is referred to as the PSD increment. An SO_2 SIP revision may consume part of an area's PSD increment. Therefore, an examination of the analyses of PSD increment consumption that accompany SO_2 SIP revisions can provide some insight into a revision's impact on an area's future growth.

In 3 of the 18 SIP revisions reviewed, the sources requesting to increase their SO_2 emissions were located in a PSD area; thus, a PSD analysis was required and prepared. The following table reflects the percent of the area's increment that was consumed by each of the three selected revisions.

Percent of Area's PSD Increment Consumed

	Boston Edison Company Massachusetts	Haverhill Paperboard Company Massachusetts	General Electric Company New York
3-hour	80	20	72
24-hour	96	35	74
Annual average	49	35	45

Regarding the proposed SO_2 SIP revision for the Boston Edison Company, a revision that permitted Boston Edison to burn higher sulfur fuel oil than generally allowed by state regulations, various organizations made the following comments with respect to PSD increment consumption during the state's public hearing on the proposed SIP revision:

--Granting a permanent variance may result in significant consumption of the 3-hour and 24-hour PSD increments, thereby limiting or slowing down future economic growth in the surrounding communities.

--The revision would result in greater difficulty and higher costs for new SO_2-emitting sources interested in locating in the area.

--It is unwise to allocate 96 percent of the available increment to any single application.

--Granting the variance would establish an unwise precedent for allocating PSD increments.

The state of Massachusetts decided to limit Boston Edison's burning of the higher sulfur fuel to a period of 30 months.

Future economic growth could also be positively impacted by a SIP revision. The benefits to the firms receiving the revision could translate into faster growth for those firms and their customers. In the case of Boston Edison, it will be difficult for other SO_2 sources to locate in the area during the 30-month period since Boston Edison is using 96 percent of the available SO_2 increment. However, the area may experience some economic benefits during this time frame due to Boston Edison's reduced operating costs and, consequently, the reduced electricity costs to its customers.

Economic benefits

Some SIP revisions we reviewed increased allowable SO_2 emissions by permitting the power plants and industrial firms to burn coal or oil with a higher sulfur content. Since higher sulfur fuel is generally less expensive than lower sulfur fuel, these revisions can translate into fuel cost savings and, in some cases, cost savings resulting from postponing or avoiding the purchase of expensive pollution control equipment. In three of the states covered by our review--Indiana, Ohio, and Pennsylvania--we were told that the SIP revisions also made possible the continued burning of coal mined in those states. The following are examples of economic benefits estimated by some of the sources effected by the 18 SO_2 SIP revisions we reviewed. We did not verify the accuracy of these estimates.

--EPA first granted permission for the Long Island Lighting Company to burn higher sulfur fuel oil for its Northport and Port Jefferson power plants in 1977. In 1981, the company estimated that the annual savings to its customers resulting from the permission to use oil with a maximum sulfur content of 2.8 percent, instead of 1.0 percent sulfur content oil, were in the range of $60-$80 million.

--The Pennsylvania Power Company stated that if its New Castle Plant was made to comply with the state's 0.6 pounds per million British thermal units (MMBtu) standard, it would be necessary to install a flue gas desulfurization system that would cost about $85 million and increase the plant's annual operating costs by $14 million per year, costs that would be passed on to its residential and industrial customers. It pointed out that the new standard reflected in the SIP revision--2.8

pounds per MMBtu--would permit Pennsylvania Power Company to continue to use a blend of low- and high-sulfur coal with a minimal increase in operating expenses.

--Consumers Power Company's B.C. Cobb Plant in Michigan was given a 5-year extension to comply with the state's 1-percent sulfur limit for plants that size. When the SIP revision was proposed, the plant was burning coal with a maximum annual average sulfur content of 3.5 percent. The company estimated that it would cost $135 million over the 5-year period to burn complying fuel of 1 percent, or $113 million for scrubbing flue gases to achieve 1-percent-equivalent emissions. The company also estimated that the cost of its interim option--coal blending to achieve an annual average SO_2 emission equivalent to burning 2.5 percent sulfur coal--was $65 million. Therefore, the company's estimated savings for the 5-year period ranged from $48-$70 million.

It should be pointed out that SIP revisions that allow increases in SO_2 emissions may also have negative economic impacts. According to a 1982 publication that summarized several government-sponsored environmental studies,[1] such impacts include the reduced recreational value of lands and waterways, increased maintenance costs to building materials, and increased health care expenses.

CONCLUSIONS

Our review of 18 SO_2 SIP revisions approved by EPA from six states disclosed that EPA determined that the key requirements of the Clean Air Act were met in deciding on those SIP revisions. We found, however, that EPA frequently requested additional information to support the SIP revisions proposed. This lengthened the time needed to process them to final approval, causing the act's 3-month time frame for EPA approval to be exceeded. Further, we identified some issues relating to processing SIP revisions that could be improved. For example, limitations exist with respect to mathematical models used to assess interstate impacts of SO_2 emissions and impacts in certain types of terrain. These affect EPA's ability to make more precise assessments of the impacts of SO_2 emissions.

SIP revisions that increase SO_2 emissions may impact future economic growth of the area in which the revision pertains by affecting the ability of SO_2 emitting sources to either build or expand in that area. Also, the area may experience negative economic impacts such as the increased health care costs associated with additional SO_2 emissions. However, the revisions

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[1] Air and Water Pollution Control--A Benefit-Cost Assessment, A. Myrick Freeman, 1982.

may produce savings related to fuel costs and avoiding or postponing the purchase of expensive pollution control equipment. These savings may benefit residential and industrial ratepayers.

CHAPTER 3

EPA MUST APPROVE AN SO_2 SIP REVISION IF APPLICABLE CLEAN AIR ACT CRITERIA ARE MET

Based on our legal analysis, we concluded that EPA approval of an SO_2 SIP revision that has been approved by a state and meets applicable criteria of the Clean Air Act is mandatory. This is also EPA's policy. States have the discretion, however, to attach conditions to SIP revisions before they are submitted to EPA for review and final decision making.

EPA APPROVAL OF SIP REVISIONS MEETING CLEAN AIR ACT REQUIREMENTS IS MANDATORY

Under the Clean Air Act, facilities may increase SO_2 emissions after a SIP revision has been adopted by the states and approved by EPA. EPA's policy requires that after state adoption and submission to EPA of the SIP revision, EPA approval is mandatory if the revision meets the criteria of the Clean Air Act. We believe that policy reflects an accurate interpretation of the act.

Section 110 (a)(3) of the Clean Air Act provides that the Administrator of EPA shall approve any revision of an implementation plan applicable to an air quality control region if the Administrator determines that it meets the requirements of the act and has been adopted by the state after reasonable notice and public hearings. The key criteria of the act stipulate that EPA must approve a SIP revision allowing an increase in pollutant emissions--including SO_2 emissions--if the proposed increase (1) will not prevent tne attainment and maintenance of the NAAQS, (2) will not violate the PSD requirements, and (3) will not prevent attainment and maintenance of the NAAQS or interfere with compliance with PSD requirements by any other state.

STATES CAN CONDITION THEIR APPROVAL OF SIP REVISIONS

While EPA must approve SIP revisions that meet the requirements of the Clean Air Act, the states can attach conditions to their approval of those SIP revisions, including revisions that allow increases in SO_2 emissions. The states, for example, can approve SIP revisions on a temporary basis, as opposed to making them permanent. The states can also condition approval of SIP revisions allowing increased SO_2 emissions on a source's agreeing to achieve long-term reductions in SO_2 emissions. Massachusetts, one of the six states covered by our review, provided good examples of the use of the latter approach.

In 1980, Massachusetts adopted a regulation, the Environment/Energy Initiative, to encourage a reduction in oil

use, conserve energy, and reduce pollution. Under the regulation, industries and institutions with an energy input capacity of less than 250 MMBtu per hour were allowed to burn less expensive higher sulfur fuel (2.2-percent sulfur oil instead of 0.5 percent or 1.0 percent, depending on location of facility) for a period of up to 30 months, provided that the cost savings were used to convert to alternative fuels, install pollution control equipment, and/or implement energy conservation measures. By the end of the period, it was anticipated that the source would be using less fuel or more modern pollution control equipment. The state pointed out the following as examples of program accomplishments:

--A small manufacturing company used savings from the program to fund energy conservation measures that will reduce fuel consumption by over half. The company could not finance these improvements without the program.

--A medium-sized paper company used savings from this program to fund conversion to wood burning. The conversion will result in lower particulate emissions and almost eliminate SO_2 emissions.

Another example of the state's ability to attach conditions to SO_2 SIP revisions involved a Massachusetts utility, the Canal Electric Company (Canal). In 1981, Canal requested a variance in order to allow the burning of fuel oil with a sulfur content of 2.8-percent instead of the 2.2-percent sulfur fuel oil it was currently burning. The company estimated that annual fuel cost savings would amount to $11.7 million in 1982 and that any savings resulting from the use of the cheaper, higher sulfur fuel would be passed on directly to consumers.

In October 1982, after determining that requirements of the Clean Air Act would be met, the state decided to approve the variance, under certain conditions. One condition stated that burning of 2.8-percent sulfur oil could begin after Canal had submitted and the state had approved a plan demonstrating the ability and intent to expeditiously reduce annual SO_2 emissions in the Southeastern Massachusetts Air Pollution Control Region to pre-variance levels. Another condition called for the company to submit a monitoring plan that would demonstrate that such emissions are in compliance with the pre-variance levels.

The company responded that the proposed conditions would impose financial burdens that would more than eliminate any financial cost savings and, instead, would impose substantial net cost burdens on the ratepayers. For example, Canal estimated that the initial annual operation, maintenance, and financing costs of the system needed to reduce SO_2 emissions to pre-variance levels would be approximately $25 million, or more than double the estimated net fuel savings to be derived from the variance. Lesser cost options, in the opinion of the company, were not workable. In June 1983, Canal decided not to

utilize the variance, notifying the state that under current technology, no available means can save money and still limit emissions to pre-variance levels. The company also pointed out that it appreciated the state's position that savings to ratepayers must still be balanced by consideration of overall sulfur deposition.

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